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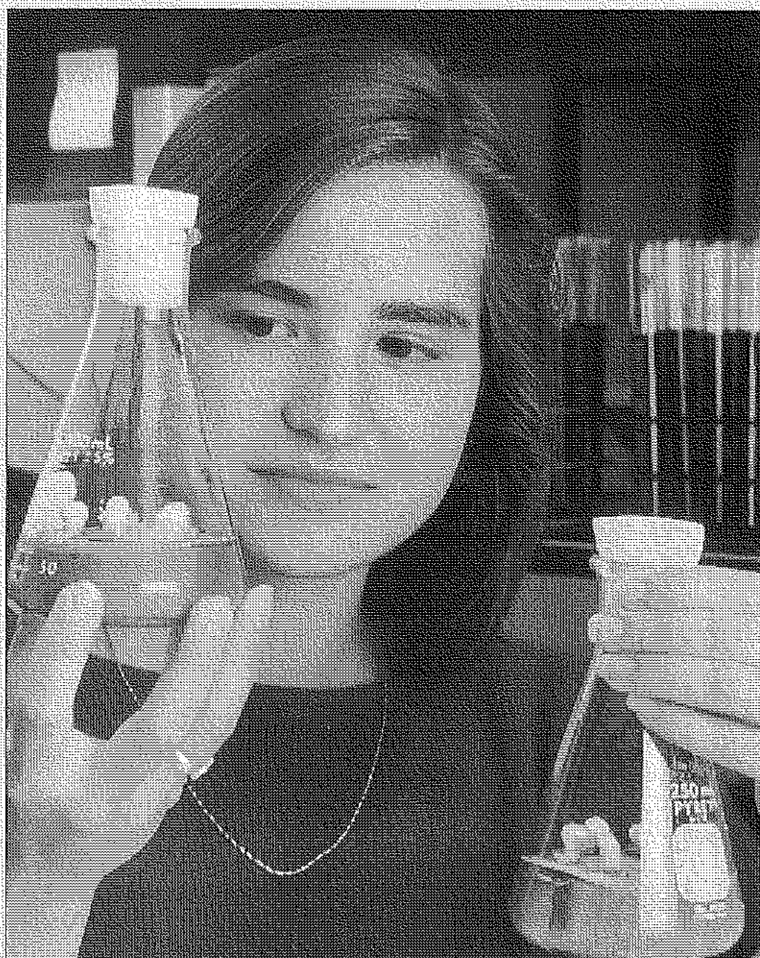

Teaching Agriscience

THE
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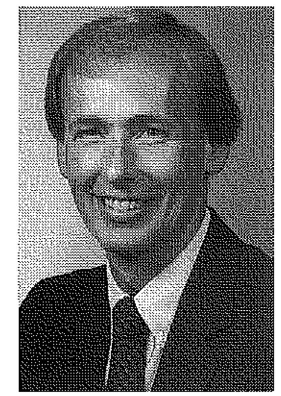
Rediscovering Our Niche



By Ed Osborne

Dr. Osborne is associate professor and program chair of agricultural education at the University of Illinois, Urbana-Champaign.

How much science should I teach in my agriculture program? Should I teach some science in *all* of my agriculture courses? What science concepts and principles should I teach? How should agriscience instruction differ from instruction offered by the science department in my school? Should I request that science credit be awarded to students who complete agriscience courses? How much of my instructional program should be *vocational agriculture,* and how much should be aimed at other purposes? What other program objectives should I target? How does my agriculture program fit into the curriculum and goals of the entire school?

There is probably not an agriculture teacher in the country who has not been thinking about many of the above questions in recent years. In fact, most teachers will re-ask and re-answer these questions many times over the next several years. These are tough questions that do not have clear cut answers or easily implemented solutions. But if teachers can muster the courage to ask these questions, then they are on their way toward rediscovering the niche of their programs in today's public schools. And clearly, we must focus on redefining the place and role of agricultural education in the secondary schools. But at the same time, it would be a drastic mistake to throw away *everything* from the past and start from scratch.

We should continue to teach technical skills, job skills, entrepreneurship, and leadership skills. We should continue to teach how to grow plants and raise animals. We should continue to teach agricultural mechanics. But we should teach these topics better by linking the practices of agriculture with the science of how plants and animals grow; how machines work; and why plants, animals, and materials respond to treatments as they do. The result will be a stronger agriculture curriculum, a student who makes better management decisions in plant and animal agriculture, and a student who has a working knowledge of science. The right kind of agriscience instruction will make the agriculture program stronger, while making a unique contribution to the scientific literacy of students in the school.

Yet, agriscience is still only one part of a comprehensive secondary agriculture curriculum. Agribusiness and leadership are equally important. Thus, we find ourselves in the precarious position of being vocational and academic, science based and business based, and lab and classroom oriented, but not too much of either extreme. We cannot afford to work only with vocational teachers; agriculture teachers must establish a good working relationship with other teachers especially those in the science department.

An abundance of excellent, new, agriscience curriculum materials has been developed in the past three years. Teachers now find themselves in the unfamiliar position of having so many good options that it's hard to know which to select. Three viable options seem to exist for incorporating new agriscience instructional materials: infusion of selected materials into existing courses, infusion of selected materials into new courses, or development of new, stand-alone agriscience courses. Of course, the latter option requires that either a new teacher be hired or one or more "old" courses be dropped - perhaps not a bad option in either case.

Teacher readiness to teach agriscience units or courses is a major concern. Unfortunately, most of us learned science as an isolated, abstract subject. Because of this, many of us just wanted to get our college science courses "out of the way." In recent years, college agriculture courses have sought to combine the production and scientific aspects of agriculture. Nevertheless, the lines between science and management (practice) are still strong. In both secondary schools and colleges, agriculture is perfectly positioned from a disciplinary standpoint to link science and management. Unfortunately, a reputation in some schools as a less rigorous, low skill curriculum has prevented this instructional linkage from occurring We have some work to do. In these cases, an incremental approach to curriculum improvement and agriscience instruction may be best, while we continue to work toward the ultimate goal of science-based agriculture and relevant science.

Our job is not to duplicate science instruction offered by science departments. Our job is to teach science in a different way, focusing

(continued on page 12)

Teaching Agriscience: A Few Cautions

BY PAUL R. VAUGHN

Dr. Vaughn is professor and chairman of the Department of Agricultural Education and Communications at Texas Tech University, Lubbock.

Although it is only in recent years that we have begun to use the term "agriscience", science has been an important part of the curriculum in agricultural education since its inception. Plant and animal science were important components of agricultural education in high schools even before the Smith-Hughes Act officially started high school agriculture courses.

If we look at the college curriculum for an agriculture teacher we see further evidence that there has always been a tremendous amount of science in agricultural education. For years, administrators and certification officers have recognized this by certifying many agriculture teachers to teach high school science courses. My high school freshman biology teacher was my agriculture teacher, as was my senior high school chemistry teacher. My first two years as an agriculture teacher included periods where I taught junior high science and high school chemistry.

Agriscience faces the potential danger of becoming absorbed within the science curriculum as a class rather than remaining a separate, distinct program. We must resist that temptation and make sure that the courses are truly agriscience rather than "regular" science.

Obviously, there are a lot of similarities between teaching "regular" science (biology, chemistry, etc.) and agriscience. Therein lies a potential problem. While we see a big difference between a program such as agricultural education and a course such as chemistry, others may not. With the trend toward semester courses in agricultural education, it is very easy for an administrator (at both the local and state level) to view "regular" science courses and agriscience courses as being basically the same. Thus, it becomes logical to think that the chemistry teacher or the biology teacher, as well as the agriculture teacher, can teach agriscience. Agriscience faces the potential danger of becoming absorbed within the science curriculum as a class rather than remaining a separate, distinct program.

To keep this from happening, we must reinforce the differences between agriscience and "regular" science. There are two basic differences. The first is that the science we have taught in agricultural education has always been applied and is part of a total program. This application aspect has provided the rationale for our laboratories and for our supervised experience programs. It is what has made agricultural education relevant, practical, and meaningful.

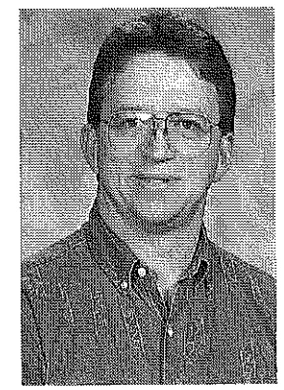
The second difference between "regular" science and science in agricultural education is the inclusion of youth organization activities as an integral part of the agricultural instructional program. The value of the FFA and its leadership training is unmatched in support by business, educational, and community leaders. It is the most unique aspect of agricultural education and is not found in the "regular" science curriculum.

As we plan for teaching agriscience in the 21st century, it is extremely important that we continue to incorporate these two essential components into the instructional program in agricultural education. Teaching environmental science, aquaculture, physical science, and computer science in agriculture are exciting additions to our curriculum and represent tremendous changes from the "traditional" production agriculture subjects we have taught in the past. There will be a temptation to treat these subjects as unique aspects of agricultural education and to perhaps leave out essential components of an overall agricultural education program. We must resist that temptation and make sure that the courses are truly agriscience rather than "regular" science. The only way to do that is by always: (1) using laboratory instruction and supervised experience to make instruction in agriscience applied, and (2) including FFA activities as an integral part of the agriscience curriculum. If we fail to do this, it may mean that we will not be teaching agriscience very far into the 21st century. ■

About the Cover

Tissue culture is a very useful tool in plant breeding and genetics. (Photo courtesy of Information Services, University of Illinois.)

Environmental Studies in Agriscience — An Integrated Approach



BY ROBERT L. WILLIAMS

Mr. Williams is principal and former agriculture teacher at Wilson High School, Wilson, TX.

Agricultural education at the secondary level has gone through many revisions, updates, and mandates during the past two decades. Programs are constantly being evaluated as administrators have to determine how limited capital and human resources will be used to achieve campus and district instructional goals. Many administrators are aware of the value of these programs in the development of skilled workers and community leaders. However, few recognize the complementary nature of agricultural eduction programs to academic subjects such as math, English, social studies, and science. By integrating concepts and skills from these subjects into agriscience courses, more academic credibility is attained, but more importantly students begin to realize the importance of academic subjects by applying them to solving agriculturally related problems.

However, few recognize the complementary nature of agricultural education programs to academic subjects such as math, English, social studies, and science.

Environmental concerns are everpresent in today's headlines and on the evening news. Science courses like biology and ecology focus on the cause and effect of environmental problems. Seldom does instruction in these areas provide reasonable or feasible solutions to environmental problems.

Production agriculture and agribusiness industries face, as well as contribute to, environmental concerns. The use of fertilizers and pesticides has, in some areas, affected groundwater supplies and wildlife populations. The cultivation of semi-arid grasslands and the use of forests for timber have brought additional negative publicity to agriculture. The concentration of large numbers of livestock and poultry has also created problems such as waste disposal, runoff, and offensive odors. If agricultural educators recognize these concerns and teach their students how to develop solutions to these problems through the application of scientific principles, then the students, the agricultural industry, and the profession of agricultural education will all benefit.

Getting Started

Getting your students started in conducting environmental studies may be easier than you think. You probably are already involved to some degree if you teach courses in plant science, soil science, horticulture, or natural resources. But what about those courses in agricultural construction, animal science, and agribusiness management?

Plant science, horticulture, and soil science all include concepts related to plant nutrition and soil fertility. Do you teach students how to monitor the level of soil nutrients and pH? Do you also teach them how to solve problems of nutrient deficiencies? This is one example of how teachers are already including environmental studies in their curriculum. Why stop there? Table 1 provides examples of how environmental concepts could be addressed in other agriculture courses.

TABLE 1
Topics for Integrating Environmental Studies into Agriscience Courses

Animal Science	Feedlot Waste Management
	Runoff Water Analysis
Ag Structures	Wastewater Lagoon Design
	Air Quality Assessment
Irrigation	Water Loss Comparisons
	Measurement of Soil Salts
	Comparison of Moisture
Ag Machinery	Using Different Tillage Methods
Agribusiness	Regulations and Permits
	Conservation Plans
	Cost/Benefit Analysis on Various Production Methods
Plant Science	Soil Fertility/pH Testing
	Sustainable Agriculture
Natural Resources	Water and Air Quality
	Wildlife Management
	Habitat Management
	Timber Management

Materials and Resources

In order to successfully integrate environmental studies into the agriscience curriculum, additional materials and resources may be →

needed. In addition to soil test kits, laboratory equipment for analyzing water and air quality would be helpful. Items such as thermometers, cameras, measuring tapes, and maps might also be useful. Scientific equipment is available through laboratory supply catalogs. However, many instruments and materials designed especially for use in environmental education are available from TERC, a non-profit organization which promotes hands-on math and science education.

An excellent source for information on the environment and opportunities for collaborative study is ECONET, a computer information network with electronic mail and computer conferencing capabilities that focus primarily on environmental issues. The AgEd/Agridata Network is a good source for lessons and news items related to the environment. Both networks require subscriptions, and you will also need computer communications software and a modem for access.

Projects and Activities

Environmental studies often facilitate specific interests in students, encouraging them to pursue more indepth studies or develop more intensive research activities. This motivation provides opportunities to promote involvement in local action and community improvement projects such as Building Our American Communities (BOAC) and competition in FFA award programs, including proficiency awards, public speaking, and the Agriscience Student Recognition Program. Many successful activities in agricultural education rely on integrating classroom and laboratory experiences with academic skills in oral and written communications, math, science, and social studies. The following project is such an example.

If agricultural educators recognize these concerns and teach their students how to develop solutions to these problems through the application of scientific principles, then the students, the agricultural industry, and the profession of agricultural education will all benefit.

The Global Laboratory Project

During the 1992-93 school year, Wilson High School students in Agriscience 101 were introduced to an environmental studies project that offered true interdisciplinary learning activities to all participants. This project, the Global Laboratory Project, was sponsored by the National Science Foundation and administered by TERC. Students from schools around the world participated in the project that included hands-on laboratory activities in environmental science. Collaborative activities included the collection and sharing of environmental data collected at each study site, as well as research ideas and suggestions by participants and TERC scientists through electronic mail and computer conferences on ECONET.

Global Laboratory Project participant schools were divided into groups or clusters. Schools participating in the cluster with Wilson High School students were from Massachusetts, Maryland, Oregon, Tennessee, Texas, Jamaica, Canada, and Russia. Each school selected a study site, and the Wilson students selected their school farm to study, since it was on campus.

The major instructional components of the project included site selection; a biological and physical inventory and description of the site, including measuring and mapping; an ecological profile of the site and community; and environmental research activities. Research activities were mentored by scientists at TERC who have academic backgrounds in various aspects of environmental science, including agriculture. Participants learned about cultural diversity, geography, math, communications, and computers, as well as science. This project enabled students to better understand the interdependence of these subjects.

Due to an unanticipated reassignment of the author from agriscience instructor to principal at mid-term, the Agriscience 101 students did not receive the full benefit from the Global Laboratory Project. However, under the direction of the WHS science teacher, Ms. Janet Kitten, the year-long project was completed by the Environmental Science class. Their work and dedication made writing this article possible in the midst of administrivia.

Implications

By integrating academic concepts and skills, including science concepts and methods, into agricultural education, the overall education of your students could be greatly enhanced. The utilization of computer networks to communicate and collaborate with students and scientists from other states and countries allows students to develop technical skills and a global awareness that will be essential in the workplace and economy of the next century.

Resources

TERC
Global Laboratory Project
2067 Massachusetts Avenue
Cambridge, MA 02140
617/547-0430
E-mail: gl@terc.edu

ECONET
Institute for Global Communications
18 de Boom Street
San Francisco, CA 94107
415/442-0220

AG-ED NETWORK
ARI Network Services, Inc.
330 E. Kilbourn Avenue
Milwaukee, WI 53202-3166
800/558-9044

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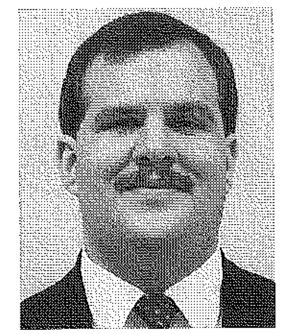
Agriculture & Science Teachers — New Levels of Integration & Cooperation



BY TOM CLAYTON, PEGGY CLAYTON, & MICHAEL E. NEWMAN

Mr. Clayton is an agriculture teacher and Ms. Clayton is a science teacher at Northeast Lauderdale High School, Meridian, MS. Dr. Newman (shown) is an assistant professor of agricultural and extension education at Mississippi State University.

Recent initiatives in vocational education have focused on the integration of vocational and academic subject matter. In agricultural education, a natural connection can be made between the subject matter of the various agriculture subjects and that of the "pure" sciences of biology, chemistry, botany, and physics.

One of these new initiatives is the Agriscience Institute, which was designed to help agriculture and science teachers make practical connections between their programs. This program, sponsored by the National Council for Agricultural Education, has used the emphasis on applied and "hands-on" science and the push to integrate vocational and academic programs to bring agricultural education and science education closer than ever in philosophy. Agriculture and science teachers have discovered innovative ways to cooperate with one another to strengthen agriculture and science programs and to create new combinations of the two disciplines.

This article shares some insights and ideas from agriculture and science teachers who participated in the Agriscience Institute.

Agriculture and science teachers have discovered innovative ways to cooperate with one another to strengthen agriculture and science programs and to create new combinations of the two disciplines.

Tom Clayton and Peggy Clayton

After 19 years of married life and 18 years together in the teaching profession, Tom and Peggy Clayton thought they knew all there was to know about each other, personally and professionally. But after one year as participants in the Council's Agriscience Institute and Outreach program, both say that their version of cooperation between agriculture and science teachers has a lot of room for growth and development.

Peggy, a chemistry, physics, and biology teacher at Northeast Lauderdale High School, said, "For so many years we have worked in two separate programs, with two almost separate sets of students. We saw a lot of connection between our subject matter, but there seemed to be so few connections in practice."

Tom, who teaches horticulture and agriscience at the Meridian, Mississippi school, said, "When I first began to teach agriculture, students earned science credit. Now things have come full circle in Mississippi with the state department of education granting science credit for our new agriscience courses." Peggy worked with Tom from the beginning of the agriscience pilot project - attending workshops, serving on an evaluation committee, and serving as a science contact person during the process of applying for a Carnegie unit of science credit.

The two found strong connections between the environmental units Peggy teaches in advanced chemistry and those in the agriscience curriculum. They began to exchange ideas and activities related to resource management and pollution control. Another area of common interest was plant science, where Tom was a supplier of both practical and theoretical knowledge to support Peggy's six-week botany unit in advanced biology.

Acceptance in the Agriscience Institute gave Tom and Peggy the chance to strengthen these bridges between their programs. One result was their agriscience activity on plant exposure to ultraviolet radiation, the Claytons' contribution to the package of material distributed throughout the outreach workshops conducted by the original institute participants. "The materials are designed to be relevant to agriculture and to science," Peggy noted. "It is not necessary to have a cross-disciplinary course in place to use them. Teaching partners are encouraged to find ways to cooperate professionally." (Workshop participants consist of teams of one agriculture and one science teacher from the same school district.)

Lena McClenny and Sharon Reilly

Other teacher teams from the institute provide some models for this cooperation. In Charlotte Courthouse, Virginia, Lena McClenny teaches horticulture and applied agricultural concepts. Her science teaching partner is Sharon Reilly, who teaches biology and chemistry at Randolph-Henry High School. Other teachers, as well as administrators, have noticed the close working relationship that has →

developed between these two teachers. After returning from the Institute, Lena and Sharon requested the same preparation period to coordinate activities. They frequently visit one another's classrooms, often combining their classes to work on joint activities.

One recent activity was a "niche kit", teaching the biological and agricultural concept of ecological niches. The partnership has extended to cooperative grantwriting. After receiving funds to build an arboretum, the two teachers involved both of their classes, as well as the Ecology Club and the FFA, in constructing, classifying, and labeling. They are working on a larger grant to do further cooperative projects.

Their shared emphasis is on making agriscience activities belong to the students - letting them take charge of experiments and activities and produce results. McClenny said, "If you make kids think they can't do, then they can't, but expect them to accomplish things, and they will!"

Frank Bridges and Rob Matheson

In Apex, North Carolina, agriculture teacher Frank Bridges was considering the creation of an agriscience research course and was in the beginning stages of developing the course when Rob Matheson was hired to teach science at Apex High School. Bridges invited Matheson to cooperate with him in the development of the course, and the two of them put together a new course called Research Methods in Agriscience, which has concluded a successful first year and is in place for another year. Finding the time to team-teach with Bridges required Matheson to sacrifice his planning period to be in the classroom most days the first semester and two days per week the second semester. The course content consists of agricultural topics investigated through scientific inquiry. Credited as a vocational course, Research Methods in Agriscience has attracted mostly traditional science students, many of whom had little background in agriculture. "I've had the opportunity to work with a whole new group of students," Bridges commented. "Most of these kids I would never have taught if not for this class."

Bridges invited Matheson to cooperate with him in the development of the course and the two of them put together a new course called Research Methods in Agriscience, which has concluded a successful first year and is in place for another year. Credited as a vocational course, Research Methods in Agriscience has attracted mostly traditional science students, many of whom had little background in agriculture.

Theresa Nowicki and Janice Gershlak

"Both curricula are more vibrant now," is how horticulture teacher Theresa Nowicki described her partnership with biology-chemistry teacher Janice Gershiak at Essex Agricultural and Technical Institute in Hathorne, Massachusetts. Senior floriculture students from Nowicki's class were trained to present agriscience activities in Gershiak's biology classes. The students and the respective programs all received a boost from the interaction. Both teachers participate in one another's classes at the expense of each teacher's planning period, team-teaching lessons which relate to science and agriculture. "Janice's programs have become more hands-on," said Nowicki, "and mine have become more technical. Agriculture has always been a science, but the marriage of our two programs has improved the local perception of agriculture as a science."

Amanda Olenio & Curtis Fall showing students how to plant Brassica seeds.

Summary

The improvement in image is a common theme voiced by cooperating agriculture and science teachers. Agriculture programs are incorporating more lessons and activities grounded in scientific inquiry. Science teachers serve as resource persons and provide a depth of knowledge and experience from the "pure" sciences. Exposure to the material, the equipment, and to the science teacher is changing the perception of vocational students about the role of science in agriculture and about their own prospects in academic science

Some additional comments made by cooperating teachers include:

"What might have been fear of science is replaced by a love of it."

"The science is theirs--they have done it themselves and seen its importance."

"Shared experiences in agriscience, in science fairs, and in student organizations have improved traditional science students' perception of agriculture."

"They (students) recognize it as real-world science."

"When the biology (or chemistry) students see the application first, they <u>want</u> to learn the science principles."

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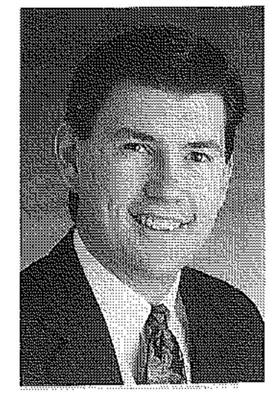
Projecting an Agriscience Image



BY ROBERT TERRY, JR.

Dr. Terry is an assistant professor in the Department of Agricultural Education and Communications at Texas Tech University, Lubbock.

In television commercials for Canon cameras, flamboyant tennis star André Agassi, in his long hair, earring, and neon colored shorts says, "Image is everything." While we may not totally agree with that philosophy, we cannot deny the influence of image upon perceptions.

In this issue you see articles about how agricultural education has changed. How agriculture has evolved and continues to develop into a more technical discipline. How the agriculture curriculum has shifted from a skills base to a science base. How students and teachers are exploring innovative and exciting new areas of agriculture. How our programs are different than they once were.

However, if people outside our profession, outside of the agriculture program in a community are not able to <u>see</u> evidence of such change, will the benefits of the change be realized? There is a lot of truth to the old saying, "perception is reality." People take what little information they have about a subject and make conclusions. We all do it! No matter how much a program has changed and progressed, if outside observers, particularly those in positions of influence, do not <u>see</u> that change, it could be all for naught.

So, what can be done to show a superintendent, a principal, fellow teachers, parents, and a community that a vocational agriculture program is now an agriscience program? How can an appropriate image be developed? How can perceptions be influenced?

The answers to these questions may be simpler than you think. But, they may not be what you want to hear.

Starting on the Inside

For a true, lasting image to be cultured, it must represent something of substance. A wolf in sheep's clothing will eventually be found out.

The agriscience curriculum calls for something different. While FFA and SAE are essential parts of a total educational experience, they are of lesser importance and are more an opportunity to apply what is learned in the classroom/laboratory rather than the focus of the entire program.

By this time, it should be obvious that there is not a lack of substance to the agriscience movement. However, it is important that we recognize and promote how our program has changed in a very real sense.

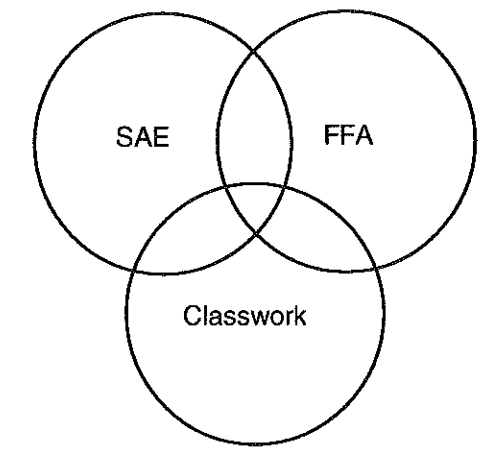


Figure 1: Model for excellence in vocational agriculture programs.

For years we have been told that a strong vocational agriculture program must have balance. The model of the three, overlapping, equal-sized circles has been a fixture of how we view our programs (see Figure 1). This model symbolizes how the ideal program should have equal emphasis on the classroom, FFA activities, and supervised agricultural experiences (SAE). It also illustrates the fact that educational experiences from each of the three areas carry over to each other.

The agriscience curriculum calls for something different. While each of the three areas are still important, the classroom/laboratory is disproportionately emphasized. While FFA and SAE are essential parts of a total educational experience, they are of lesser importance and are more an opportunity to apply what is learned in the classroom/laboratory rather than the focus of the entire program. Figure 2 illustrates this model.

In proposing this new model, I would contend that very few vocational agriculture programs ever really fit the equal circles mode. Most probably had major emphasis in one of the three areas. In many cases certain FFA activities, such as livestock shows and other competitive activities, might have been most →

emphasized - or even been the foundation of some programs. The greatest amount of effort and thus the greatest amount of recognition - image - came from that aspect of the program. As shown in the latter model, modern agriculture programs focus upon the classroom, thus projecting a strong, academically rooted image.

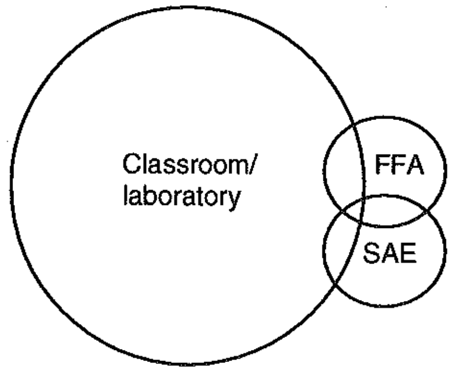


Figure 2: A model for excellence in agriscience programs.

Projecting to the Outside

The temple of the agriscience program is its facilities. Community members drive by them and students pass through them daily. The appearance of facilities provides information that helps to form perceptions about what you teach and how you teach.

An agriscience classroom should look more like the high school biology classroom than the vocational agriculture classroom of old.

Look around your facilities. What do you see? Does your classroom and laboratory look like a place where SCIENCE is taught? Are they clean and orderly? Do they reflect pride and progressiveness?

I have been in countless facilities for high school agriculture programs over the past few years. Unfortunately, I must say that most facilities I have seen do not look like agriSCIENCE classrooms. If science is being taught, it is hidden very well. However, in most cases, it would not take too much effort to improve the situation.

Being an agriculture teacher is not an excuse to look less professional than other teachers.

Many facilities need only some "sprucing up" to help reform the image they project. An agriscience classroom should look more like the high school biology classroom than the vocational agriculture classroom of old. Bulletin boards should be an important visual aid to what is currently being taught. Audio-visual equipment should be in good working order. Storage areas for curriculum and reference materials should be neat and accessible.

To take things a step further, science teaching equipment could be obtained. If the vocational agriculture classroom did not have microscopes and other science lab equipment, the agriscience classroom should. Aside from purchasing new equipment, it may be possible to obtain or borrow equipment not currently being used by science teachers at the school. From time to time, there are also grants available on the federal and state level that can help teachers purchase equipment and improve facilities.

Students, parents, and other supporters could be used to help do necessary remodeling chores. Perhaps the best FFA service project that could be conducted would be one to clean up or at least build a fence around the metal yard.

The agriscience building should be a place that administrators want to show off to visitors. It should be a drawing card to help recruit students of all backgrounds and abilities to your program. It should reflect the positive direction of your teaching.

The Program — Personified

One of the two best representatives of your agriscience program is you. The image you project is a window to your priorities and concerns for your program. It is important for agriscience teachers to promote their programs and take advantage of opportunities to tell others about the new direction of the curriculum.

In addition, it is vital that the teacher "look the part." I tell student teachers that a visitor to a high school campus should not be able to identify the agriscience teacher by his or her appearance, unless he or she is the most professional-looking teacher at the school. I make this suggestion, fully aware that the activities of certain class periods on certain days do not lend themselves to the teacher wearing a tie and slacks or a skirt. However, special arrangements can be made for those times. Being an agriculture teacher is not an excuse to look less professional than other teachers.

Perhaps the most important thing you can do to improve as a professional is to participate in the activities of professional organizations. A great deal of valuable information regarding developments in agricultural education is communicated via state and national agriculture teachers associations. In addition, your voice can be heard by taking part in meetings and conferences of these organizations.

In many states inservice activities have been developed to help teachers get a jump on newly developed curricula. These workshops often provide hands-on opportunities for teachers to become familiar with new materials and activi-

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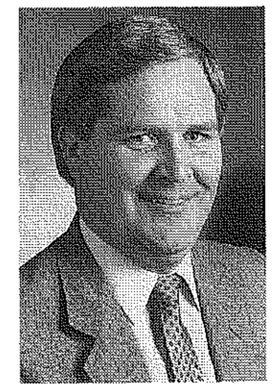
How Much Science is Being Taught In Our Agriculture Curricula?



BY DR. STEVE FRAZE

Dr. Fraze is an assistant professor in the Department of Agricultural Education and Communications at Texas Tech University, Lubbock.

Webster's Dictionary defines science as 1) the state of knowing, 2) a department of systematized knowledge as an object of study, 3) something that may be studied or learned like systematized knowledge, or 4) one of the natural sciences. In recent years, we have adopted the term agriscience as a result of the national attention on educational reform. The use of any of these definitions or a combination of these definitions of science combined with agriculture will readily define what secondary agriculture instructors are trying to accomplish in their instructional programs.

The National Academy of Science in its 1988 report Understanding Agriculture: New Directions for Education stated:

> *Ongoing efforts should be expanded and accelerated to upgrade the scientific and technical content of vocational agriculture courses. The "vocational" label should be avoided to help attract students with diverse interests, including the college bound and those aspiring to professional and scientific careers in agriculture. Agricultural courses sufficiently upgraded in science content should be credited toward satisfying college entrance and high school graduation requirements for science courses in addition to the core curriculum.*

The agreement that sponsored this study of agricultural education occurred in 1984 between the Secretary of Education, the Secretary of Agriculture, and the President of the National Academy of Sciences. That same year in Texas, a man by the name of H. Ross Perot headed up a state committee on educational reform that started the changes in the Texas Vocational Agriculture Program four years prior to National Academy of Sciences' recommendations for needed change.

The major change that started transpiring in 1984 was a rapid evolution from teaching year-long vocational agriculture courses to the development and adoption of 23 agriscience semester courses. Clichés such as agriculture is more than cows, sows, and plows or seeds, feeds, and weeds were used to illustrate the point of the new agriscience curriculum with such offerings as Introduction to World Agricultural Science and Technology, Food Technology, and Energy and Environmental Technology. The development of these courses not only helped to save the agriculture programs in Texas, it has contributed to an unbelievable growth in student enrollment of approximately 55,000 students at the time of implementation to over 86,000 students today.

The development of these courses not only helped to save the agriculture programs in Texas, it has contributed to an unbelievable growth in student enrollment of approximately 55,000 students at the time of implementation to over 86,000 students today.

Are we saying suddenly that somewhere in the 1980s we realized a need to include science in our agriculture curriculum, based on the recommendations of others? Years before the agriscience revolution, science teachers would use examples of agriculture to illustrate a scientific principle. Without a doubt, science has been the underlying strength of good agriculture teaching. What we started doing in the 1980s was to promote the concept of science and accept the fact that our profession goes beyond the training of young people to enter an agricultural career upon completing their high school requirements.

The question that now may be asked is **"How much science is being taught in our agriculture curricula?"** Many states now allow students enrolled in agriculture classes to receive science academic credits needed for graduation. A recent research project sponsored by the Texas Education Agency was designed to examine the content of specific semester agriscience courses to determine how much science, math, and other academics are being taught or reinforced in these courses.

The Texas State Board of Education has established a comprehensive set of rules for curriculum. The mandate of the Board is that each school shall provide a well balanced curriculum containing knowledge, skills, and competencies established through the essential elements for each course. The term "essential elements" might also be referred to as objectives or outcomes. For every course offered in Texas, from kindergarten through twelfth grade, essential elements have been established. One pur- →

pose of the essential elements was to develop a uniform curriculum throughout the state. Any course of study offered in a Texas school must meet the essential elements established for that course.

The project sponsored by the Texas Education Agency identified the essential elements of various academic courses and determined how many were being taught or reinforced in ten selected agriscience courses. The ten Agricultural Science and Technology courses which were evaluated included:

1) Introduction to World Agricultural Science and Technology (AGSC 101);
2) Applied Agricultural Science and Technology (AGSC 102);
3) Introduction to Agricultural Mechanics (AGSC 221);
4) Animal and Plant Production (AGSC 231);
5) Agribusiness Management and Marketing (AGSC 311);
6) Agricultural Metal Fabrication Technology (AGSC 322);
7) Animal Science (AGSC 332);
8) Equine Science (AGSC 334);
9) Landscape Design, Construction and Maintenance (AGSC 361); and
10) Wildlife and Recreation Management (AGSC 381).

Any student in Texas enrolled in these courses plus other courses will have been exposed to the essential elements of Biology I numerous times without ever being enrolled in the biology class.

The Texas State Board of Education Rules for Curriculum lists 10 Essential Elements to be included in the instruction of Biology I. Essential element number 2 for Biology I states: The student shall be provided opportunities to (A) observe plants, animals, and protists in their environment; (B) examine biological specimens: and (C) recognize patterns in nature. AgriScience courses 102, 231, 332, 334, 361, and 381 address Essential Element number 2 for Biology I. In fact, the Applied Agricultural Science and Technology course (102) and the Animal Science Course (332) contained all 10 essential elements required for teaching Biology I. Any student in Texas enrolled in these courses plus other courses will have been exposed to the essential elements of Biology I numerous times without ever being enrolled in the biology class.

This study found that these ten courses also taught and reinforced a majority of the essential elements for Biology II, Environmental Science, Anatomy and Physiology, Physics I, Chemistry I, Physical Science, and Geology. In answer to the question. **"How much science is being taught in our agriculture curricula?"**, we can say in Texas that a majority of the curriculum is science based.

In the agriscience courses, teachers' decisions about course content determine how much science is actually taught, just as it is in the biology or chemistry class. Agriculture teachers in Texas, as well as other states, can say, "Yes, we are teaching science in our agriculture curriculum. If you have the time I can show you."

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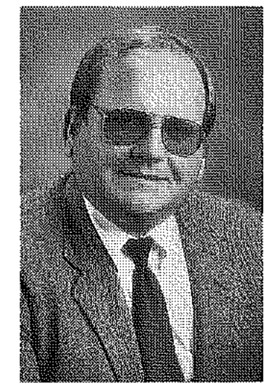
Rediscovering Our . . .

(continued from page 3)

on applications of science in all facets of the broad agricultural industry. If we offer agriculture courses for science credit, then one or more basic science courses should be prerequisites for agriscience courses. Students should not first study science in agriculture courses. Rather, basic study in the sciences should be followed by applications of science concepts and principles in agriculture. Student experimentation should be used as <u>the</u> method of teaching and learning in agriscience courses.

A balanced, yet diverse, agricultural education program can clearly fill a void in today's high schools. In many ways, agriculture is applied science. But "pretended" agriscience instruction will quickly do more harm than good. Agriscience instruction must be technically accurate, scientific, and agriculturally oriented. Only then will the science connections in agriculture instructional programs be recognized and appreciated. ■

When is a Rabbit a Horse?



BY CRAIG EDWARDS

Mr. Edwards is an agriculture teacher at Klein Oak High School, Spring, TX.

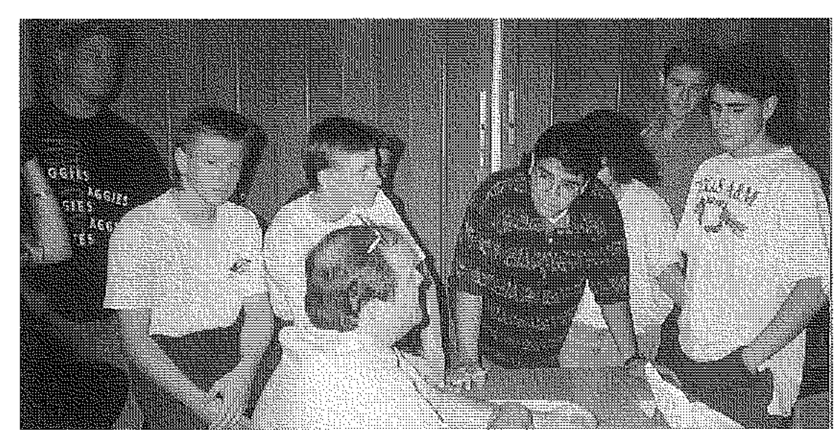
When teaching the anatomy and physiology of the digestive system of a horse, that's when. Both are monogastrics, and both have a functional cecum. Obviously, doing the post-mortem of an eight-pound rabbit instead of a 1200 lb. horse is much easier, cheaper, and more feasible. The cecum of both species will be located at the same anatomical spot (junction of small and large intestine) (Ensminger, 1990) and will have basically the same function (physiology). Not to mention along the way, teaching the other common gross anatomy of the monogastric digestive system, such as pharynx, esophagus, stomach, small intestine (duodenum, jejunum, and ileum), large intestine (colon), and the accessory digestive structures (salivary glands, pancreas, liver, gall bladder) (excluding the horse), (Ensminger, et al, 1990). With the exception of the size difference of the two specie systems, the rabbit digestive system is an excellent replacement for that of the horse; especially in the high school agricultural science class setting.

Set the Table

I tell my students that agriculture is nothing more, or less, than the practical application of scientific principles, including but not limited to, biology, chemistry, physics, and mathematics. To truly understand and comprehend what is really happening in agriculture, we must consider and strive to grasp the science behind it.

The beauty here is that this approach does not make imparting this knowledge less "hands-on" in nature, but more so.

As described previously, this exercise could easily include actual rabbits, or if teaching the specifics of poultry digestion, chickens instead. If not on a one per student basis or in pairs, the teacher could at least demonstrate on a real specimen. Would we think of teaching soil texture or structure without hands-on sampling and comparison by the student? I think not.



Students enrolled in Animal Science 332 observe a preserved cow tract while the instructor discusses the anatomy and physiology of the female bovine reproductive system.

Collegiate Influence

If we think back, did not many of us do something similar to this in our basic poultry or animal "science" courses in college? I know at Sam Houston State University in Huntsville, Texas, under the tutelage of Dr. Perry Little, this was part and parcel of one of our laboratory experiences. It worked for many of us in imparting this knowledge, it can and does work in our high school classrooms.

How Does It Compare?

How different is this from what is going on in our high school biology labs with fetal pigs? Perhaps, with the level of student interest higher in our classrooms (if we can believe what we are told about student interest and elective selection) the learning experience should be intensified, and therefore learner outcomes greater.

Bridging Theory and Practice

What about when teaching the reproductive systems of livestock? At the very least, a preserved cow tract can be used to facilitate instruction. This tract can be given double duty when teaching the principles of palpation and artificial insemination breeding tube passage. These tracts can be purchased from a well known agri-supply company for less than $40.00. I doubt many administrators could find fault with this kind of instructional aid purchase. In fact, if used properly, the teacher should be commended.

During the 1990-91 school year, I taught for the first time in a rural farming/ranching area. Prior to this I had spent eight years teaching in a town of 60,000 plus. My new locale gave me the opportunity to "bridge the gap" (for lack of a better description) between the scientific part of the curriculum and the more "hands-on" production end. At the conclusion of our animal reproduction A.I./palpation unit in Animal Science 332, we took a field trip to a student's farm. The student's family has a small beef cattle herd from which we selected several cows to palpate and determine if open or bred, and if →

bred, estimate length of pregnancy. In addition, breeding tube passage was demonstrated on several open cows. This experience was as "hands-on" as it gets, but all knowledge utilized and assimilated by the learner to make this practicum effective was rooted in scientific (in this case biological) principles.

When teaching avian reproduction, postmortem one or several laying hens. Herein lies an excellent opportunity to incorporate some basic endocrinology, with the study of the common hormones (follicle stimulating hormone - FSH, luteinizing hormone LH, estrogen, oxytocin, etc.) involved in female sexual maturation, production of a mature ovum (egg yolk), and the egg laying process (oviposition). This lab is extremely inspiring to the student if an egg is currently being formed in the hen's reproductive tract and can be removed.

How different is the comprehension and application of the principles behind soil science and fertility or the uptake and usage of soil nutrients by plants? Or what about the algebraic and geometric principles used everyday in agricultural mechanization and engineering? And the endless mathematical calculations in a "true" agribusiness, management, and marketing curriculum. The surface has only been scratched in the area of biotechnology and the high school agriculture curriculum.

Conclusion

The opportunities for an agricultural educator to "bridge the gap" and demonstrate the science of agriculture in a real and meaningful way are only as restricted as our own attitudes and perceptions. Be the agricultural science teacher who uses the practical application of scientific principles to influence the student who ultimately becomes a veterinarian or medical doctor. Or be the instructor that influences the student who goes on to become an agricultural scientist, perhaps one who develops the drought-tolerant plant variety that enables African Saharan nations to feed their own people. At the very least, make science more relevant and palatable for the students who, for whatever reasons, will not spend their lives a part of it. Or provide the spark that inspires the future surgeon, who will someday tell his/her colleagues how the first post-mortem and examination of a gastro-intestinal (G.I.) tract he/she ever witnessed was that of a rabbit. And he/she will tell about the agriculture teacher who was "mad as a hatter", kept calling the rabbit a horse, and was talking about a functional cecum. **BRIDGE THE GAP!!!!**

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Projecting an . . .

(continued from page 10)

ties to make teaching more effective. Of even greater value is the chance to visit with other teachers meeting the same challenges and exchange ideas with them. Teachers learn from each other how to creatively and effectively teach agriscience.

Extending the Audience

Agriscience teachers must recognize the fact that they are a part of a total school effort. The new curriculum has definite ties with other academic programs - particularly science. Teachers must learn to work together to improve instruction in all areas.

There are certain agriscience topics that might best be introduced or supplemented by the chemistry teacher or the biology teacher. Likewise, there are topics and laboratory activities in chemistry and biology that would best be taught by the agriscience teacher.

In addition, facilities can be shared for the benefit of all students. If the agriscience department does not have a fully equipped lab with microscopes, burners, and glassware, perhaps teachers can work out a time for the agriscience students to spend time in the biology lab while the biology class studies in the agriscience greenhouse. The same arrangement could be made for other facilities, such as computer labs.

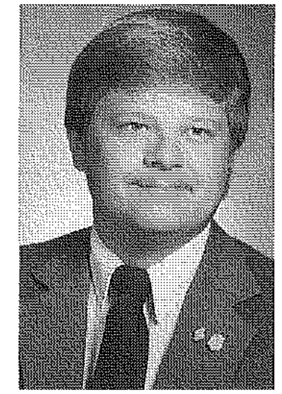
Change Expectations

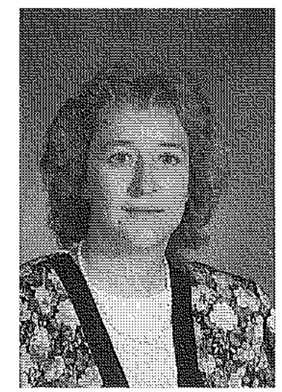
Some teachers feel they cannot change the emphasis and image of their program because of community pressure. They fear that if they change what they are currently doing, they will lose their support base. They believe the community has expectations that do not include intensive, classroom-based, agriscience teaching. To answer these concerns a teacher must become proactive . . . expectations can be changed!

Again, people will define your program based upon their perceptions. Their image of agricultural education on the secondary level can be shaped by the standards that you provide. As new topics are taught, as innovative activities are used, they must be shared and promoted. Teachers must use local and area media outlets to tell supporters about changes taking place and how they are benefiting students and the community. The program must be seen as progressive and in step with the current trends in agriculture and education.

The agriscience program of today is not the program most of us grew up with. It is not the program many of us taught in the past. It does, however, hold a great many opportunities and challenges. Make sure that people looking at your program see agriscience. After all, to them, image may not be everything - it could be the only thing.

Integrating Agriscience Programs in Rural & Suburban Schools





BY DAVID TWENTE & PATTI BRATTON

Mr. Twente is an agriculture teacher at Wellington-Napoleon High School in Wellington, MO. Ms. Bratton is a science teacher at Grandview High School in Grandview, MO.

It has been accepted by educators that getting students to accomplish a task means that learning has taken place. Those who were interested in higher learning concepts hoped to get their students to achieve an understanding about why something is done. True leaders of education today would insist that real learning takes place when students ask questions, inquire about ways to discover the answers, then find the answers themselves. When my father graduated from high school in 1936, his competition sat next to him in his class. Skills he learned included repairing a leather harness, making rope halters, mixing rations, and when and how to plant and harvest crops. College was an option only for the rich. When I graduated from high school in 1970, my competition was regional to statewide in scope. Skills I learned included arc welding, selecting livestock, and using chemicals such as 2, 4-D and Atrazine. Higher thinking/problem solving skills included selecting hybrid seed corn varieties, balancing rations with soybean meal, and analyzing costs between selecting gas versus diesel tractors for the farm (done without the aid of a hand-held calculator). In 1996, when my daughter graduates from the same high school, her competition will be in a worldwide marketplace. Skills that she may learn include marketing commodities via satellite communications, computer modeling and analysis, micropropagation of plants, developing plants that are tolerant of acid rain or excessive radiation, and many other life skills which may have not even been thought of yet. Things have certainly changed in the last 60 years or have they?

Education must be designed to create an environment where students are deeply involved in the learning process.

Many of the skills that were taught then, and certainly those taught now, are often done through the environment of various hands-on learning processes. Today, with the explosion of technology, education must address scientific principles as they apply to agriculture. Education must be designed to create an environment where students are deeply involved in the learning process. The National AgriScience Institute and Outreach Program models a teaching approach that increases student creative thinking and problem solving. The primary purpose of the project is to integrate the teaching of agriculture and science. The program has brought more science education into the Wellington-Napoleon agriculture program and has certainly enlightened many Grandview science students with the rich, practical application of agriculture.

The approach is a simple one - combine science education with agricultural education. Rather than a lecture/study/experience format, students are immediately challenged to become involved in the actual process of science. Instead of giving answers to all questions, or providing information for the students to study, students are asked to observe a problem, develop questions from their observations for a hypothesis, then develop and complete an experiment that will test their hypothesis. The research process is taught, demonstrated, and explored by each student, with students collecting their own data, analyzing the results, and forming their own conclusions based on their own results. As with much of science, failure is often encountered. Students are encouraged to learn from their failures and make the necessary corrections to cause the experiment to work properly. By designing and conducting their own experiments, students often find they have uncovered more questions than they have answered, encouraging further investigation. This process has an ultimate result of students actually discovering conclusions and learning from them, instead of memorizing information or mechanically performing specific tasks.

Students as Wellington-Napoleon had the unique opportunity of having a diverse series of experiments developed for them from both the 1991 and 1992 classes of the AgriScience Institute. I was able to fit most of both year's experiments into one or more of my classes during the school year. Under the heading of Environmental Sciences, Horticulture, Natural Resources, and Junior High Exploring Agriculture, students explored the effects of acid rain, ozone depletion, salt build-up on irrigated land, and plant responses to chemicals or pollutants. Students also studied the response of plants to various levels of fertility, genetic diversity, crossbreeding, evolution, and gravity. They also investigated the many properties of soil and how it is the basis for life on earth. Food science students learned of the many ways to preserve food, from making Korean KimChee from Chinese cabbage to making alfalfa silage using genetically engineered *lactobacillus* bacteria from Pioneer Hybrid. →

"How," you ask, "were you able to teach all of those topics with a limited budget and expertise?" The answer is simple — Wisconsin Fast Plants coupled with Bottle Biology. Both tools are classroom-tested approaches to hands-on

Instead of giving answers to all questions, or providing information for the students to study, students are asked to observe a problem, develop questions from their observations, form a hypothesis, then develop and complete an experiment that will test their hypothesis.

science using plastic 2-liter soda pop bottles, 35 mm film containers, and other throwaway or recyclable items. Bottle Biology offers a low cost way to create experiments and life science explorations that may be used to study a variety of biological principles in agricultural applications. Wisconsin Fast Plants, a variety of *Brassica rapa*, were initially developed as a research tool by Dr. Paul Williams at the University of Wisconsin, Madison. Wisconsin Fast Plants are now providing an exciting resource for teaching plant science in preschool through college classrooms. In addition to their remarkably short life cycle, Fast Plants respond rapidly to environmental stimuli. These plants provide an inexpensive way to teach areas of biological and plant science, such as growth and development, reproduction, physiology, genetics, evolution, and ecology. After students were first oriented to Bottle Biology basics, they were excited to go to work each day. They were encouraged to try to elaborate on suggested bottle constructions to make improvements.

This process has an ultimate result of students actually discovering conclusions and learning from them, instead of memorizing information or mechanically performing specific tasks.

Through the Outreach Program, Agriscience Institute teaching teams fulfilled the objective of teaching other agriculture/science teacher teams across the country. By the end of October 1993, agriculture/science teacher teams in every state will have participated in Outreach Workshops. These workshops will help get the creative juices flowing between the members of those teams and hopefully instill the need for integration of information between agriculture and science. Resistance to this integration of agriculture and science has been met from some. Replacing science teachers with agriculture teachers is not the goal. Rather, all teachers should be trying to support and supplement each other's curriculum. Teachers should try to capitalize on all of the resources available to them. There are tremendous resources and opportunities available just by learning to know and share with the science teacher down the hall. It has been our experience that the rich field of agriculture is a natural for teaching science, and everything experienced in agriculture today involves scientific process.

Solving problems by investigations has certainly helped increase student interest and motivation toward the study of both agriculture and science. As our students investigated the various areas of science, more questions were asked by students than were answered by their teacher. Many agriculture students were exposed to higher order thinking skills in agriculture in unique ways, such as discovering the value of livestock manure by building a methane digester. At the same time, suburban science students at Grandview were exposed to agriculture for the first time. Rural students, such as those at Wellington-Napoleon, had many ideas and concepts from previous classes reinforced through experimentation. Grandview science students learned that there is much more than the "cows and plows" concept they associate with farming.

Grandview and Wellington-Napoleon students come from very different cultures, even though they are only 45 miles apart, and both are bedroom communities for Kansas City. With 1200 plus students in grades 9 - 12, Grandview is a medium-sized suburban school district with no agriculture program. Interested students may attend the Kansas City Agricultural Magnet School. On the other side of the coin is the Wellington-Napoleon School District, with 124 students in grades 9 - 12 and an agriculture program of 54-60 students. All seventh grade students are also enrolled in a one semester Exploring Agriculture class.

Although there are many differences in the two schools, there are also many similarities. While both groups of students were studying The Horrors of Acid Rain and doing a lab experiment relating to that topic, very similar questions were asked. "Are certain plants more or less tolerant to acid rain?" "Can plants be specially bred to be more tolerant to acid rain?" "How can the effects of acid rain be slowed, changed, or reversed?" While doing a study on ozone depletion, students from both schools pointed out the damage done to plants by ultraviolet light rays and associated it with skin exposure to the same light rays in tanning beds. As novice engineers, students from both schools "invented" machines that would move an egg across a table, built "rocket ships" using trigonometry to determine the altitude achieved on lift off, and explored robotics and pneumatics, all using 2-liter bottles, plastic tubing, Scotch tape, syringes, and film cans.

In the Wellington-Napoleon Elementary School, students in the fourth and fifth grades participated in a local science fair. They too, were exposed to doing research with Fast Plants and Bottle Biology. This integration of programs from elementary science to biology, math, physics, and industrial technology, along

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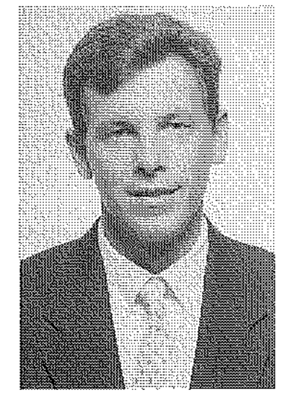
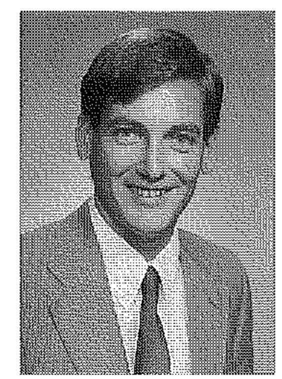
Balancing Production Agriculture and Agriscience: You Make the Call





BY DAVID MCCREERY & MATT BAKER

Mr. McCreery (top) is an agriculture teacher at Hemet High School, Hemet, CA. Dr. Baker is an associate professor of agricultural education at Cal-Poly, Pomona.

Few would argue the importance of refocusing a program's direction away from strictly production agriculture towards a more scientifically based curriculum. In fact, some progressive teachers have already dramatically refocused their programs. Teachers began jumping on the science bandwagon 10 or so years ago. In fact, it is often difficult to delineate the difference between these programs and most traditional science programs. Individuals were quick to junk their stock trailers, sell their livestock, and convert their agricultural mechanics laboratories (complete with makeshift, above-ground swimming pools) into aquaculture facilities. On the other end of the continuum, there are resistant teachers who will change their production-oriented programs when subtropical plants are grown on the North Pole.

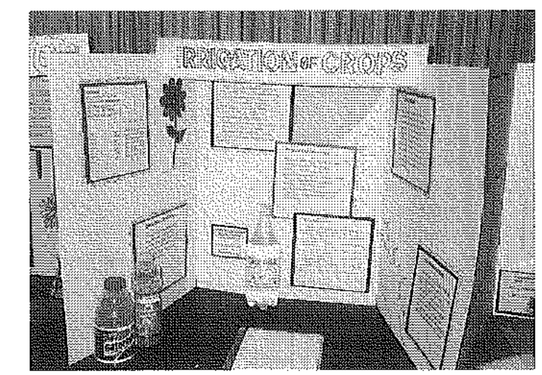
Fortunately, most agriculture teachers fall somewhere in the middle and have struggled for a number of years to determine how much science should be included in their curriculum. Such teachers tend to understand that the balance between teaching production agriculture and agriscience is not an either/or scenario. They have always included a great deal of science-related information in their curriculum. They have seriously pondered where their programs belong on the continuum. The following factors are provided to assist this group in making meaningful decisions.

Student Input

The types of students found in agriculture classrooms tend to vary tremendously. Students may be college bound, vocational, wanting to learn about agriculture subject matter for avocational reasons, simply interested in exploring career alternatives, or probably a combination of all four. Students' wants and needs must be taken into consideration when designing a program. Student involvement in the curriculum development process is a key to meaningful program development.

Local Community & Industry Needs

A diversified advisory committee can be a tremendous program asset when determining local community and industry needs. By selecting members with a broad range of practical experience and occupations, you provide a strong sounding board to help answer the balancing question. One action that might be considered is to include a science teacher on the advisory committee. Adding someone with a background on the other end of the spectrum provides another viewpoint to consider for the question of balance in the classroom between agricultural production and agriscience.



Many states have initiated agricultural science fairs, posters, and essays.

Professional Development Opportunities

Agricultural educators have always placed a high priority on professional development. Summer workshops, graduate courses, internships, and traditional inservice educational opportunities must be made available for agriculture teachers who wish to make curricular changes. It is important that teachers work closely with state supervisors, teacher educators, and industry to insure that appropriate professional development activities are provided.

Remember, meaningful professional development activities do not have to be agriculturally oriented. Since agriculture is an applied science, there are many science workshops that can fulfill agriscience needs. It may be a good idea to ask your school's science teacher to keep you advised on available workshops in science education. Joint agriculture and science professional development programs may also be a consideration. This has been done very successfully with the Agriscience Institute and Outreach Program. →

Influence on FFA and SAE

Agriscience has already had a major influence upon the FFA. Many states have developed Agriscience Fair competitions, and the National Agriscience Student Recognition Program promotes scholarships to students involved in agriscience research. In addition, many students are utilizing topics in agriscience in the prepared and extemporaneous public speaking contests. The national FFA organization also sponsors an Agriscience Teacher of the Year award. In terms of SAE, exploratory agriscience programs can be utilized to enrich the classroom experiences of students.

Big Picture Awareness

Fortunately, most agriculture teachers have a very broad background in terms of academic disciplines. They have had numerous courses in the plant sciences, animal sciences, agricultural engineering, entomology, agricultural business, and economics. In addition, most teachers have been very masterful at incorporating such disciplines into the secondary curriculum. However, a need may exist to broaden the interdisciplinary basis of their programs even further through an infusion of science-based curricular ideas.

Emerging societal issues, such as environmental concerns, global issues, and challenges in technology transfer, lend themselves to new and innovative curricular changes that have the opportunity to broaden the base of potential students. Such courses should be both developed and taught on an interdisciplinary basis. Imagine the potential of such courses team taught with your local science educator and home economics instructor.

Summary

When attempting something new, there is an inherent risk that it is not going to work. The prospective agriscience teacher has to deal with this issue before ever preparing the first agriscience lesson. To be successful with an agriscience program, the teacher must be willing to try new things, and therefore, be willing to fail.

One thing to consider in the field of science is the past history of the success and failure of science programs as a whole. There have been many studies to show the deficiencies of science education in the United States (American Association for the Advancement of Science 1989; Bishop, 1989; National Research Council, 1990). According to Hazen (1992), one of the main reasons for this failure is that students are turned off to science at an early age due to large amounts of memorization and "cookbook" laboratory work. Current trends in science education leave little room for true experimentation and connectivity between the classroom and real work experiences.

Students may complain that science is boring and has no relevance to their lives. Agriscience offers an answer to this dilemma. It offers the chance to apply science to real-life situations and to see usable results. For example, instead of learning pH as litmus paper and a secret solution, it can be learned as the pH of soil and its effects upon the ability of that soil to produce various crops.

The bottom line is that you are the best judge as to the balance between teaching production and teaching agriscience in your local community. Based upon student interest, advisory committee input, your depth of knowledge, and interest in expanding your knowledge base, only you can determine the best curriculum for your school.

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Integrating Agriscience . . .

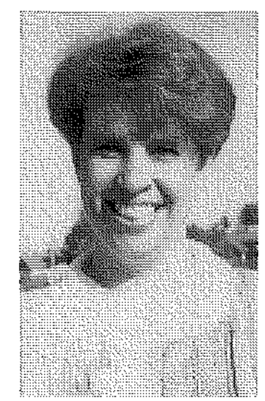
(continued from page 16)

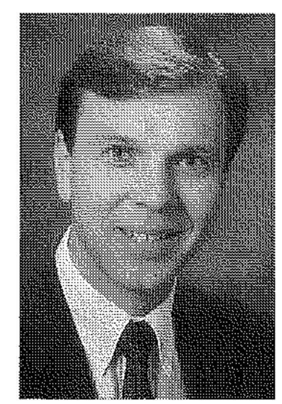
with agriculture, has a synergistic effect. As students and teachers begin to see the way that various pieces of the puzzle that we call education fit together, the puzzle becomes easier to teach and much more practical and fun to learn. When agriculture and science education curricula share similar purposes and vehicles to accomplish their goals, students will be better prepared to solve the problems they will encounter in the future. ■

FEATURE COLUMN

Ag Ed in Elementary Schools

Teacher Training Programs Provide an Abundant Harvest





BY CLARE ROSANDER, PAM MOSSMAN, & MARK P. LINDER

Ms. Rosander (top) and Ms. Mossman are fourth grade teachers at Sandrini Elementary School, Bakersfield, CA. Mr. Linder is executive director of California Foundation for Agriculture in the Classroom and agricultural education program director for the California Farm Bureau Federation.

Like many state Agriculture in the Classroom programs, the California Foundation for Agriculture in the Classroom believes it is very important to provide opportunities for all teachers to learn about agriculture. Teachers are no different than any other adult - they are reluctant to talk about a subject they know little about. Because so many people today are two or three generations removed from the land, it is important for us to help teachers become informed and aware of the food and fiber system and career opportunities in agriculture. Clare Rosander and Pam Mossman are excellent examples of teachers who participated in an Agriculture in the Classroom program and returned to the classroom with creative ideas to teach their students about agriculture. Their innovative project, Crazy Crops Farm, consists of 17 lesson plans and involves 550 elementary students. It is a good model of how teachers can easily integrate the study of agriculture into several curriculum areas. Through the study of agriculture, learning is enjoyable and students develop various skills, including critical thinking, cooperative learning, and problem solving.

The partnerships we form with teachers enable the study of agriculture to expand far beyond what we could do alone. Our experience in addressing the agricultural awareness challenge since 1980 clearly demonstrates the positive results of Ag in the Classroom's proactive education activities. It's a win-win effort for both agriculture and education, as students of all ages in every grade level learn from their teachers about agriculture's contributions to our economy and society.

Crazy Crops Farm

Crazy Crops Farm - the name certainly was not my choice. After all, a school farm needed a much more sophisticated title, like Sandrini School Farm. But my students didn't agree, and since I did want this experience to have student ownership, I had to settle for the name they selected. As it turned out though, the name became very appropriate. Crazy Crops Farm produced everything from carrots to zucchini. In fact, 22 different crops were grown and harvested that first year.

The idea for the school farm developed after using agriculture as a yearlong theme in my fourth grade classroom the previous year. I completed the year having been able to integrate agriculture into al[1] major subject areas. The satisfaction and enthusiasm I felt after such a fun, successful year was hard to contain. That's when I decided to share my discovery with my staff, and hence the farm project came about. My class became the Crazy Crops Consulting Corps, and we invited all other classes to join our farm, offering them a four-row plat of land. Twenty classes accepted the offer.

Having no previous formal agricultural background, I immediately contacted the Kern County Farm Bureau. They connected me with a farmer, and my class officially adopted Russ Cartree.

Mr. Cartree took us step-by-step through the process of preparing the soil, digging furrows, planting, and thinning. Once our plot was ready, students then helped the other classes by passing on the knowledge they gained.

My class participated in Mrs. Rosander's Crazy Crops in a different way. Instead of being farmers, we became two important support services for those classes who were growing crops.

The first service we provided was a bank. Mrs. Rosander created a "farm bucks" economy in her class. She had produced play money (farm bucks), which was earned by her students in different amounts for various reasons. Farm bucks were also made available to other teachers who wanted to use them. Any class with farm bucks could deposit them in our First Federal Gotbucks Bank. We kept their money safe and provided statements of account balances. We were not a lending institution, however. If we had been a fifth or sixth grade class, we might have attempted to pay interest, but percentages are not a part of our fourth grade curriculum.

The other service my class provided was water . . .not watering, just water. When classes wanted to water their crops they would come to Mossman's Moisture Monopoly. I would send a "Water Marshal" from my class, equipped with a big, yellow water can and a clipboard. The water marshal would count on the clipboard the number of canfuls of water the class used to water their crops. They were billed at a later time for their water usage. When Mossman's Moisture Monopoly was first established, all classes participating were taxed a one-time fee.

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Improving Your Teaching: Set Induction

By William G. Camp

Dr. Camp is professor of agricultural education at Virginia Tech, Blacksburg.

We have probably all learned at one time or another that in a good speech you "tell' em what you're going to tell' em, tell' em, and then tell' em what you told' em." In some ways, a good lesson is like that, too. It consists of a set induction phase, an instruction phase, and a closure phase. All three phases of a lesson are critical, but far too many teachers pay little attention to set induction.

There are many things that are essential to effective learning: class order, clear directions, student motivation, and the list goes on. One factor without which nothing else will work is student attention (Borich, 1992). The steps that we use to get students oriented to and interested in a lesson have often been referred to as set induction. "When you begin a lesson, unit, or activity, try to induce in your students an appropriate set, that is, a predisposition or receptive mood that will generate interest and attention, and, it is hoped, spur students to attack their work enthusiastically and diligently" (Callahan & Clark, 1988, p. 140).

In fact, no lesson should be attempted until at least some thought has been given to set induction. In general, there are three basic things that need to be accomplished at the very beginning of any lesson in the set induction phase:

* use an interest approach;
* put the lesson in context; and
* provide advance organizers.

Interest Approach

Even with students who are motivated to learn, it is necessary to gain their interest in the lesson. The students come to class from some other class, or they may have been involved in some other activity in your class. Regardless, they are not thinking about the upcoming lesson, and you must do something to get their interest. Effective interest approaches should create a felt need on the part of the student to learn the material in the lesson (Newcomb, McCracken, and Warmbrod, 1986). Examples of effective interest approaches might include:

- Raising perplexing questions;
- Showing specimens or samples, such as a dead animal or a broken part;
- Presenting a case study in which a job to be done is outlined and students are asked to explain how to do it;
- Showing pictures of success and failure good and bad; and
- Giving a skillful demonstration (Newcomb, et al., 1986, p.69).

In short, an interest approach is anything that you can do to get the students' attention and interest in a lesson. An interest approach should be used at the beginning of every unit, every lesson, and every class. During a lesson, when you change from one topic to another or initiate some new activity, such as a film or a practical exercise, you should plan some sort of attention-getting and focusing device to facilitate the transition.

Putting the Lesson in Context

Where does this lesson fit in the flow of the unit or the course? What have we learned in the past that applies to today's lesson? What leads us to this topic? These are the kinds of questions that should be answered during the set induction phase.

A brief review of previous lessons as they apply to the current lesson is appropriate and helpful. Such an activity reinforces previous instruction to improve retention. But just as importantly, it helps students to understand the links between past and present learning.

Advance Organizers

"An advance organizer gives learners a *conceptual preview* of what is to come and helps them store, label, and package the content for retention and later use" (Borich, 1992, p. 221). There are a number of legitimate ways to accomplish this.

In most discussions of competency-based education, the teacher is advised to write the performance objectives on the board before class and then announce them to the class. In a problem-solving lesson, probing for student questions to discuss can provide structure for the lesson. In less structured classes, teachers may find it adequate to simply tell the students something like, "Today we are going to discuss . . ."

Regardless of how you do it, be sure that →

your students know early in the lesson what they are expected to learn that period. Then as you change from one topic to another or from one activity to another, provide additional advance organizers. Students who know what you want them to learn are more likely to learn it.

In Conclusion

At the beginning of any new lesson, and for multiple day lessons at the beginning of each class, the effective teacher attempts to insure that the students are all "on the same train," thinking about the same subject and going in the same direction. The steps involved in accomplishing this are collectively referred to as set induction.

There are generally three things that you need to do in terms of set induction:

* Use an interest approach to get attention;
* Put the instruction in context with previous instruction; and
* Provide advance organizers to give direction.

At the beginning of a course or a major new unit of instruction, set induction activities may involve extensive activities and time - perhaps as much as a full class period. At the beginning of a daily lesson, it may involve only a minute or two. Regardless, it is very important that a planned effort at student set induction be included in every unit plan and in every lesson plan.

References

Borich, G. D. (1992). **Effective teaching methods,** 2nd ed. New York: Macmillan Publishing Company.

Callahan, J. F. & Clark, L. H. (1988). **Teaching in the middle and secondary schools,** 3rd ed. New York: Macmillan Publishing Company.

Newcomb, L. H., McCracken, J. D., & Warmbrod, J. R. (1986) **Methods of teaching agriculture.** Danville, IL: The Interstate Printers & Publishers, Inc. ■

Coming in November . . .

Theme: Effective Teaching
- Student Learning Styles
- Teaching in the Ag Mech Lab
- Motivating Students
- Teacher Commitment
- Questioning Strategies
- Knowing Your Learners

Ag Ed in Elementary . . .

(continued from page 19)

This was done so the students would understand that real farmers must pay fees to their water district above and beyond their payments for the water they use. In addition, Mossman's Moisture Monopoly offered for classroom viewing a professionally produced video about water usage and water conservation. It was interesting for the students to learn that it takes more water to produce a pair of denim pants than a meal of a hamburger, fries, and soda.

While the crops - and weeds - were growing, arrangements were made for 13 classes to be visited by the "Plant Doctor," a Pest Control Advisor, trained by the California Agricultural Production Consultants Association. The Plant Doctor visited classrooms and talked about pest control, weed control, disease control, and fertilization. We were able to take the Plant Doctor right out to the farm for a hands-on application.

The year culminated with the Breadmake program, in which 120 students made bread, all at one time! What better way to see what happens to some of the farm products once they are harvested. ■

***Note:** Since 1980, the California Foundation for Agriculture in the Classroom has provided teacher training, student programs, and resource materials for the public and private education system in California.*

Agriculture & Science . . .

(continued from page 8)

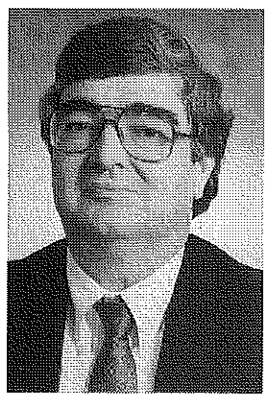
"Students with an interest in science can see agriculture as a technical, progressive career field."

"The best part of the partnership is that it helps us offer more to our students. That is the bottom line for any educational program."

As shown by the above comments, the benefits of a science teacher-agriculture teacher partnership are many and varied. Agriculture teachers should initiate this cooperation process in their local schools to begin reaping some of these benefits. ■

Community Awareness Programs:

A Role for Agriculture Teachers



BY MARY BETH BENNETT, ROBIN KEYSER, & EDGAR YODER

Ms. Bennett (not pictured) is project associate in the Department of Dairy and Animal Science, Ms. Keyser is assistant professor of agricultural and extension education, and Dr. Yoder is associate professor of agricultural and extension education at Penn State.

How often have you heard the comment, "Agriculture isn't important to me," or "Why do we need agriculture instruction?" Typically, people in the agricultural community respond to those questions with more questions directed back to the general public "Do you eat?", or "Where do your clothes come from"?

The reality is that the general public does not know what role agriculture plays in our society and in each individual's life. Many youngsters have an even more inaccurate understanding regarding agriculture. Ask them where their food comes from, and the most frequent response is "the grocery store." Too often our children assume that because we buy our food in a grocery store, it's grown there. As agricultural educators, we have an opportunity to play an important role in educating the general public through avenues other than the formal education system.

As agriculture teachers or 4-H volunteer leaders, we have dealt with young FFA or 4-H members who raise animals for the local livestock show and sale. The youngsters go into the project knowing that the animals they are working with will be shown and then sold to the highest bidder, if it's a market animal. After devoting months of intense care and love to a steer, pig, or lamb raised from infancy, youth often become very attached to the animal(s). Parting with them at sale time, something they know is going to happen but for which they often are not really prepared to do, is often a fairly traumatic experience.

Looking for ways to help children deal with the emotional stress of this experience brought us to the realization that many times youngsters in our programs and the general public only see an animal as a meat product. The general public, including our youth enrolled in agricultural education and 4-H programs, is really unaware that many consumer items, from pharmaceuticals to footballs, are by-products or derivatives of livestock and poultry processing. This article describes one approach used by the authors to inform and make people outside the formal school setting more aware of the role of animal agriculture.

We believe agricultural educators play an important role in educating the general public about agriculture through community-oriented informational exhibits. These exhibits may be the products of our in-school instructional program. To that end, an animal by-products or co-products display for informing the general public was developed. The co-products display was used to inform the general public, but it is also helpful for educating the youth enrolled in our programs.

Animal Co-Products Display

The exhibit or display has been used on several occasions in various Pennsylvania settings, including shopping malls and state-level agricultural shows. The exhibit has received very positive reviews and comments from the general public and agricultural commodity groups, and has been the topic of several newspaper articles. People of all ages have made comments such as, "I never knew that," or "this is really informative and educational." The display has helped young people deal with selling their animals for processing, because they can see that such things as insulin and other pharmaceutical products important to the treatment of a variety of illnesses are derivatives of animal products.

One of the most interesting and extensive areas included in the exhibit is the fats, both edible and inedible, derived from animals. Edible fats, kept fit for human consumption throughout processing, are rendered to make lard or tallow and eventually are used in spreads, pastries, candy, and other food items as shortening. The proportion of fat handled this way has increased with the trend toward boxed beef and pork. Inedible fats, generally gathered from various sources where trimming occurs, are used for biodegradable detergents, flotation agents, candles, plastics, glycerines, other chemicals, lubricating oils, and hundreds of other materials. They are also used in livestock feeds, because of their extremely high energy value.

The production of fatty acids from the inedible fats and greases is another area that is included, because the uses for fatty acids in manufacturing products are enormous. Common products derived from fatty acids include surfactants, soaps, plastics, resins, rubber, plants, lubricants, textiles, and cosmetics. Fatty acid nitrogen derivatives include amide; which is used in the manufacture of water repellents; synthetic detergents; nonionic surface active agents; printing inks; and plastics. Fatty acid amines are extremely water soluble and are used in the rubber and textile industries and as corrosion inhibitors, liquid detergents, and nonionic surface active agents. Fatty acid esters are used in the manufacture of emulsifiers, coating agents, textile sizers and lubricants, plasticizers, and defoaming agents. →

Long-chain fatty alcohols are formed by reduction of fatty acids. Their greatest use is in the production of sodium alkyl sulfates which are used in the production of detergents.

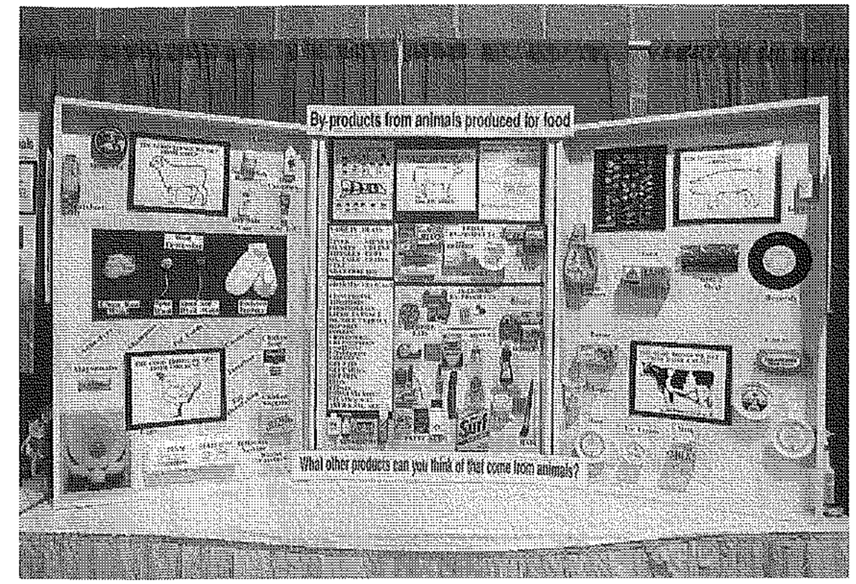


Photo courtesy of Steve Williams, Penn State

Interestingly, in the United States, Canada, and Europe, tallow fat from cattle provides the largest single contribution to the manufacture of bar soap. A typical bar of soap would contain approximately 80% tallow soap and 20% coconut soap. Beef tallow is widely used in soap formulations for a number of reasons. For meat-eating countries it is available in abundant supply, is relatively inexpensive, and it imparts some excellent characteristics to both soap and soap/synthetic combination bars. If the formula for bar soap contained all coconut soap, it would be extremely soluble, lather profusely, and strip oil from the skin so aggressively that irritation of the epidermis would result very quickly. The tallow used in soap formulas imparts mildness, acts as a binder, adds lubricity to the bar, and helps control cost, since tallow has a history of being considerably less expensive than coconut oil. It should be noted that in other parts of the world where beef tallow is not readily available or not used for religious reasons, other materials are used. For example, in Australia a considerable amount of readily available mutton is used to make soap. Moslem countries would probably make vegetable oil soaps. Palm oil is a reasonably good substitute for beef tallow where it is available at a reasonable cost.

In addition, dozens of drugs or pharmaceuticals are purified from glands and organs removed during and after livestock and poultry slaughter. ACTH, thyroid extract, and insulin are common to all. Others include epinephrine, used to relieve symptoms of hay fever and allergies; thrombin, which helps blood coagulation following injury or surgery; and heparin, which is an anticoagulant used to prevent undesired coagulation during surgery. Trypsin, a protein-digesting enzyme from the pancreas, is used to liquefy pus and debris in wounds. The liver yields an extract for treatment of anemia. There are many other examples which could be given.

Other Uses for the Animal Co-Products Display

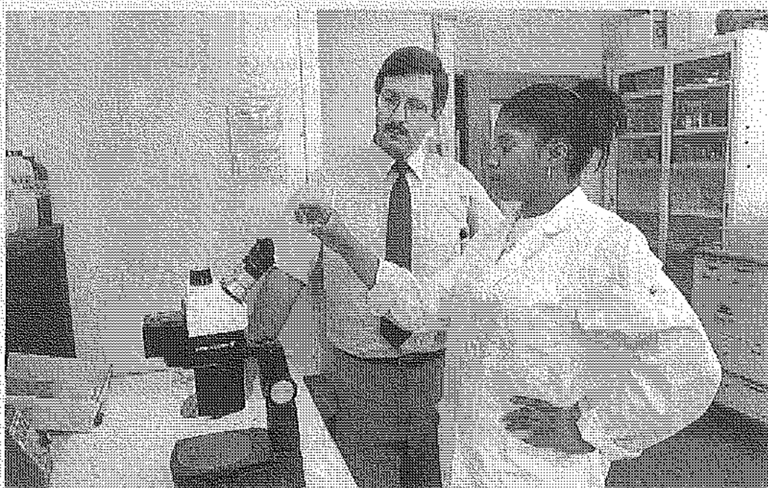
Although the animal co-products exhibit was developed as a way for agricultural educators to assume an educational role external to the formal school setting, we believe it also has potential for use within the school setting as part of an agricultural awareness or literacy program. Depending upon the students you teach, there is an animal by-products unit which can be adapted to your curriculum for the formal school setting. Learning activities, including student research into by-products, give students opportunities to learn how to make various products and how these animal co-products evolved. If one is interested in hands-on learning, there are several activities, such as candle making and soap making, which can be used to walk students through a simplified process so they may experience for themselves the process of converting animal products into products they use daily. Keeping track of current events may lead to the discovery of new products being made with animal by-products. Animal by-products is an area that can provide many challenging and interesting lessons. ■

***Note:** The display described in the article is part of a joint effort involving personnel in the Departments of Agricultural & Extension Education, Dairy & Animal Science, and Agricultural Economics & Rural Sociology at Penn State University.*

Upcoming Themes

December	—Teaching Academically Disadvantaged Students
January	—Tech Prep
February	—Distance Education
March	—The New Financial Records and Management Information Curriculum
April	—Land Laboratories

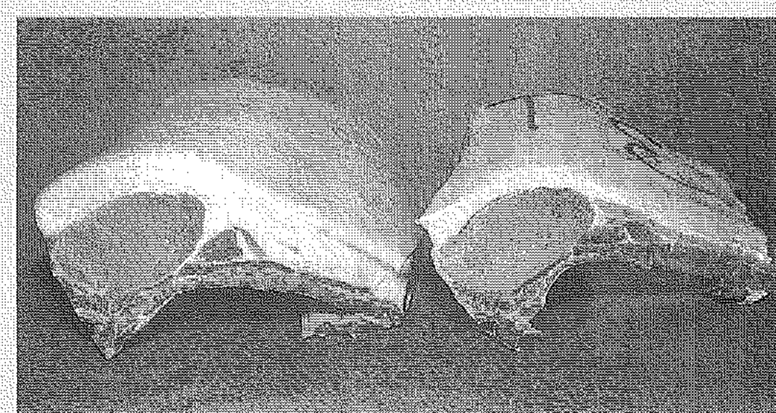
Stories In Pictures



Basic laboratory facilities are needed for good agriscience instruction. (Information Services, University of Illinois)

Checking the effects of different rations on weight gain. (Information Services, University of Illinois)

Potatoes growing in a sand culture hydroponic system.



Effects of porcine somatotrophin (PST) on carcass quality. (Information Services, University of Illinois)