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Teaching International Animal Agriculture

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ABSTRACT: Students who major in animal science at U.S. institutions are generally exposed to a curriculum that emphasizes commercial, large-scale production of the few traditional food animals: cattle, poultry, sheep, and swine. Globally, most farmers live in lesser-developed countries under limited-resource conditions of land, feed supplies, equipment, and capital. The promotion of commercial animal production enterprises may not be appropriate for such farms because it can subject farmers to considerable economic risk. Rather, use of limited numbers of large livestock, locally adapted breeds, or smaller livestock (e.g., ducks, goats, guinea pigs, and rabbits) may be more appropriate under subsistence, integrated farming systems. In this global context, a course in international animal agriculture has been taught for 15 yr to undergraduate and graduate students. The course consists of a review of traditional and potential livestock species well suited for impoverished families on small farms and methods to implement sustainable livestock projects, including feasibility, design, implementation, monitoring, and evaluation stages. To enhance student understanding,

global food issues and challenges are illustrated with case studies. A term paper is also assigned for which students choose three suitable livestock species or local breeds that would be complementary on a small crop farm (< 5 ha). Daily dietary requirements of protein and energy per family member are calculated. Itemized enterprise budgets and production tables are prepared. Early in the course, the general consensus of students was that people who are malnourished and live in poverty have low personal ambition and motivation, and that their problems should be amenable to solution by application of American technology and expertise. The course modifies such attitudes and enhances a student's critical thinking and problem-solving abilities and communication skills. Course evaluations indicated that students believed that it is important to acquire some international knowledge and understanding when seeking a job, and that certain animal science courses should contain some international content. Students gain an understanding of global animal agriculture and an appreciation of the complexity of food production and hunger issues.

Key Words: Teaching, Farming Systems, Sustainability

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Introduction

Institutions in the United States generally provide students majoring in animal science with a curriculum that emphasizes commercial, intensive livestock production systems. This focus is limited by tradition to major food animal species: cattle, poultry (chickens and turkeys), swine, and sheep, which contribute significantly to the U.S. food supply and economy.

Intensive animal production systems are not appropriate for the majority of the world's farmers, especially those in the lesser-developed countries (LDC) who have limited access to land, feed supplies, equipment, and capital (Udo, 1997). The Food and Agricultural Organization of the United Nations (FAO, 1997) reports there

are at least 140 million small farms with ≤ 5 ha of land. The promotion of intensive livestock production systems has subjected many such farms to considerable economic risk. Integrated farming systems and sustainable practices, involving smaller populations of large livestock, local breeds, and(or) alternative small livestock species, have been recommended for limited-resource farmers (McDowell, 1978; Lukefahr and Preston, 1999).

In addition to the academic focus on animal science at U.S. institutions, students should also be educated about major trends in international agriculture. Students should be aware of global issues and challenges involving food production, such as 1) the observation that nearly 50% of the world's cereal grain supply is fed to livestock (Sansoucy, 1995), 2) the earth's ability to produce more food may be approaching the saturation point (Brown and Kane, 1994), and 3) a human population of 8 to 10 billion people is expected by the middle of the next century (Bongaarts, 1996).

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The purpose for this article is to report on experiences gained during 15 yr in developing and teaching a course in international animal agriculture (IAA) to students at Alabama A&M University and Texas A&M University at Kingsville.

Course Overview

International Animal Agriculture has been offered to upper-level undergraduate and graduate students as either a semester or summer course that counts for three credits toward graduation. The IAA course has been taken as either an advanced agriculture elective or as an animal science management elective in the students' degree plan. The prerequisites are Introduction to Animal Science (a required course for all agricultural majors) and a minimum of 9 h in a student's program area of specialization. In 1998, biology students were allowed to take the course as an advanced biology elective (prerequisite of 12 credit hours of biology) because of the course content in animal biology and biodiversity, species conservation, environmental protection, habitat characteristics, food preference, and geographic distribution of animals suitable for domestication. Between 10 and 20 students usually enroll in the course.

The course syllabus is presented in Appendix 1. The course consists of two parts. First, a review is made of traditional and potential livestock species particularly suited for impoverished families on small farms. Chapters from the second text listed in the syllabus (NRC, 1991) and selected readings are preassigned to students for discussion in the next class session. A topic sheet listing assigned and supplemental (nonassigned) readings is provided to students. A sample topic sheet is shown in Appendix 2. The course syllabus, topic sheets, and term paper assignment are available on the Internet (<http://www.tamuk.edu/aghs/anws/sluka.html>). Nonassigned readings are available for students to borrow from my office. Topics are presented as modules, which include 1) introduction to global agriculture and the role of small livestock, 2) genetic conservation, 3) rabbits, 4) guinea pigs, 5) rodents, 6) game ranching, 7) poultry, 8) reptiles, and 9) gender awareness. Sheep and goats are covered in another course (ANSC 3308: Sheep and Goat Management).

In the first module, papers that address contemporary issues, such as human population, health, diet, and social factors of food production are presented and discussed. For the specific species modules (3 through 8), content includes geographic area of potential use, biology, management, advantages and limitations, and research and conservation needs, according to the outline used in NRC (1991). Assigned papers generally highlight the role of small livestock, defined as small breeds and species of livestock that are suitable for production on small farms under subsistence conditions, in integrated farming systems involving sustainable agricultural and animal management practices

that directly target limited-resource families on small farms. Papers published in the electronic journal, *Livestock Research for Rural Development* (<http://www.cipav.org.co/lrrd>), are particularly useful.

More specifically, appropriate village-scale technologies (e.g., recycling farm by-products, composting animal manures, and integrating aquaculture with livestock production) are described in many of the assigned papers. Several papers feature appropriate methods of livestock management. Such methods include practices of feeding (utilization of local feeds and zero grazing), reproduction (natural incubation and brooding of chicks and colony breeding), and breeding (selection for trait functionality vs productivity; Cartwright and Blackburn, 1989). Review papers (Dalibard, 1995; Preston, 1995) provide practical measures of environmental conservation (e.g., establishing fodder tree banks or alley-cropping to conserve forests, biogas generation from animal manure to minimize use of electricity and fossil fuels, and zero grazing to prevent overgrazing and soil erosion).

The second part of the course covers how to target sustainable livestock projects for families on small farms. Topics include feasibility, design, implementation, monitoring, and evaluation stages of project development. The first text listed in the syllabus (Lukefahr, 1992) provides essential background for project development. Simple and practical methods of designing low-cost (minimum investment) projects for the poor, following the "Project Request Guide" developed by Heifer Project International (HPI), are discussed. Actual, albeit anonymous, proposals (weak and strong) submitted for funding consideration are reviewed and critiqued by students. Also examined are the backgrounds and present status of several successful and unsuccessful livestock projects. Evaluation is based on progress and evaluation reports. Critical factors of success are identified and discussed by students.

Personal audiovisual materials and those from humanitarian organizations are used in each class session. Global food issues and challenges are illustrated with actual project examples to enhance student understanding. In some class sessions, students are introduced to Internet sites, for example, the FAO-Initiative for Domestic Animal Diversity (<http://www.fao.org/dadis>), The Ecological Farm Project (<http://www.hcm.fpt.vn/inet/~ecofarm>), HPI (<http://www.heifer.org>), International Foundation for Science (<http://www.ifs.se/index.htm>), and World Neighbors (<http://www.wn.org>). In some years, field trips are taken to nontraditional livestock operations (e.g., ostrich, reptile, and highly integrated, small livestock farms).

A term paper is assigned to graduate students as an additional course requirement (Appendix 3). The student chooses a minimum of three livestock species or breeds (depending on the species chosen, more than three species may represent a more efficient production system) that would be complementary on a crop farm (< 5 ha) where a family of 10 earns \$1,500 per year.

The goal is for the farm to meet the daily dietary requirements for protein and energy of family members and, concurrently, to increase farm income. The student determines production goals and management strategies for each livestock species or breed based on literature reports. For each species or breed, itemized enterprise budgets (costs and returns) and production tables are prepared. Once the nutritional needs (protein and energy) of the family are met, surplus crops and livestock are sold for cash. Term papers are written using the most recent *Journal of Animal Science* style and format guidelines (ASAS, 1999).

Grading undergraduate academic performance is based on midterm and last (noncomprehensive) examinations, whereas graduate students are also graded on the term paper assignment (Appendix 1). The examinations consist mostly of essay questions, but listing and short discussion, definition of terms, and multiple-choice questions have also been used. A sample of examination questions gathered from several years of teaching IAA is provided in Appendix 4. Final grades of undergraduate and graduate students are determined separately. In 1999, students were also graded on oral presentations of assigned papers and writing assignments (100 points each).

The evaluation instrument was used to determine student awareness of the importance of the international dimension of the course and of the degree program in general. In 1998, 11 undergraduate and three graduate students completed the evaluation form (Appendix 5). Scores for the first nine questions were based on a 1-to-5 scale, with 1 as "Not Important," 2 as "Somewhat Important," 3 as "Important," 4 as "Considerably Important," and 5 as "Very Important." In the appendix, the underlined word in each question was the basis for the score ranking.

Student Impressions and Accomplishments

The IAA course format was based largely on readings of assigned papers in preparation for discussion in the next class session. For many undergraduate students, this was their first critical evaluation of the scientific literature. Initially, students were hesitant to express their views in class. The classroom environment (e.g., small class size, thought-provoking papers and audiovisual materials, and a discussion format whereby the instructor served as a facilitator) was amenable to enhanced critical thinking and problem solving and oral communication skills. Students were encouraged to actively participate by sharing their ideas, experiences, and opinions. Peer pressure was effective in ensuring all students contributed to discussions. A positive teacher-student relationship emerged, in accordance to the philosophy of Schillo (1997), who stated, "A teacher must become less of an authoritative figure, whose role is to pass on information, and more of a facilitator, whose role is to promote questioning, exploration, and synthesis." Further, Schillo (1997) stressed that teach-

ers should strive to educate, rather than indoctrinate, by teaching students to think analytically and to make independent judgments about scientific claims. Students learned there are rarely simple solutions to complex global problems, such as the basic causes of hunger and poverty. Hence, the key components for a sound undergraduate curriculum (e.g., subject matter expertise, communication skills, independent studies, and history and understanding of other cultures) were the cornerstones of the IAA course.

Early in the course, the general consensus of students was that people who are malnourished and live in poverty have low personal ambition and motivation. Their problems should be amenable to solution by application of American technology and expertise. For example, in the LDC, local breeds of livestock that are less productive should simply be replaced by more productive U.S. breeds. By the end of the course, a marked shift in attitude occurred as students gained a higher level of sensitivity to cultural or social values, gender roles, basic human rights, biodiversity, environmental conservation, appropriate livestock production systems, and project innovations. Johnson (1996) reported international experience improved a faculty's ability to better prepare students for the 21st century. Thus, students acquired a broader perception of animal science in an international context. A broader curriculum emphasis was previously proposed by Kunkel and Hagevoort (1994), who eloquently stated, "The domains for science of animal agriculture should be reconstructed to include a larger integrating component that interconnects the pieces and levels of knowledge . . . concerned with biological, physical, and social issues and values." Consequently, adoption of an integrative-based curriculum may better serve and prepare our students for future global challenges in animal science.

Course Evaluation and Student Feedback

Results from the evaluation instrument revealed that students believe it is important to acquire some international knowledge when seeking a job after graduation ($4.4 \pm .2$) and to effectively live and function as a U.S. citizen ($3.5 \pm .2$) (Appendix 5). Students indicated it is also important that certain animal science courses (e.g., introductory animal science, animal breeding and genetics, and animal nutrition) contain some international content ($4.4 \pm .3$). Responses to Questions 4 and 5 also confirm that IAA stimulated student interest to enroll in other courses with international content ($4.0 \pm .2$) and for some even to pursue an international career in animal science or biology ($3.2 \pm .2$).

The evaluation response further revealed that students sensed a basic weakness in their knowledge of international animal agriculture ($3.2 \pm .2$). This awareness may have been developed because of the international content presented (Question 7), information shared, and materials used (Question 8), which were considered to be understood by and useful to students

($4.3 \pm .2$ and $4.0 \pm .3$, respectively). The course was highly recommended to other students ($4.5 \pm .2$). Background data revealed that 50% of the students had traveled or lived outside of the United States, and this might also account for their limited international knowledge. Despite this figure, 70% of the students had studied a foreign language. Information gathered from the evaluations and from individual student interviews support the impression that the course objectives were accomplished. This feedback was especially useful in realizing a student's basic perception of the course.

Teaching IAA in Retrospect

The approach in teaching a course on IAA is obviously a matter of choice, depending largely on the background experiences and(or) expertise of the instructor. The thrust of this course deals with small-scale livestock projects as a vehicle for the poor to help themselves and is based on 15 yr of experience of assisting projects in 20 LDC. Alternatively, the course could have a similarly narrow animal science focus: for example, the global contribution of ruminants in roughage utilization, international beef and dairy cattle genetic evaluation, and impact of livestock commodity imports and exports on domestic industries. Conversely, a broader animal science focus could be taken to include major and minor livestock species and intensive and nonintensive (extensive) production systems. In an attempt to balance some of these pertinent subject areas, in some years this course has been either team-taught or faculty with specialty area expertise were invited to present guest lectures.

A particular challenge in teaching IAA is to keep abreast of recent international developments. Popular articles, books, conference proceedings, Internet sites, professional contacts, overseas experience, and key refereed scientific publications are useful sources of information to update an IAA course. Other resources are new slide sets, videos, and other audiovisual resources made available from agricultural development organizations.

Implications

An international animal agriculture course provides a broader perception of the animal science industry and of the role of livestock in human development. Initially, students have the attitude that farmers in developing

countries are poor because traditionally inefficient methods of animal production are used and that the solution is the adoption of American technologies. During the course, however, students gain an appreciation that hunger and poverty problems are complex and that local solutions are generally more appropriate (e.g., access to capital and land, gender sensitivity, native breeds, and on-farm training). Students also learn how to design self-help livestock projects that are relevant to impoverished populations. Student evaluations reveal that it is important to acquire some international knowledge in animal science when seeking a job career. There is flexibility in designing a course in international animal agriculture at institutions of higher learning.

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Appendix 1. Syllabus of International Animal Agriculture Course

ANSC 4305/5335—INTERNATIONAL ANIMAL AGRICULTURE

Abridged Syllabus

Texts: Lukefahr, S. D. 1992. *A Trainer's Manual for Meat Rabbit Project Development*. A Heifer Project International Publication, Little Rock, AR.

NRC. 1991. *Microlivestock*. National Academy Press, Washington, DC.

Examination Schedule: One regular examination worth 100 points and a final also worth 100 points, oral presentations of assigned papers (100 points), and writing assignments (100 points). **Graduate students will prepare a term paper (100 points) with the objective of designing a development project involving small livestock species of the student's choice.**

Grading: 90 to 100% = A, 80 to 90% = B, 70 to 80% = C, 60 to 70% = D, <60% = F.

Objectives: Students will acquire practical knowledge of small livestock production as an increasingly important global source of food and how to design and execute projects targeted at the poor. Students will also learn how projects are designed to benefit limited-resource farmers.

Lecture Topics: The course will focus on the production of high potential small livestock/wildlife species, such as rabbits, guinea pigs, quail, pigeons, guinea fowl, game animals, reptilian, and rodent food species, and certain microbreeds of chickens. Emphasis will be made on self-sufficiency, integrated village-scale technologies of small livestock project development that directly target limited-resource families, such as recycling of farm by-products, composting of animal manures, establishing forage plots, and aquaculture-livestock integration. Key components of project development (e.g., project feasibility, design, implementation, monitoring, and evaluation) will be presented.

Instruction Methods: Lectures, slide and video presentations, assigned readings, critical evaluation of research and past project development strategies, group discussions, and field trips.

Appendix 2. Readings Assigned to Students in One Subtopic Area, Guinea Pigs

Assigned readings:

Charbonneau, R. 1988. Fiesta for six: One guinea pig. IDRC Rep. July:6–8.

Loetz, E., and C. Novoa. 1983. Meat from the guinea pig. *Span* 26(2):84–86.

Morales, E. 1994. The guinea pig in the Andean economy. *Latin Am. Res. Rev.* 29(3):129–142.

NRC. 1991. *Microlivestock*. Chapter 20—Guinea Pig. National Academy Press, Washington, DC.

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Vietmeyer, N. 1984. In Peru they eat guinea pigs. *Intl. Wildl. July–Aug.*:16–17.

Supplemental (nonrequired) readings:

Bolton, R. 1979. Guinea pigs, protein and ritual. *Ethnology* 18:229–252.

Chauca de Zaldivar, L. 1995. Guinea pig (*Cavia porcellus*) production in the Andean countries [In Spanish]. *World Anim. Rev.* 83(2):9–19.

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Appendix 3. Term Paper Assignment to Graduate Students Enrolled in the International Animal Agriculture Course

ANSC 5335–INTERNATIONAL ANIMAL AGRICULTURE

TERM PAPER ASSIGNMENT

General: The purpose for the term paper is to provide the student with the opportunity to develop a hypothetical farm model that integrates a minimum of three small livestock species or local breeds into the farming system. The farm consists of less than 5 hectares. The farmer has a wife and eight children. The daily intake of dietary protein and energy is half of the requirements recommended by nutritional authorities. The annual income is only \$1,500. The student is to *describe* and *justify* the selection of various farm components (e.g., garden, orchard, fish pond, ducks, iguanas, and rabbits) that must be complementary and that will increase food production levels, improve family nutrition standards, and increase farm income. Anticipated costs and returns from each component will be calculated and presented, as well as the dietary protein and energy intakes from animal and plant products of each family member per day.

Style: The paper is to be less than 20 typed pages (including title page, table of contents, tables, and figures), double-line spaced, and page numbered. Tables should be typed, but figures may be hand-drawn on graph paper or plotted from a computer spreadsheet program.

Outline:

- 1) Title Page—Paper title, Student, Course, Session, Year.
 - 2) Table of Contents—Headings, Tables, and Figures with page numbers.
 - 3) Introduction—Set the stage by using global statistics, as cited from the literature, which justify the role of small livestock integration on small farms.
 - 4) Farm Model Development
 - A) Initial farm goal and supporting objectives.
 - B) Rationale or justification of each major farm component in terms of its integrative and complementary contribution.
 - C) Projections of food production (and possible by-products, e.g., skins, feathers, and manure compost) from each farm component and determination of the average animal protein and energy intakes per family member per day.
 - D) Itemized budgets of costs and returns for each livestock species or breed (include investment costs).
 - 5) Tables and Figures and Literature Cited—Use the style and form of the *Journal of Animal Science*.
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Appendix 4. Sample of Examination Questions Collected from the Past Four Semesters of Teaching International Animal Agriculture

ANSC 4305/5335—INTERNATIONAL ANIMAL AGRICULTURE

ESSAY

1. Why is integration such a vital measure in developing livestock projects in poor communities? Give some specific examples of integration. Distinguish between the terms “integration” and “diversification.”
2. Choose three livestock species that are expected to become especially important in the next century as urban livestock. Describe briefly how these species can be fed and housed.
3. From an ecological standpoint, describe examples (five or more) where *ranching*, as opposed to *farming*, of a wild species would be more easily justified and at the same time help poor families?
4. Discuss at least five advantages of including outside experts (e.g., a nutritionist, an economist, and a sociologist) throughout all five stages of project development. Tip: Identify a specific small livestock species to use as a project example.
5. One small project had the ambitious objective of training 500 farmers every 6 mo over a 5-yr period. Gaze into your crystal ball and predict the outcome of this project by stating several specific problems that would likely occur as a direct consequence of this ambitious objective.
6. How does Heifer Project International’s “Passing on the Gift” (POG) method of breeding stock distribution help to foster true development, as opposed to simple hand-outs or emergency relief efforts? Discuss several ways in which development activities could generally be strengthened through POG measures.

LISTING

1. List five poultry and five rodent microlivestock species. For each species listed, provide a brief statement that describes a *unique* contribution or management aspect that highlights its promising role in terms of benefits to small farm families. Also, define the term “microlivestock.”
2. List five disadvantages or potential risks that could be represented by microlivestock farming. More specifically, for each of the five disadvantages that you list, provide an actual species example.

Appendix 5. Evaluation Form Developed to Determine the Student’s Awareness of the Importance of International Animal Agriculture

Question	Score
1. How <i>important</i> do you believe it is to have some international knowledge of animal science when you seek a job after graduation?	_____
2. How <i>important</i> do you believe it is to have some international knowledge to live and function as a U.S. citizen?	_____
3. How <i>important</i> do you believe it is to have animal science courses include some international content?	_____

