

References

Chairmen's Report of a Conference on Research on Testing. August 1978. "Testing, Teaching and Learning," The National Institute of Education, HEW, Washington, D.C.

Duncan, Marvin and Larry F. Leistriz. October 1972. "Multivariate Statistical Analysis: Concepts and Economic Applications," Ag. Econ. Misc. Report No. 10, Dept. of Ag. Econ., Ag. Experiment Station, North Dakota State University, Fargo, N.D.

Kendrick, James C. 1973. "Techniques for Motivating Students," *American Journal of Agricultural Economics*, 55 :762-66.

Newcomb, L.H. July 25, 1980. "Conditions under which Students Learn More and Better," AAEA Teaching Workshop, SIU, Carbondale, Illinois.

Samuelson, Paul A. 1973. *Economics*, 9th Edition, McGraw-Hill, N.Y., Book Co.

Siegfried, John J. and Rendigs Fels. 1979. "Research on Teaching College Economics: A Survey," *Journal of Economic Literature*, 17 :923-969.

Steel, Robert G. and James H. Torrie. 1970. *Principles and Procedures of Statistics*, McGraw Hill, N.Y., p. 190.

Willis, Cleve E. et al. 1978. "Multicollinearity: Effects, Symptoms and Remedies," *J. of the Northeastern Agricultural Economics Council*, 7 :55-61.

Notes

- 1 Computer Learning Quizzes were developed at the University of Notre Dame based on Samuelson's Economics (9th Edition).
- 2 For a good review of the literature and problems in measuring learning in economics see Siegfried and Fels.
- 3 The same computer make-up quiz test bank questions were used over the five-year period as well as the same procedure and grade incentive. Twenty-two individual quizzes were used on the rotating basis for the extra credit assignments. Since each extra credit quiz had to be handed in on hard-copy computer paper and each printout had the time and date printed on it, even if students had the correct answers they would have to work each assignment and select the answers one question at a time. In short, to obtain the extra credit at least some additional exposure would have to take place. It is also noteworthy if a student obtained 10 extra points on each quiz, it would only raise the total grade point by 3 points (.6 pts. per quiz x 5 quizzes). A maximum of three points on a total scale of 100 points would not seem a very strong grade incentive to do all extra credit quiz assignments.

CASE REPORT

Diffusing Low Energy Agricultural Technology To Florida Professionals

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and Ellen S. Kelbert

Few subjects have generated such heated debate or prolonged public discussion as have the energy problems of recent years. Because of the United States' highly industrialized, energy intensive economy, and huge consumption of energy per capita (six times the world average), the economy has become highly vulnerable to foreign energy producers. In Florida the problem is particularly acute since the major income producing activities of the state — agriculture, construction, and tourism — are high energy demanding industries.

Florida's 13 billion dollar agricultural industry is characterized by its diversity; its concentration on fruits, vegetables, and ornamentals; its extensive

mechanization in the production and harvesting of specialized crops; and its heavy use of fertilizer, pesticides, irrigation, and drainage. On a per acre basis, Florida leads the nation in both total pesticide and insecticide use and ranks third in consumption of fertilizer. Florida agriculture, directly and indirectly, consumes approximately 97 trillion B.T.U.'s of energy, roughly 6 percent of the state's total energy consumption. Therefore, if Florida's agricultural industry is to continue to grow and contribute to the economic prosperity of the state and nation, a major effort must be directed towards improving agricultural technologies by making them less energy-intensive while retaining the high yields and quality necessary to compete in both United States and world markets (Delaney, 1978).

In the spring of 1979, the Florida legislature moved to assist the energy strained agricultural industry in the state by authorizing additional money to the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida for research, development, and diffusion of low energy technologies (LET) in agriculture. As part of IFAS, the Department of Agricultural and Extension Education restructured some of its major goals in order to contribute to the diffusion of low energy agricultural technology. The thrust areas of the department were providing inservice educational programs; instructional materials development; and the development of an interdisciplinary course. The following is a brief description and discussion of the three thrust areas.

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Inservice Education

The inservice education component of the department's LET activities was developed with the primary purpose of diffusing low energy technology to key professionals in agriculture via workshops and seminars. Many individuals now occupying professional leadership positions in agriculture received their formal education during a period of low cost and abundant energy, long before the current energy problems surfaced. The department expanded its inservice educational programming to deliver educational activities to professionals needing to increase their knowledge and understanding relative to low energy technology in agriculture. As a result, these individuals should be better able to develop low energy educational programs and activities for their respective client groups. Specific objectives were to offer annually inservice training workshops throughout the state related to current low energy agricultural technology and to explore the possibility of offering formal credit courses at off-campus locations throughout the state dealing with low energy technology.

The target audience included vocational agriculture teachers; county extension professional staff; home economics teachers; professional agricultural staff in agencies such as Farmers Home Administration, Production Credit Association, Soil Conservation Service, Agricultural Stabilization and Conservation Service, commercial lending institutions; and similar professionals in agricultural positions.

Topics and content for the inservice educational programs were identified through meetings with IFAS departments, the target audience, and those who administer programs involving the target audience. Examples of workshops, seminars, and tours identified and executed include:

- Agriculture - Energy - FFA - and You
- Energy and Agriculture Seminar
- Low Energy Citrus Production
 - Beef and Forage Production - A Low Energy System
- Forest Resources and Conservation
- Turfgrass and Sod Production Clinic
- Minimum Tillage - Multiple Cropping Systems
- Low Energy Agricultural Engineering
- Citrus Production and Processing Utilizing Low Energy Technology
 - Vegetable Crops and Energy Consideration
 - Choosing the Energy Efficient Home
- Personal Values, Motivation and Energy Management Behavior
 - Home Energy Update Mini-Sessions
 - Principles and Practices of Ornamental Horticulture and Emphasis on LET
 - Methane Generation from Animal Waste

A variety of other educational activities related to LET are being planned for the future.

For each session, an agenda and written and/or visual instructional materials were developed and provided to the participants. From November, 1979, to May, 1982, more than 800 individuals have participated in the LET inservice educational opportunities offered throughout Florida. Each inservice training workshop was evaluated and the results of each indicated a high degree of satisfaction by the participants regarding the value and quality of the activities.

Curriculum Materials Development

In order for professional agricultural educators to better utilize Low Energy Technology information with their clientele, the department developed instructional materials to be disseminated throughout Florida. To accomplish this goal, the following specific objectives were developed to guide these activities:

1. Identify materials related to LET in agriculture which would be useful to professional agricultural educators in promoting awareness and adoption of LET practices.
2. Develop "user guides" designed to assist professional agricultural educators to effectively incorporate the identified low-energy materials into various instructional situations.
3. Serve as liaison between various departments and/or individuals within IFAS for the development of materials in commodity/program areas for which limited or no low-energy instructional materials exist.
4. Disseminate materials identified, collected, and/or developed to professional agricultural educators.

The department's Instructional Materials Service (IMS) obtained and disseminated these LET materials to the professional agricultural educators. The following procedures were employed to accomplish these activities. First, efforts were made to locate quality instructional materials in LET from a variety of sources. These materials were obtained and then distributed to professional agricultural educators through the Instructional Materials Service distribution system. Instructional materials which could not be handled through the IMS, due to cost of availability, were brought to the attention of vocational agriculture teachers and cooperative extension educational personnel through the IMS Newsletter which is distributed quarterly. Educators could then order these materials directly from the source.

Second, a major development effort was undertaken to produce quality instructional modules (units of instruction) for use by vocational agriculture teachers, home economics teachers, and cooperative extension education personnel. Graduate assistants, under faculty supervision, and with cooperation from other IFAS departments and Agricultural Research and Education Centers made this effort possible. To date the following departments have cooperated in the development of

LET instructional materials modules: School of Forest Resources and Conservation; Agricultural Engineering; Agronomy; Animal Science; Editorial; Entomology and Nematology; Food and Resource Economics; Fruit Crops; Home Economics; Ornamental Horticulture; Plant Pathology; Soil Science; and Vegetable Crops.

As a result of this effort, a total of 20 different printed or audio-visual materials on LET in agriculture, the energy problem, or energy conservation from non-IFAS sources have been made available to the professional agriculture educators in Florida. In addition, eleven LET instructional modules have been completed. These modules are:

- Low Energy Technology — For Florida Agriculture — Agricultural Economics — Planning For Energy Savings.
- Energy Conservation in Field Crop Production.
- Low Energy Technology — Citrus Production.
- Low Energy Technology — For Florida Agriculture Crop Protection with Integrated Pest Management.
- Low Energy Technology — Housing and Home Environment — Attitudes.
- Low Energy Technology — For Florida Agriculture — General Energy Concepts.
- Low Energy Technology — Housing and Home Environment — Lighting.
- Low Energy Technology — Housing and Home Environment — Home Energy Usage and Conservation.
- Low Energy Technology — Housing and Home Environment — Single Family Housing, Multiple Family Homes, Mobile Homes.
- Low Energy Technology — Housing and Home Environment — Insulation.
- Low Energy Technology — Housing and Home Environment — Electrical Energy Usage.

Most modules contain criterion-referenced objectives, student activities, facts about low energy technology, and a bibliography. To date approximately 3000 publications have been distributed. Several other modules are in various stages of development.

Dissemination of low energy technology agriculture has just begun. The results of research, experimentation, and field tests are beginning to emerge from IFAS departments and other sources at an accelerated rate. Dissemination of this knowledge through the efforts of this curriculum development activity will continue to assist in the implementation and application of low energy technology in Florida agriculture.

Interdepartmental LET Course

The third thrust by the department was the development of an interdepartmental course entitled "Low Energy Technology for Agriculture." The course, offered for the first time during the fall quarter of 1980, was designed to provide an overview of Florida's agricultural energy situation, instruction in energy efficiency, and instruction related to the change processes required to bring about implementation of low energy technologies for agriculture.

The 3 semester hour credit course, a joint effort by eight departments within the College of Agriculture, was coordinated by the Department of Agricultural and Extension Education.

A development committee composed of twenty-nine members from various IFAS units worked on the development and implementation of the course. The committee determined the low energy topics to be covered as well as the selection of instructors on the basis of their expertise.

Promotion of the course to University of Florida students was made through counselors, IFAS faculty, brochures, posters, and a special slide/tape presentation. The Low Energy Technology course included lectures from the eight participating departments as well as field trips showing actual low energy techniques. Lecture topics and departments responsible are shown below:

Topics	Departments
Course overview. Energy Requirements for Florida	Agricultural and Extension Education
Agriculture Economic Considerations	
Transportation	Agricultural Engineering
Energy Technology for Agricultural Machinery	Agricultural Engineering
Minimum Tillage	Agronomy
Multi-Cropping	Agronomy
Irrigation and Energy of Water Movement	Agricultural Engineering
Wood Production	School of Forest Resources and Conservation
Economics of Fertilizer Usage	Soils
Symbiotic Nitrogen Fixation for Crop Biomass Production	Soils
Crop Biomass Production	Agronomy
Integrated Pest Management	Systems Pest Management
Energy Technology for Processing Systems	Agricultural Engineering
Energy Technology for Processing Agricultural Products	Agricultural Engineering
Energy Status of Food Handling, Processing and Consumption	Food Science
Waste and Residue Utilization, New Technologies	Food Science
Energy Generation from Agricultural Raw Materials	Food Science
Wood Fiber for Energy Production	School of Forest Resources and Conservation
Land Use Planning for Agriculture	Soils
Facilitating Change to Low Energy Methods and Practices	Agricultural and Extension Education
Course Review and Summary	Agricultural and Extension Education

A student handbook was developed which included an outline for each lecture topic as well as the objectives developed by the respective professors. Each student was required to develop a research paper on a low energy agricultural area in which he was interested.

At the conclusion of the term, participating students evaluated the course using the stated course objectives as the criteria. Students were given the opportunity to express both positive and negative comments as well as offer suggestions for course improvement. Student ratings were high with an average of 4.0 on a scale in which one was very poor and six was excellent. This indicated student satisfaction and success in reaching the course objectives as well as the success of the team teaching approach.

From the evaluations, appropriate changes have been made to assure students an updated exploration of the increasing need for energy awareness in Florida's agriculture.

The course will be offered again during the spring semester 1983.

Summary

In conclusion, the University of Florida's Institute of Food and Agricultural Sciences has made a commitment to explore new energy ideas for Florida's agriculture in the 1980's. Likewise, the Department of Agricultural and Extension Education is dedicated to supporting that commitment with low energy technology inservice education programs, instructional materials development, and an interdisciplinary course.

The three thrust approach, developed by the Department of Agricultural and Extension Education at the University of Florida, has modeling potential for similar dissemination projects in other states. This approach has been successful in disseminating new low energy ideas to vast numbers of agricultural professionals while retaining a high degree of useful and complete information.

References

Becker, W.J., and D.C. Scanlon, 1981. **Low Energy Technology Curriculum Development Activities Progress Report**. Department of Agricultural and Extension Education, University of Florida, Gainesville, Florida.

Cheek, J.G., M.B. McGhee, and T.L. Curry, 1980. **Evaluation of the Workshop Agriculture - Energy - FFA and You, Final Report**. Department of Agricultural and Extension Education, University of Florida, Gainesville, Florida.

Cheek, J.G., M.B. McGhee, and T.L. Curry, 1980. **Low Energy Technology Inservice Educational Activities — A Summary**. Department of Agricultural and Extension Education, University of Florida, Gainesville, Florida.

Cheek, J.G., M.B. McGhee, and C.E. Paulson. **Low Energy Technology Inservice Education Activities — A Summary, January 1, 1981 - August 31, 1981**. Department of Agricultural and Extension Education, University of Florida, Gainesville, Florida.

Delaney, Charles J., 1978. **Energy Information Handbook**. Center for Environmental and Natural Resources Programs. Institute of Food and Agricultural Sciences. University of Florida, Gainesville, Florida.

Farrington, W., R. Churchill, and N. Funderburk, 1981. **The Course AGG 4325 - Low Energy Technology for Agriculture - Project Report**. Department of Agricultural and Extension Education, University of Florida, Gainesville, Florida.

McGhee, M.B., J.G. Cheek, and G.A. Chesnut. **Low Energy Technology Inservice Educational Activities — A Summary, September 1, 1981 - August 31, 1982**. Department of Agricultural and Extension Education, University of Florida, Gainesville, Florida.

Teaching Research Extension

Exploitation of Complementary

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In many Land-Grant institutions, the question of the efficacy of split appointments (Teaching, Research, and Extension) gives rise to heated debate. Oftentimes, it is stated that County Agents prefer that Extension Specialists remain 100 percent Extension and specifically avoid the classroom — presumably because classroom teaching reduces the flexibility of the specialist in responding to the needs of traditional Extension clientele (individual farmers and farm groups).

Although no formal survey of attitudes was attempted for this paper, our experience is that the true major stumbling block of three-way split appointments is the inflexibility of individual professionals (whether they are Extension-oriented or Teaching-Research-oriented). Further, there are administrative problems which arise between the Experiment Stations and Cooperative Extension Services in trying to maintain balance of time and budgets between the differing functions, roles, and programs. However, we believe that there are many compelling complementarities among teaching, research, and Extension that can be exploited through systematic use of three-way split appointments.

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