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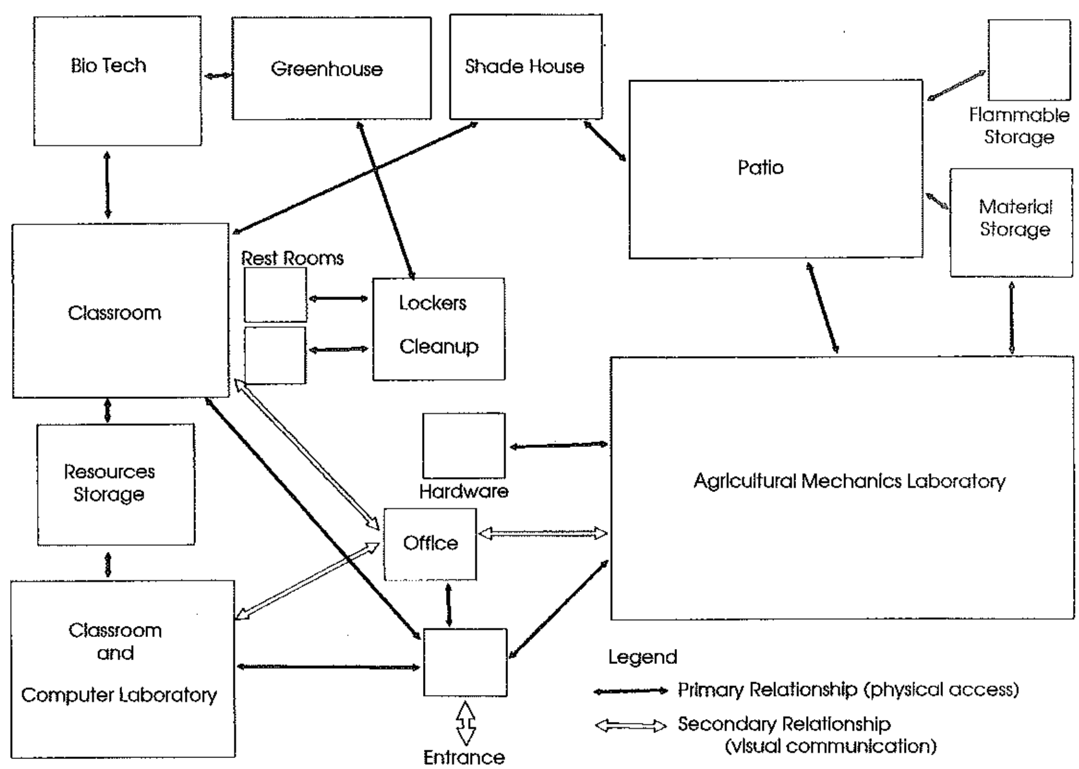
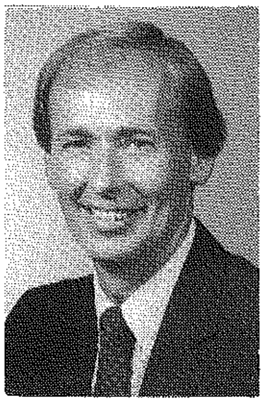


Lab Facility Improvement

What If the State Superintendent Drops By?



BY ED OSBORNE

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

I recently visited a student teaching site and learned that just a few days earlier the State Superintendent of Education had visited the school and toured the agriculture program - an intimidating visit to say the least. I wondered how I would have prepared for such a visit. I had been to the school about three weeks earlier and observed that the mechanics lab was somewhat cluttered and unorganized. The equipment and work areas certainly limited the amount of learning that occurred in this lab. However, as I discussed the superintendent's visit with the cooperating teacher and student teacher, I realized that a huge transformation had taken place in the lab since my last visit. Not only were the work areas organized and the clutter gone, a new aquaculture unit and germination table had been installed in a section of the mechanics lab! I was thrilled to see the changes that had taken place in such a short time. Obviously, the teacher had planned for some time for this facility improvement, but the state superintendent's visit certainly provided some incentive to get things in order. It's reassuring to see that high-level state bureaucrats can have such a positive impact at the local level!

Laboratory maintenance and improvement is a tough challenge – one for which most teachers are totally unprepared to meet. There exists a huge void in most of our preservice and inservice programs in the area of laboratory facility improvement and expansion. Teaching day after day in the same environment causes one to become blinded to the features of that environment. But, every new visitor to the agriculture program forms an immediate impression of that program, based in large part upon the nature, condition, and appearance of the lab facilities. Teachers should occasionally bring in a spouse or friend (someone who will share their honest opinions), have them tour the agriculture program, and ask for their impressions and reactions. The results may be startling, but very useful.

Laboratory facility needs are driven by curriculum and clientele. The number of students, course and program objectives, and number of teachers are the major factors in determining lab facility needs. Teachers have essentially two avenues for improving their lab facilities: improving/renovating existing facilities and/or constructing a new/expanded facility. The route to take depends upon the condition of current facilities and the extent to which current facilities have the potential to meet laboratory instructional needs of the program.

Many existing facilities could be greatly improved by cleaning, reorganizing, and redesigning work areas. If you are a secondary teacher reading this article, walk to the lab areas in your program (either physically or mentally) right now as you continue to read. Identify the pieces of equipment in your lab(s) that are inoperable or never used - time to let them go. Where are the cluttered areas in the lab? Time to clean them up.

If total facility needs cannot be accommodated in existing laboratory facilities, then an expanded or new facility request is in order. Unfortunately, school boards and administrators are not inclined to ask teachers what they need to effectively do their work (teach). Thus, teachers must make lab facility needs known to administrators and other key groups. The major steps in lab facility expansion or development are:

1. Develop a documented rationale and need for the new/expanded facility, based upon needs assessment data and program objectives. Involve the agriculture advisory council in this initial stage.
2. Determine the primary laboratory activities in which your students will engage, again based upon program and course objectives.
3. Discuss your general plans for facility expansion with parents, administrators, students, and community residents.
4. Develop the design details of the expanded facility - equipment (with specifications), tools, dimensions, floor plan, work areas, doors and windows, demonstration area, traffic lanes, storage, and similar details.
5. Secure the support of school officials and community residents. Make a formal request to the school board. Be persistent, energetic, creative, and

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THEME EDITOR'S COMMENTS

Laboratory Facilities Improvement

BY GLEN M. MILLER

Dr. Miller is associate professor of agricultural education at the University of Arizona, Tucson.

Facilities in agricultural education have traditionally reflected the curriculum. As the curriculum expands, so do the demands placed upon agricultural education facilities. Both new and existing facilities must be designed to support a diversifying curriculum.

Agricultural education facilities were once geared for production agriculture. Today, facilities may need to accommodate curriculum thrusts and laboratory facilities such as:

- Technologically current science-based mechanics laboratories;
- Animal science - land/livestock laboratories;
- Landscape and turf laboratories;
- Greenhouse and horticultural production laboratories;
- Biotechnology laboratories;
- Aquaculture laboratories;
- Food science laboratories;
- Computer/agribusiness/CAD laboratories; and
- Production agriculture laboratories.

All of these laboratories have some common needs that must be satisfied. Those needs include:

- Reflecting the agricultural community served;
- Efficiently serving the curriculum;
- Facilitating effective and efficient use of teacher time;
- Providing student and teacher safety;
- Reflecting industry-current technology;
- Providing security; and
- Efficient and complementary arrangement.

Currently in Arizona, a number of older production and horticulture facilities are being remodeled to reflect current curriculum changes. Two new facilities are under construction, and at least one more will follow within one year.

These facilities, both new and old, are reflecting changes in curriculum. Computer laboratories and biotechnology laboratories are leading the charge of new curriculum thrusts and new facility needs in Arizona. Classrooms are being designed to serve a dual purpose as both computer laboratories and as traditional classrooms. Biotechnology laboratories are being established through modification of the traditional agricultural mechanics laboratory–in areas once used for storage, or, as in one case, a darkroom no longer used in the school. New facilities have embraced aquaculture, biotechnology, and production agriculture. Regardless of the starting point of the facility, principles of facility planning still apply and need to be considered. The alternative is a facility that fails to meet the needs of the curriculum and worst of all, becomes a burden on teacher time. Many teachers are trapped by laboratory facilities that demand their attention 24 hours a day, seven days a week. Careful planning can reduce or eliminate this trap.

General Considerations

Some general considerations for new agricultural education facilities should include:

- Availability of land area for laboratory development;
- Availability and cost of utilities installation;
- Site preparation;
- Convenience of administration, student, and custodial service;
- Sufficient space for future expansion and addition of specialized instructional programs; current needs for parking, outside storage, and work areas;
- Access from roads or streets;
- Disturbances generated by noise, odor, smoke, and fumes affecting other housing or public buildings;
- Aesthetics; and
- Security.

Functional Requirements

Components of the facility, whether new or old, need to be arranged in a complementary fashion. A spatial model needs to be developed which considers the interrelationship between traffic flow and the functional nature of various components. Computer laboratories need a clean and secure environment. They must be arranged so teachers may effectively instruct and supervise students. Proper electrical power and functional work stations must be provided. Dust must be minimized. Access and distractions must be controlled.

Biotechnology laboratories must have proper

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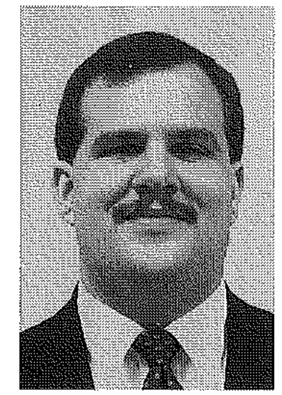
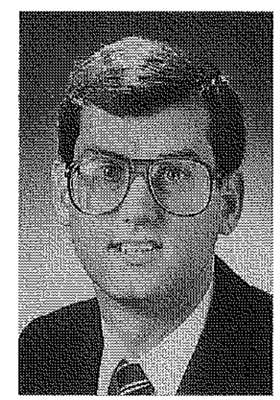
THEME ARTICLE

Remodeling Laboratories for Agriscience Instruction





BY MICHAEL E. NEWMAN AND DONALD M. JOHNSON

Drs. Newman (top) and Johnson are assistant professors of agricultural and extension education at Mississippi State University, Mississippi State.

Across the nation, many agricultural education programs are changing to more science-based courses. Units such as plant tissue culture, biotechnology, and applied physics have been added to the curriculum. These additions have produced the need for students to participate in experiential learning activities different from those traditionally engaged in by agriculture students.

The result has been a change to make the old "vocational agriculture facility" more closely resemble a chemistry, biology, or physics laboratory, at least in part. Agriscience programs require the use of microscopes, test tubes, Bunsen burners, aquaria, light stations, incubators, and other equipment that probably was not considered when the facilities were constructed.

The challenge facing agriculture teachers is how to renovate existing classroom and laboratory facilities to meet the needs of a new curriculum. This article describes how five Mississippi agriculture teachers have addressed this challenge.

Tommy Waldrip
Saltillo High School

Tommy Waldrip, the agriscience teacher at Saltillo High School in Saltillo, Mississippi, teaches Introduction to Agriscience, a one-hour, year-long class for 9th and 10th grade students. When he started teaching this class, two of his primary problems were a lack of storage space and lack of facilities for hands-on demonstrations and student activities.

Tommy has improved his facilities by seeking out unused science laboratory equipment from other schools in his district. He obtained a laboratory storage cabinet to store dissecting kits, soil and water test kits, microscopes, test tubes, beakers, Petri dishes, chemicals, and other supplies.

A discarded science laboratory demonstration table has been useful for student activities and teacher demonstrations. The portable table is equipped with electrical outlets, a sink, a cold-water faucet, and a ring stand. Tommy was able to obtain the table at no cost when the high school science department purchased a new one.

Tommy has also had new electrical outlets installed along one wall of his classroom. By placing tables along this wall, he has created suitable workstations for plant and animal dissection, soil and plant testing, and small, applied physics projects. Tommy has also equipped the classroom with an aquarium and an incubator for student agriscience group projects.

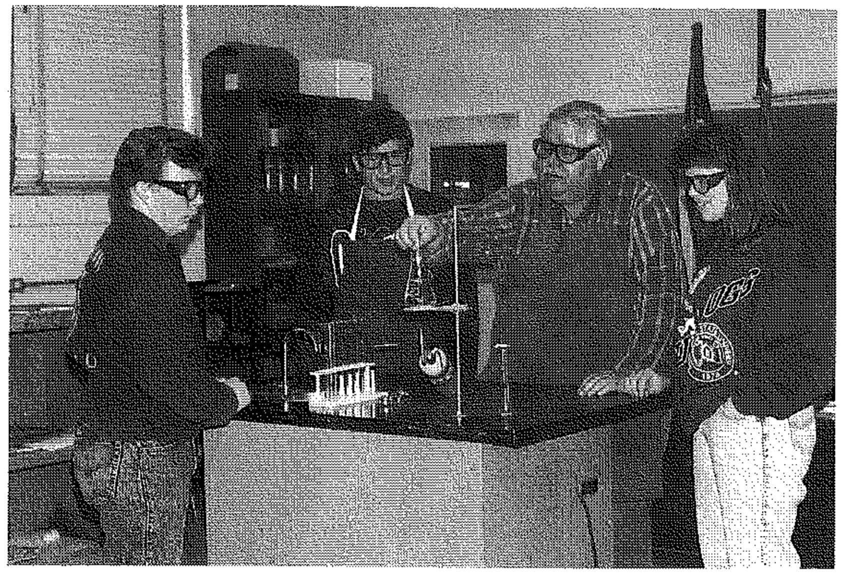
Ed Settle
Biggersville High School

At Biggersville High School in Biggersville, Mississippi, Ed Settle has transformed approximately one-third of his agricultural mechanics laboratory into agriscience learning centers. He has a plant science center, an aquaculture center, and a wet lab available for student learning activities.

Like the other teachers profiled in this article, Ed has worked closely with the administration and science faculty at his school to make sure things are done the right way.

The wet lab includes cabinets donated by a local manufacturer. The lab contains storage for microscopes, supplies, test kits, and other equipment. Overhead fluorescent lights illuminate the counter area for students' work. Other features include hot/cold running water, sink, compressed air, and electrical outlets. Ed and his students did all of the work required to make the wet lab operational. The students →

Ed Settle, agriscience teacher at Biggersville High School, shows tissue cultures done by his students to the science teacher, Darla Janzen. A good working relationship with the local science teacher can be very beneficial to both programs, leading to the sharing of expertise and resources.



Tommy Waldrip, agriscience teacher at Saltillo High School, uses a portable demonstration table obtained from a junior high science laboratory. The table contains a sink, electrical outlets, and a ring stand.

use this area for water, soil, and pollution analysis activities, as well as most microscope work.

The aquaculture center is a closed (recirculating) system that the students designed using an old, 300-gallon milk tank as the growing unit. Students helped design the system and installed the water heaters, environmental controls, pumps, and biofilter as a class project. Tilapia are grown in half of the tank, while the other half contains a settling basin and biofilter.

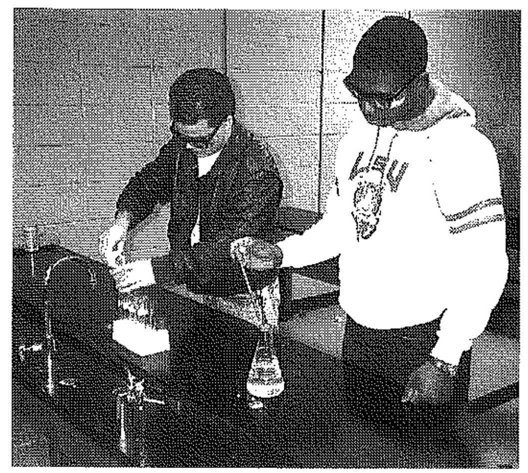
Part of the laboratory is used as a plant science learning area. This area consists of a table with grow lights and a refrigerator for holding samples. Students use this area to complete plant tissue culture activities and to conduct plant and soil-related experiments.

A local furniture industry donated some cabinets for storage of agriscience equipment and supplies at Biggersville High School. Students installed the cabinets and hooked up the hot/ cold water, compressed air lines, and electrical outlets. Note the counter space available for student work.

Ken Dorris
Millsaps Vocational Center

At Millsaps Vocational Center in Starkville, Mississippi, Ken Dorris had a facility that was already suitable for agriscience instruction. Ken's horticulture facility had a soil testing laboratory that was easily adapted for agriscience instruction. The outstanding features of this facility are the amount of work/counter space and the way each workstation is set up with water, a sink, gas, and air readily available. The facility has ample storage cabinets under each table and against one wall. The wall counter also includes a student cleanup station.

The agriscience laboratory is located adjacent to, but not in, the classroom—an ideal layout. If a teacher has the opportunity to build a new agriscience facility, this would serve as a good model.

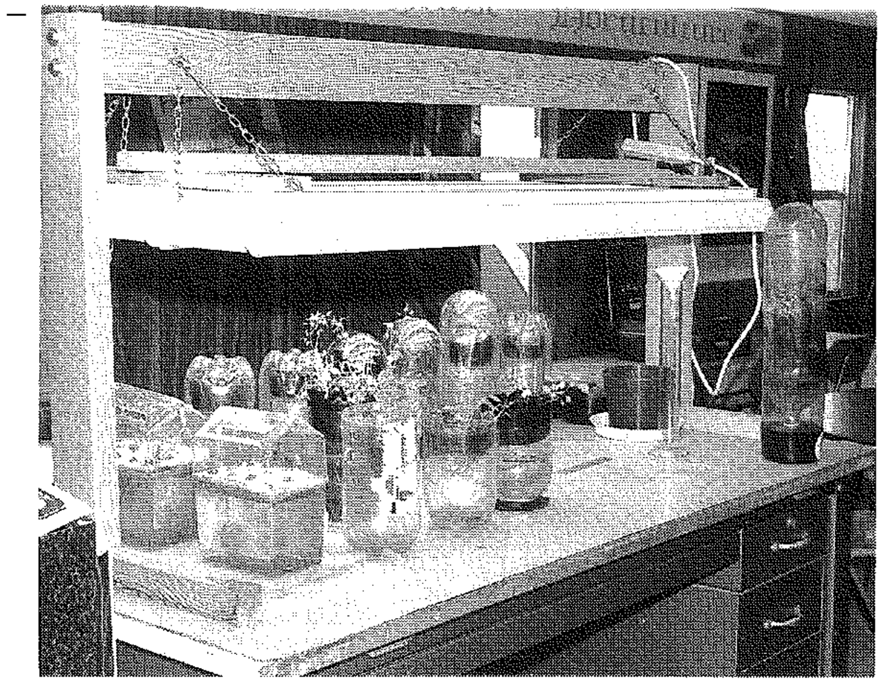


Two students at Millsaps Vocational Center perform some water quality tests in the agriscience laboratory. Each table (three workstations) has a compressed air supply and two electrical outlets. Each workstation has a sink, cold water supply, and natural gas supply.

Tom Clayton
Northeast Lauderdale High School

Although Tom Clayton's facility at Northeast Lauderdale is located in a trailer, he has made the most of his situation and enthusiastically incorporated agriscience into his program. In his classroom, Tom provided space for tables with grow lights, an aquarium, and soil and water testing stations. Since classroom space is limited, Tom has selected student learning activities that can be accomplished in a small area. Tom's students make extensive use of Wisconsin Fastplants™ and Bottle Biology activities to enhance classroom instruction.

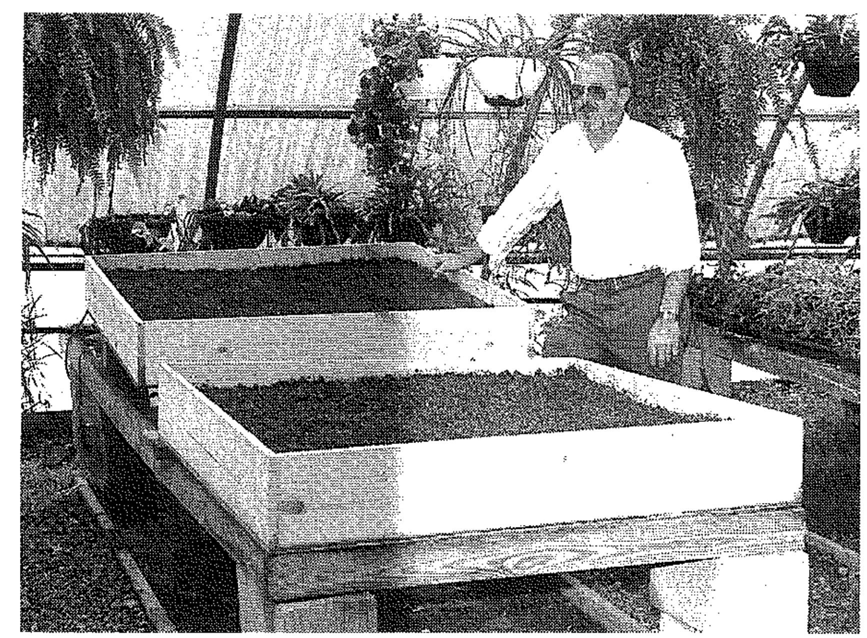
Tom makes good use of the greenhouse provided for the horticulture program to provide agriscience students with space and materials for experimentation in agriscience. Part of the greenhouse is devoted to an aquaculture system with two 350-gallon tanks. Space is also →



Some classroom space at Northeast Lauderdale High School is devoted to two tables with growth lights for plant science activities, and experiments. Students complete hydroponic projects (left) and Bottle Biology experiments using two-liter soda bottles.

available for student agriscience/science fair projects.

Future plans at Northeast Lauderdale include the construction of a quail hatchery and growing facility, along with an animal science center. These facilities will allow for additional experimentation by future agriscience students.

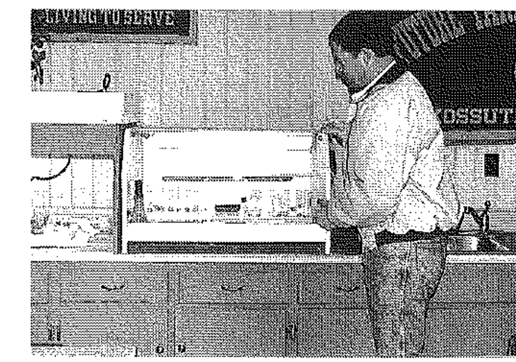


Tom Clayton, agriscience teacher at Northeast Lauderdale High School, shows a student agriscience project designed to measure leaching of fertilizer and chemicals from an upper field to a lower field. Other greenhouse space is devoted to an aquaculture system and other student projects.

Rodney Hopper
Kossuth High School

At Kossuth High School in Kossuth, Mississippi, Rodney Hopper and his students solved their facility problems by erecting a 40' x 75' donated metal building. Rodney and his students disassembled the building, moved it from its original location to the school campus, and assembled it on a concrete slab poured by the students. All construction, including electrical and plumbing work, was completed by students as a class project. The cost for the facility was approximately $5.00 per square foot.

In planning the new building, Rodney was mindful of the special needs of an agriscience facility. The 30' x 20' classroom is equipped with a wet lab, having a double sink, hot/cold running water, above-counter electrical outlets, and ample storage and counter space. Rodney's students make use of a bank of growth lights to conduct plant growth experiments and projects.



Rodney Hopper, agriscience teacher at Kossuth High School, demonstrates some of the features of the new agriscience building. This entire wall of the classroom has cabinets with counter space, hot/cold water, and electrical outlets.

Summary

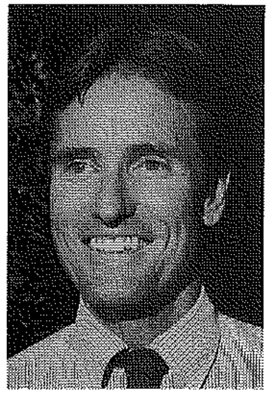
The move to more science-based instruction in agriculture requires the development of different types of facilities. Ideally, a modern, carefully designed facility would be provided as each program shifts to agriscience instruction. Unfortunately, constructing a new facility is not likely. Teachers, therefore, must accept the challenge of upgrading and updating existing facilities.

The teachers profiled in this article have accepted this challenge. Their efforts have improved the educational experiences available to their students. ■

About The Cover

Components of a lab facility should be arranged in a complementary fashion. This illustration is an example of a spatial arrangement suitable for a curriculum emphasizing biotechnology, horticulture, and agriscience. (Illustration provided by Glen Miller and Clinton Jacobs, University of Arizona.)

Planning For Change



BY JOHN MULCAHY

Mr. Mulcahy is agriculture instructor at Peoria High School in Peoria, Arizona.

Someone once wrote: "Life is best understood backwards but must be lived forward." The same can be said for everything this author knows about facility planning and development. Years of teaching have improved his knowledge of the subject, but it is all due to hindsight. He makes no claim to an abundance of wisdom on the subject. However, he does claim to have identified one guiding principle: plan for change.

The author will use his own experiences at Peoria High School in Peoria, Arizona, to illustrate his points. Peoria's story is typical of historical changes in agricultural education across the country. Peoria was once a small town whose principal industry was production agriculture. The high school agriculture program's focus for most of its 60 year history was production agriculture. As the community changed, so did the program. No longer is the focus on production agriculture. Ten years ago the production agriculture curriculum gave way to a curriculum focusing on landscape design, installation, and maintenance. In the last 10 years, the curriculum has evolved to encompass turf management, nursery management, and biotechnology. All curricular changes reflect the ever changing needs of the community's agricultural base.

Few could have predicted 25 years ago the changes this program would experience when the current facility which houses the agriculture program at Peoria High School was built. Nonetheless, speaking from hindsight, it is evident that we should have planned for change, even if the nature of that change was unknown. Fortunately, we are currently planning a new facility. This takes some of the sting out of admitting to our mistakes of old.

The literature is filled with specifics about facility design. With this in mind, the present article will focus on broader considerations for agricultural education facilities and how the errors encountered in Peoria's facility planning might be avoided.

Location and Expansion

In Peoria's case, the agriculture department was nestled in between two other buildings. Consequently, as the program grew and the necessity arose to build a greenhouse, biotechnology laboratory, and nursery, there was no place to go except *away* from the existing agriculture facility. As a result, one can log a full mile walking from the classroom to the nursery and back to the classroom again! Land/livestock laboratories should be big enough to provide students with industry-current experiences, but not so big that they enslave both students and teachers to their maintenance. Additionally, it is important to remember that as your curriculum evolves, so too must your facilities. Leave some room for expansion.

Once again, Peoria's history illustrates this point. As land became available for facility expansion, we quickly used it up. As an example, the land laboratory was completely dedicated to a nursery. While this was appropriate given the program's direction, it complicated construction of future turf plots.

Classrooms

Classrooms for agriculture programs should be essentially science classrooms. That is, they should have a demonstration table in the front of the classroom complete with a sink, water, gas, and ample room for demonstrations and storage space. This sort of demonstration table lends itself to demonstrations on a variety of subjects, including plant growth and development, animal science, biotechnology, and agricultural mechanics.

The periphery of the classroom, like any →

Grow shelves, such as those shown above, are critical for maintaining tissue cultures. This one has a timer to control day length.

good science classroom, should be lined with counter tops, dry erase boards, tack boards, and locking cabinets. Dry erase boards are recommended because of their visual appeal, but also because of the damage chalk dust does to computers and printers. The counter top space is essential for computer use and problem solving exercises. If at all possible, counter tops should be designed to enable students to sit comfortably against them with their feet underneath. A generous number of electrical outlets should be spaced throughout the classroom. Locking cabinets are essential for storing realia, references, and supplies.

Desks or tables, comfortable chairs, a television with videocassette recorder, an overhead projector, and a screen are all necessary to complete the classroom. The writer's personal preference has always been tables as opposed to desks simply because they are easily moved about for large and small group discussions, as well as regular classroom work. Tables are also large enough to enable students to perform design exercises. Finally, they can be folded and removed when the need arises. Linoleum or tile is the best flooring choice because it reduces noise and is easily cleaned.

Aside from the classroom, most agriculture programs include additional facilities such as mechanics laboratories, greenhouses, and land/livestock laboratories. In general, anyone designing agriculture programs should give consideration to the "clean room/dirty room" concept used in technology programs. A "clean room" is provided for learning situations that may require sterility or at least a minimum of dust. A "dirty room" is provided for those situations where air contaminants, oil, and grease are likely to be present. In both cases, the rooms should be designed with appropriate utilities and plenty of work space to accommodate future adaptations as the agriculture program's curriculum evolves.

The Clean Room

Many agriculture programs today are involved in biotechnology activities. Generally, such activities would have greater success if they were housed in a clean environment. The size of such a room will vary depending upon the size of the program. The lab in the author's program is approximately 400 square feet and will accommodate no more than 10 students working at any one time. It had to be small because it was built inside the existing agricultural mechanics laboratory. If only we had thought ahead!

The laboratory has a tiled floor to facilitate sterilization. There are ample cupboards throughout the room with smooth countertops. There is also a sink with hot and cold water. Additional equipment will vary depending upon the activities to be conducted in the laboratory.

A laminar flow hood or plexiglass transfer chamber is a must for any program that plans to do a considerable amount of tissue cultures.

A laboratory dedicated to tissue culture might include the following equipment:

★Dishwasher
★Still
★Laminar flow hood
★Microwave
★pH meter
★Refrigerator
★Autoclave
★Grow shelves
★Hot plate/stirring plate
★Stereoscope
★Scale

Not all the above-named equipment is absolutely necessary. A pressure cooker can be substituted for the autoclave. Many programs do without the microwave. However, it is useful for quickly boiling water and liquifying media. A dishwasher is also optional but is certainly a time saver. The laminar flow hood is a must for any program that wishes to provide students with industry-current experiences. However, transfer chambers made from plexiglass can be substituted.

Programs that wish to expand their biotechnology activities beyond tissue culture will want to consider some additional equipment. There are excellent curriculum guides available from the Math and Science Education Center at the University of Missouri to guide teachers in using some of the following equipment:

★Electrophoresis power supply
★Gel Electrophoresis Chamber
★Spectrophotometer
★Centrifuge
★DNA Transilluminator/Camera
★Water Bath

In all cases, the choice of equipment will

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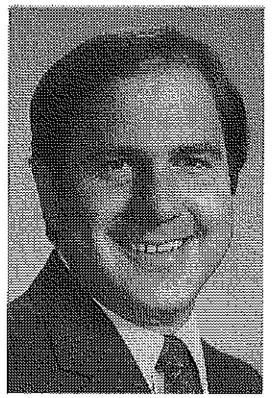
THEME ARTICLE

Laboratory Facilities Improvement for Technology Transfer



BY JOE G. HARPER

Dr. Harper is associate professor of agricultural education at the University of Arizona, Tucson.

While many things change around us, there are some fundamental principles which will continue to provide the foundations for agricultural education instructional programs. In order to remain a viable instructional program, we must hold to the fundamental ideals of providing effective instruction where students are active in the learning processes. Our instructional programs must be based upon providing active learning experiences for students. We cannot expect students to learn the latest technologies without having active involvement.

Our future teaching laboratories will not look the same as they do today, but they will be based upon the same fundamental principles. However, there is need for change in the way we organize facilities and provide laboratory instruction. The future facilities for laboratory instruction in agricultural education will be based upon the fundamental concepts of effective technology transfer, total quality management, and the adoption of innovative instructional strategies. We can no longer wait for others to explore innovative instructional technologies and then adopt these technologies as late adopters.

Strategies for Effective Technology Transfer

Technology transfer is based upon the concepts of creating, developing, testing, implementing, and improving innovative technologies for utilization. Agricultural education instructional laboratories should be based upon not only the foundations of effective instruction, but also effective technology transfer.

First, technological innovations may be in the form of product or a process. In our laboratory instruction we should provide learning experiences which emphasize both. In the past we have usually placed greater emphasis upon the latest technological product innovations. While our laboratories should be equipped with the latest, most innovative equipment available, we should also provide instruction on the latest innovative processes. For example, the use of a computer to increase the efficiency of a parts inventory would be to emphasize an innovative process, not just the technology product. As we strive to improve laboratory facilities, we must place greater emphasis upon improving processes. The adopted usage of MIG welders to improve the quality and efficiency of fabrication projects is another example of where an innovative product also was utilized as an innovative process.

Another concept of technology transfer which has application to improve laboratory facilities is the utilization of systems. Agricultural education laboratories should be organized based upon systems approaches. Systems approaches call for holistic strategies of instruction. Oftentimes our laboratories lack a systematic flow from one area to the next. The facilities and equipment seem disorganized and out of sync. To improve the facilities we need to give greater consideration to systematic facilities layout and improvement. Think of your facility as a flow chart. Does your laboratory instruction "flow" from one area to the

The future facilities for laboratory instruction in agricultural education will be based upon the fundamental concepts of effective technology transfer, total quality management, and the adoption of innovative instructional strategies.

next? Design the facilities and instruction based upon systems approaches. The classic example of instruction which does not apply a holistic approach is when students construct a project which cannot be removed from the laboratory because it is too large. The students did not consider the holistic systems approach in their instruction.

Furthermore, and possibly most important, is the concept of rapid technological development. Technological innovation is occurring at such a rapid pace that it is increasingly difficult to effectively plan facilities or make adequate improvements. The concepts of technology transfer imply that we will need to provide for advancement, without knowing precisely what those advancements will be. Consequently, we have seen changes in the way we design and improve teaching laboratories. Laboratory instruction has become based to a greater extent upon instructional "modules." Modules are → easier to adapt and innovate than more comprehensive instructional units. It is easier to change one greenhouse instructional module than it is to change the entire greenhouse. Teaching six different modules over a period of twelve weeks to a class of 18 students at one time is more efficient than teaching six of the same modules to 18 students for two weeks at a time. It may not be easier to teach, but it is more cost and facilities efficient. We need to redesign and improve our existing facilities to further adopt these technology transfer strategies.

Agricultural education laboratories of the future will broaden in scope to be "Centers for Technology Transfer." We need to improve existing facilities based on the concepts of effective technology transfer, utilizing products and processes of innovation, systems approaches, and innovative strategies which are more efficient as well as effective.

Total Quality Management

The fundamental concepts of Total Quality Management (TQM) will provide strategies for the improvement of agricultural education teaching laboratories. While much has been published concerning the evolution and implementation of TQM in business and industry, only recently have applications been made for effective teaching and learning. The recent SCANS report supports the concepts of incorporating total quality management strategies into instructional programs. Several fundamental concepts of TQM can be readily applied to

Upgrade existing instructional materials and equipment based upon improving quality, not necessarily quantity. Do not request three additional welders of the same type you presently have. Instead, improve the quality of the facility by upgrading the existing equipment. Also, expect greater quality from students in all aspects of laboratory instruction. Greater instructional time should be devoted to improving quality, not just the amount of work.

improving agricultural education instructional laboratories.

First, emphasize quality in all aspects of instruction. Upgrade existing instructional materials and equipment based upon improving quality, not necessarily quantity. Do not request three additional welders of the same type you presently have. Instead, improve the quality of the facility by upgrading the existing equipment. Also, expect greater quality from students in all aspects of laboratory instruction. Greater instructional time should be devoted to improving quality, not just the amount of work. Reward students for improving the quality of a laboratory exercise. Utilize instructional strategies in which students are expected to improve a product or process, not just complete a project. Oftentimes, an instructional project is considered complete before it is put to use, without regard to how to improve the project based

Our instructional programs must be based upon providing active learning experiences for students. We cannot expect students to learn the latest technologies without having active involvement.

upon its actual or simulated testing in "real world" applications.

Second, total quality management strategies utilize team activities. Design and improve existing instructional laboratories to utilize teams of students. Individualized instruction was the basis for the majority of designs for instructional laboratories. Students were expected to work alone, in relative isolation. Agricultural education laboratories need to be designed to facilitate working together. Work centers should be open to allow students to be able to work together. Oftentimes, the physical layout of the laboratory with enclosed or square work areas actually keeps students from working together. We need to redesign our laboratories for teams of students.

Furthermore, total quality management strategies expect students to be able to communicate more effectively. Our instructional laboratories should be improved to increase student use of effective communications. Students should be expected to follow a variety of communications media. Communications in a laboratory setting should include not only the spoken and written communications, but also the various electronic communication strategies. Our instructional laboratories need to increase the usage of computers to communicate laboratory activities. We need to provide a variety of communications strategies for students. Laboratory assignments of all types, even traditional agricultural mechanics and production activities, should be communicated via innovative electronic media. Students could develop communications skills by developing computer-generated reports of laboratory assignments and projects. A construction project is of little value in business and industry unless the merits of the innovative product or process can be communicated to the eventual users.

Innovative Technologies

The greatest challenge for improving instructional laboratories will be to keep pace with the latest technological innovations. Instructional technologies are being developed at such a rapid pace that sometimes we are better off to start a new instructional laboratory than to

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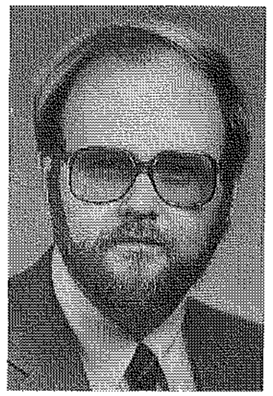
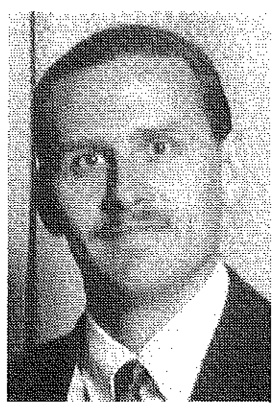
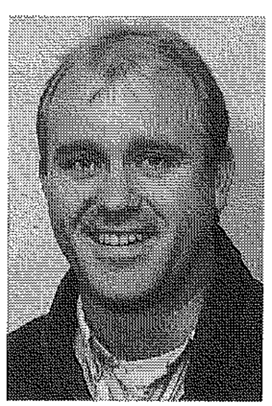
THEME ARTICLE

Facilities for Agriscience Instruction







BY DAVID M. AGNEW, JEFF LIPFORD, & ROCKY CLEMENTS

Dr. Agnew (top) is assistant professor of agricultural education at Arkansas State University. Mr. Lipford (center) is agriculture teacher at Adamsville High School in Adamsville, Tennessee. Mr. Clements (bottom) is agriculture teacher at Bay High School in Bay, Arkansas.

Although teachers have always faced the need to update and improve laboratory facilities, such improvement has often been framed within a familiar context of existing or known subject areas. However, rapidly changing technology and increased emphasis in science within the agriculture curriculum present a new challenge.

As a profession, agricultural education has expressed a strong belief in the need to emphasize the scientific principles underlying agricultural practice. Since agricultural education has had a long history of using experiential learning in laboratory settings, a logical step is to adapt laboratory facilities and activities to increase emphasis on science. This may mean redirecting money for resources from the traditional laboratories or areas of special interest to agriscience. Equally important will be redirecting teacher planning time to learning new concepts, principles, and laboratory activities that are associated with agriscience instruction.

Two teachers who have already made great strides toward increasing integration of science into their curriculum and developing laboratory facilities for agriscience are Jeff Lipford from Adamsville, Tennessee, and Rocky Clements from Bay, Arkansas. Mr. Clements has adapted an existing facility to serve as an agriscience laboratory for aquaculture and soil science. Mr. Lipford has constructed a new structure solely for the purpose of performing tissue cultures. Each has a unique perspective on how to meet the need for an agriscience laboratory.

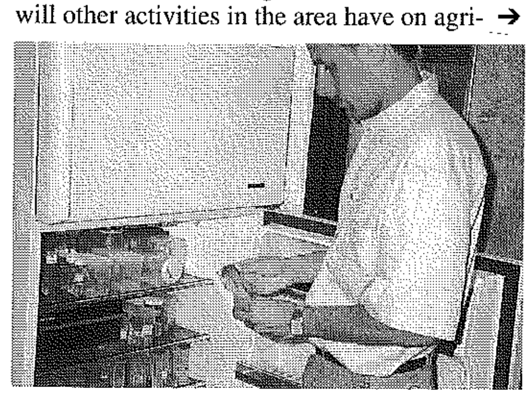
Rocky Clements
Bay High School, Arkansas

Bay High School, located in the heart of the Mississippi Delta rice and cotton production area, has a traditional mechanics laboratory, aquaculture and soil science laboratory, greenhouse, livestock facility, and fruit tree orchard. In this school of 300 students (grades 7-12) the current enrollment in agriculture is 70.

One challenge in implementing agriscience activities is keeping students interested. Student interest and enrollment in a course is more a function of the methods used to teach than what is taught. Motivating students in agriscience, as with any subject, requires hands-on, laboratory activities in an environment conducive to learning. As a fellow teacher stated, "When I teach welding I fill the class. When I offer a course with emphasis on science I might get five students." This may occur because welding students go to the laboratory and weld, while agriscience students spend less time in laboratory activities. Laboratories will have a very important function as more and more teachers begin to emphasize science concepts in their curriculum.

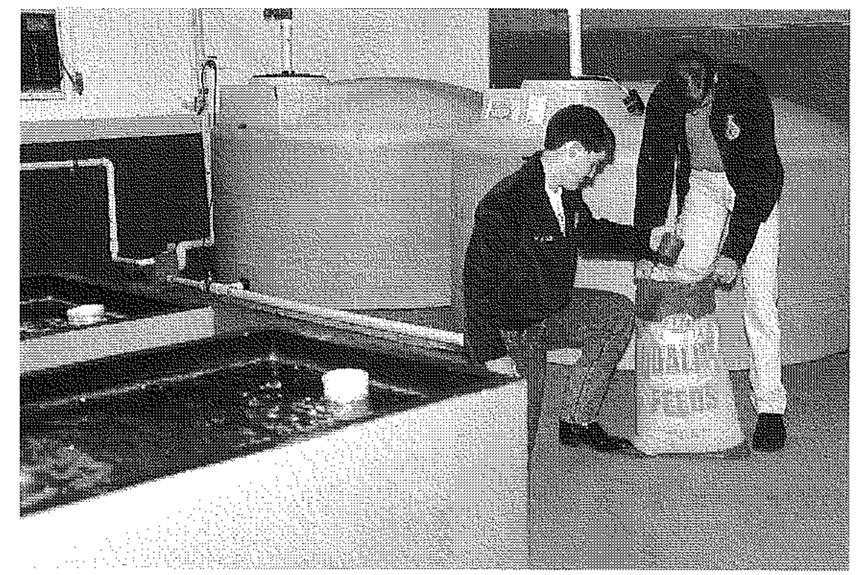
When science principles were first integrated into the agriculture curriculum at Bay, a need for laboratory equipment and space that supported such activities was soon realized. The first question was where to locate the lab. Should existing laboratory space be reallocated, should space in a separate building be sought, or should an attempt be made to acquire a new facility? Since a new facility was not possible, and the traditional agricultural mechanics laboratory was small, locating space outside the existing facility became the only choice. Fortunately, a metal storage building located near the agriculture building was available. After submitting a proposal to the school administration and gaining approval, the agriculture department was given use of the vacant building. With a little ingenuity and initiative it was fairly simple and inexpensive to adapt the facility to an aquaculture and soil science laboratory.

For those considering adaptation of an existing laboratory or facility, there are several questions to consider. First, what is the general condition of the existing structure? What effect will other activities in the area have on agri- ➔



Adamsville, Tennessee teacher Jeff Lipford uses a refrigerator to store chemicals and specimens used in tissue culturing.(Photo Courtesy of David Agnew, Arkansas State University)

science activities? In most traditional mechanics laboratories a common problem is dust and smoke. Temperatures in the mechanics laboratory may vary greatly in the cool season due to large spaces and overhead doors. Dust and other contaminants are stirred by conventional heater fans. In warm weather heat can be a problem, and fans create wind gusts, stirring contaminants. The extent to which these factors are a problem depends on the presence of an exhaust or dust collection system, temperature controls and the vent or blower systems, and the type of agriscience activities to be attempted. Given a crude environment, a teacher might select activities less sensitive to dust and variations in temperature. Space needs vary based on the kind of agriscience laboratory activities



Students at Bay High School regularly measure feed and perform routine maintenance tasks. (Photo Courtesy of Rocky Clements, Bay, Arkansas)

attempted and equipment needed. Some problems may be corrected by simple modifications, such as curtains or the installation of a dust collection system, while others require major expense and effort.

The presence of electricity, water, and a drainage system is important for some agriscience activities. In an existing facility consider the following factors: voltage, amperage capacity of existing wiring, number and placement of outlets, hot and cold water, drain and sewage capacity, need for refrigeration, space for equipment, work bench and floor condition or surface covering, ventilation, lighting, and the presence of windows. Knowing the kinds of laboratory activities to be conducted helps determine the extent to which each physical characteristic might be a limitation. For example, the presence of sunlight will likely cause algae to grow in an aquaculture laboratory.

While it is helpful to have a laboratory to emphasize science, much can be done without a special laboratory or expensive equipment. A typical greenhouse can provide a setting for a variety of agriscience activities. An aquaculture project can be conducted with a water trough and filter made with materials purchased from a hardware store. Outdoor laboratories such as wildlife habitats, orchards, or test plots of crops can be easily adapted to emphasize scientific principle. Also, livestock facilities/pens for rabbits, poultry, or chinchillas are inexpensive yet excellent for teaching genetics, feed efficiency, reproduction, and other principles of animal science. The number of science activities that can be done in an existing or outdoor laboratory is limited only by one's imagination.

Jeff Lipford
Adamsville High School, Tennessee

Adamsville High School, located in the gentle rolling hills of West Tennessee, has a 50' x 70' mechanics laboratory, 30' x 50' lean-to greenhouse, 36' x 90' quonset greenhouse, and a 24' x 30' plant tissue culture laboratory. The lean-to greenhouse and mechanics laboratory were built when the school was constructed in 1979. The quonset greenhouse and tissue culture laboratory were built in 1991. The school has an enrollment of 390 (grades 9-12) with about 70 in the agriculture program.

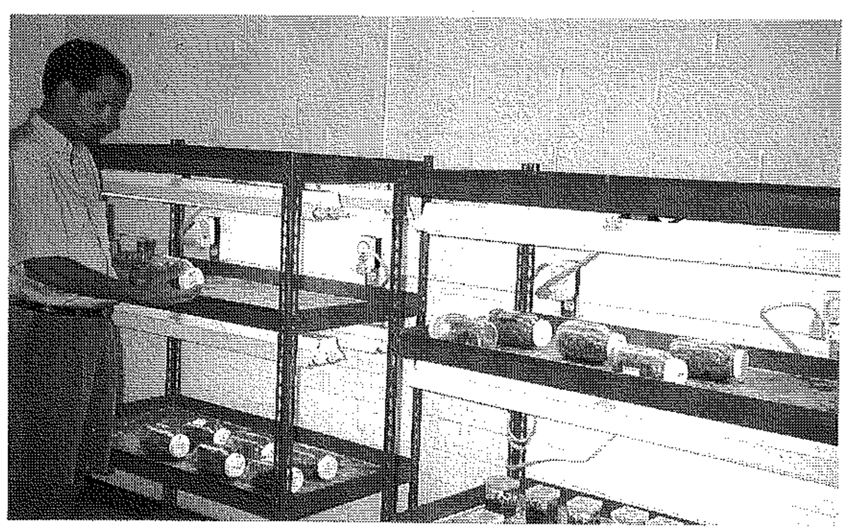
Seven years ago very few laboratory activities, much less laboratory activities in agriscience, were being integrated into the curriculum at Adamsville. The program had only 28 FFA members and three small classes of horticulture and agriculture. A new approach was needed. In Tennessee agriculture courses can be counted for science credit. Early in the adoption of agriscience curriculum content it was realized that the kind of laboratory activities being conducted and those that were desired would require more elaborate facilities to be successful. Due to plans to use a portion of the existing facility for other uses in the near future, a new facility seemed to be the best solution, assuming a funding source could be located.

After researching possible funding sources, it was determined that the Tennessee Valley Authority might fund this kind of project. Since matching funds were necessary, the next step was to justify the need for an agriscience laboratory to leaders in the local funding process. This included convincing the community that such a laboratory would benefit the students, school, and community.

Through a cooperative agreement, the Tennessee Valley Authority agreed to provide $35,000, and the local school board contributed $30,000 toward the cost of constructing the laboratory. The next step was extensive research to determine appropriate physical and educational requirements for a large scale tissue ➔

culture laboratory. People from the funding source and several books provided more details on how to proceed. Based on this research, a list of physical building requirements and equipment needs was developed. (Note: Books used for reference were: *Plants from Test Tubes: Introduction to Micropropagation* by Lydiane Kyte, and *Tissue Culture Techniques for Horticultural Crops* by Kenneth C. Torres.)

Design features included the physical structure, as well as electricity, plumbing, heating, and cooling needs. In some cases, equipment to be used would affect the design of the laboratory. The tissue culture laboratory has no windows, since control of light to plants is necessary. A special low velocity fan in the central air and heating system was used to reduce the stirring of air, which causes contaminants to be circulated around the laboratory. For the same reason a wall with a small 2' x 2' sliding door was installed through which tissue cultures are passed during the transfer stage. The opening and closing of a regular door stirs air and moves contaminants. Another recommendation is to use counter tops and sinks which are resistant to chemicals that may be used in some experiments. When possible, start with sinks and counter tops designed for chemistry labs. (Note: Some tissue culturing activities can be done in an existing facility; however, large scale tissue culturing requires a higher degree of control over the environment. For smaller scale activities in existing labs, many of the control problems can be diminished by simple modifications, such as covering a window or installing a new motor or rewiring a motor on a heater unit to deliver a lower volume of air.)



An environment without stray sunlight and free from dust is most desirable for tissue culturing. (Photo Courtesy of David Agnew, Arkansas State University)

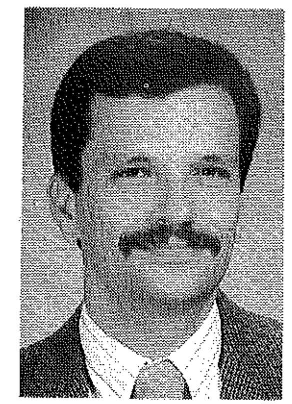
Equipment needs vary by type of agriscience activities attempted. However, a common belief is that every agriscience laboratory should have a Biotronette Chamber, since it can be used with a variety of experiments. This provides an environment in which heat, humidity, and light can be controlled. Also, a laminar flow hood is useful in providing a clean environment that is free of contaminants. In the case of these two pieces of equipment, as with most other pieces of equipment, no special facility design or modification is necessary.

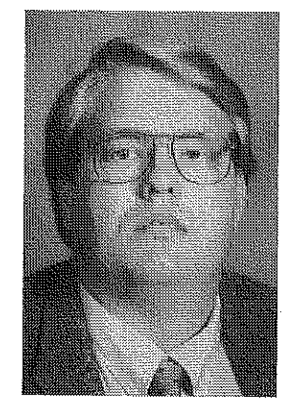
While discussing equipment, it is appropriate to address kits that can be used in the agriscience lab. A variety of scientific kits are available and are great for classroom and laboratory use. The following are kits used by the students at Adamsville in the laboratory: environmental pollution test kit (water), soil testing equipment, air pollution kit, dissolved oxygen test kit, plant tissue test kit, and plant tissue culture media kit. These kits can be used in the classroom or laboratory setting if care is given to prevent contaminating the supplies and equipment.

Summary

Every teacher starts with a different set of circumstances. Some have access to space or financial resources which make the integration of scientific concepts easier, while others must seek alternative resources. Some like the scientific aspect of agriculture, and others are a little reluctant to focus on science. Taking action to create change means that teachers must ask themselves some hard questions. What should I teach and how? Will students enjoy agriscience laboratory activities as much as traditional laboratory activities? Will students drop my course if they don't get the traditional mechanics courses? Should limited financial resources be spent on traditional laboratory equipment and supplies for agriscience? What equipment is needed for agriscience? What costs are involved? Do I have enough resources to make a reasonable effort in the improvement of the facilities to incorporate agriscience? Where will I find space to start another laboratory? What will I give up to create a new agriscience laboratory area? Can the mechanics laboratory or greenhouse share space with a laboratory for agriscience? Will the use of hands-on activities in agriscience compare with the use of hands-on activities in other more traditional areas? What textbook should I use, if any? What can I do with existing facilities and no new resources? As teachers ask these soul-searching questions in sorting priorities for the future, the end result will affect the extent to which teachers improve the laboratory and its use in agriscience. The final question is what long-term effect will adapting or building an agriscience laboratory have on students. ■

Laboratory Facility Improvement: From A Strong Past Comes A Stronger Future!





BY NICK D. BOREN AND DAVID A. DWYER

Mr. Boren (top) is agriculture instructor at South Callaway R-1 High School in Mokane, Missouri. Mr. Dwyer is agribusiness resource teacher at East Magnet High School in Kansas City, Missouri.

Since the inception of the total agricultural education program, the laboratory has played an intricate and vital part in allowing students the opportunity to develop skills necessary in the American and global food and fiber industry. Today, the laboratory continues to hold this sacred and valuable mission.

Numerous agricultural educators (authors included) often think of the word "laboratory" as it primarily relates to agricultural mechanization. By no means should the importance and relevance of agricultural mechanization skills ever be discarded or discontinued!! As technology advances, mechanical aptitude and awareness will continue to prove themselves as worthy and marketable skills. Agricultural education and the accompanying technological advances in the agribusiness and agriscience sectors have deemed it necessary that agricultural education make relevant contributions. This trend is very reflective of upgrading and improving laboratory facilities. In the past two decades agriculture laboratories have grown to include greenhouses and outdoor education areas, such as demonstration plots, outdoor classrooms, and land laboratories. The 1990's have allowed the laboratory to expand and evolve (with the total program) to include areas such as aquaculture, hydroponics, tissue culture, laboratory animal science, biotechnology, food science, agribusiness computer applications, and urban agricultural mechanization. These curriculum offerings are now becoming the standard by which today's agriculture programs are being measured, compared, and evaluated. Presently, there is a great demand for updating and improving laboratory facilities. In support of this fact, Silletto (1992) stated,

> "Identification of the future role of instructional laboratories is a growing concern for agricultural educators. It can be shown that laboratory instruction is important and effective. It can also be shown that laboratory instruction has continually evolved with technology changes. The change process is an ongoing transition with considerable potential for the future." (p. 23)

The focus of this article is to promote the practice of teacher or departmental resourcefulness in improving the laboratory facilities.

Facility and Instructional Alignment

Agricultural educators should strive to provide quality and effective laboratory instruction. For this to occur, laboratories should facilitate the growth, improvements, and changes occurring now and for the future in agricultural education and the agricultural industry.

The transfer of skills and knowledge during the teaching-learning process in a laboratory setting is practiced throughout today's agricultural education. Laboratory facility improvements must be viewed with a cautious, yet forward-looking vision. Instructional growth and development should be viewed as a constant concern in any agriculture program.

An honest and accurate assessment of the needs and goals of the specific program and the abilities/skills of the teaching staff are the first step in determining laboratory improvements needed. Once evaluated, the next step is to effectively combine the programs' needs/goals and the intended outcomes for each activity with the laboratory areas available (school-based, industry-based, or community-based). These laboratory areas and resources can be identified and utilized for predetermined instructional activities or needs. The third step is to evaluate this combination for the actual teaching-learning process and skill transfer. Lastly, necessary changes or deletions may be implemented when and where deemed appropriate. These four basic steps can be used to align relevant facility improvements with instructional capability and desirable outcomes.

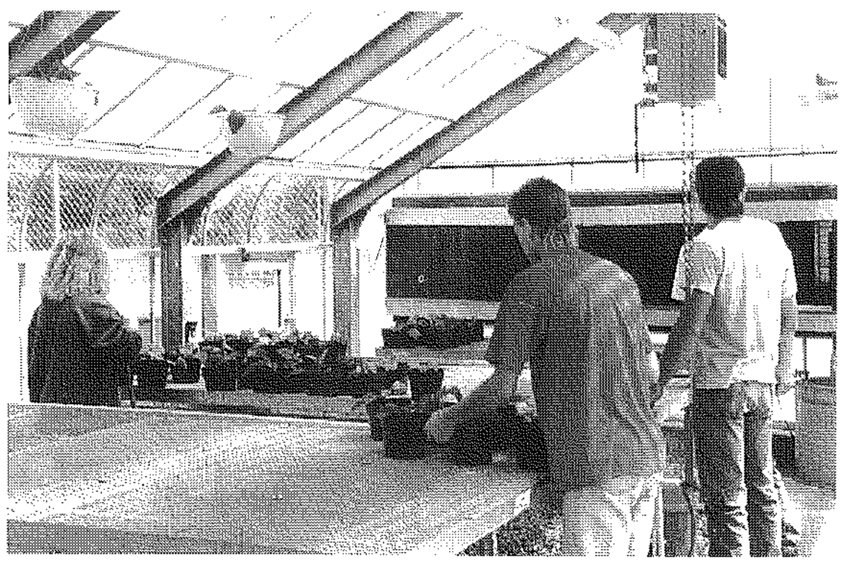
Regardless of the curriculum, present-day needs have mandated that students receive an opportunity to learn and practice the necessary skills to become marketable in today's workforce. The laboratory can be utilized as an effective tool to achieve the demand placed upon education by industry.

Instructional Resourcefulness in the Laboratory

As stressed by Phipps and Osborne (1988, p.427) "Securing adequate facilities and up-to-date equipment can be one of the most challenging and frustrating responsibilities of an agriculture teacher." Frustrations aside, the laboratory continues to evolve and expand with the onset of more and more advanced tech- →

nologies in the food and fiber industry. Agricultural educators have traditionally taken it upon themselves to wheel-and-deal, trade, borrow, or salvage the necessary instructional materials for their programs. With this in mind, one technique that can be used is "instructional resourcefulness." This is applicable to any objective, goal or skill(s) to be exchanged, location (urban versus rural), nature (traditional versus alternative), or the resources available (both physical and human) for the program. The largest limiting factor in adapting an existing laboratory to meet the needs of today and tomorrow is usually imagination and determination, followed by financial and human resources.

The degree of resourcefulness will vary from teacher to teacher and program to program. Each program will differ due to specific laboratories. The list of desired facility improvements will, for most of us, always be endless. But where there is a need, there is almost always a way to satisfy that need—professional networks, industry donations, community members, advisory councils, and so on.



This 24' x 32' greenhouse was added on to the existing agricultural education facility. A majority of the labor was provided by students enrolled in Agricultural Construction classes.

Conclusion

The effectiveness of laboratory instruction need not be solely reliant upon the immediate presence or lack of physical facilities. In most cases, laboratory facilities can be improved by implementing teacher and departmental resourcefulness to enhance and improve laboratory instruction.

The useability and quality of the chosen laboratory exercises and the application of their outcomes can be attributed to "laboratory facility improvements" in the highest degree. Lab facility improvements originate from the need to increase skill levels of students. In support of this fact, Josko (1992, p.23) stated that "Progressive, science-based agriculture laboratories will be dynamic areas where exciting demonstrations, thought-provoking experiments, and student-centered activities occur." The direct result of any type of laboratory facility improvement should always be a positive increase in the teaching-learning environment for laboratory instruction. When considering available resources, one important point to remember is to not be intimidated by or content with the laboratory component of agricultural education.

To try something new, different, or innovative with the results of "quality and relevant educational outcomes" is to be on an educational threshold. If you are currently exercising resourcefulness for the improvement of your laboratory facilities to enhance instruction, you are to be commended. The everyday efforts of agricultural educators continue to serve the progressive evolution of laboratory facilities today for the technology of tomorrow.

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What If the State . . .

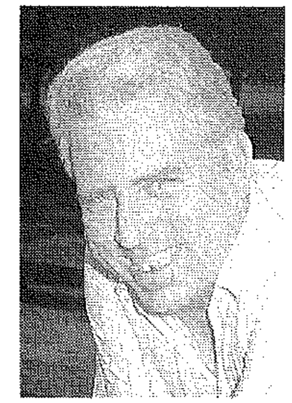
(continued from page 3)

cooperative as you seek approval. Requests should be realistic, complete, and able to absorb some reductions. Develop several requests and start with the most desirable.

6. Maintain an active role as plans are drafted and construction is completed.

Use existing lab space in the best possible way and present a well-documented plan for lab facility expansion to administrators as needed - that's the bottom line. Of course, the teacher is responsible for the upkeep, appearance, and general effectiveness of all lab facilities. For many people a glance at lab facilities leaves many impressions about program activity, effectiveness, and quality. You never know when the State Superintendent of Education might decide to drop by for a visit. Be ready. ■

Upgrading Facilities Can Be Inexpensive



By Jim Wilson

Mr. Wilson is agricultural mechanics instructor at Nevada Area Vocational-Technical School in Nevada, Missouri.

The first thing that comes to mind when thinking about upgrading facilities is building a new building, or remodeling the existing one. In most cases, building or remodeling is out of the question because of the funds available. We should think of our facilities as the place from which we offer a special service - the education of our youth. If we keep this first and foremost in our minds, we will continually upgrade our facilities.

The reasons for upgrading facilities are safety, program improvement, and maximizing student achievement. The person responsible for upgrading facilities is the instructor. It is the instructor's responsibility to ensure that students have a safe place to learn the skills taught in the program. Upgrading facilities can include adding shelves in storage areas, providing better organization, and keeping clutter to a minimum. Replacing damaged or missing safety devices on laboratory equipment, cleaning up work areas, and removing from service and/or replacing any unsafe equipment all make for safer places of learning. Complying to OSHA, EPA, and DNR regulations regarding waste handling and hazardous materials handling is becoming more important because of the products used in our programs. As programs become more flexible and open-entry/open-exit patterns become more common, we may need to consider surveillance cameras in laboratory areas.

In the area of program improvement, upgrading facilities can include:

- Creating work stations;
- Procuring components;
- Designing teaching aids;
- Making changes in the curriculum to reflect industry changes; and
- Creating audio/visual materials.

My past experience as a mechanic, coupled with good community relations, has helped get components, audio/visual materials, and teaching aids donated to the agricultural mechanics program at Nevada AVTS. These materials were donated by local salvage yards and machinery dealerships, as well as machinery manufacturers. I have also constructed trainers and videotaped demonstrations for the students to use.

Upgrading facilities to improve student achievement can include such things as painting the classroom and laboratory walls to provide an atmosphere more conducive to learning, making the curriculum and training stations flexible enough to meet student needs, providing the latest possible components and informational materials available to teach your program, and preparing special materials for special needs students so they have the same chance to learn as everyone else.

Upgrading facilities takes time, effort, energy, cooperation, and money. Less money creates more need for innovative ways to upgrade. By using the resources available to all instructors, upgrading facilities can be rather inexpensive. Much of the physical labor can be done by students, as long as the work performed reflects the curriculum and does not pose a safety hazard. The building maintenance staff can be involved in certain tasks, and the instructor can utilize summer contract time, Christmas vacation, spring break, or even free time to do some of the upgrading. Some of the upgrades can be constructed or produced by other instructional programs, if the upgrades fit their curricula. Advisory committees can be useful in getting industry support and generating ideas on how upgrading can be accomplished.

By continually upgrading facilities, we as instructors can better educate the students under our charge. As a result, our students will have safe places to learn the skills we teach, our programs will improve to meet industry needs, and our students will be better prepared for industry. ■

Coming in June...

Theme: Agricultural Educators in Non-School settings

Plus other articles on
- Agricultural Literacy
- Teaching Urban Students
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and Feature Columns on
- Food Science
- Ag Ed in Elementary Schools

FEATURE COLUMN

Research on Teaching: More of the Ingredients of Effective Teaching

BY GEORGE WARDLOW

Dr. Wardlow is associate professor of agricultural and extension education at the University of Arkansas.

"I don't understand it, these kids are just not getting it. What can I do to make them understand something as simple as this?"

As a teacher, if you have spent more than a few days in front of a classroom, it is likely that you have asked yourself this question. It is also quite likely that you have spent many difficult hours agonizing over "...how to get them to understand." However, it may be that you are focusing on only one-half of the issue, if you are trying to understand what you believe to be a student learning problem as "their problem." Perhaps it is time to focus on your half of the problem. Effective teaching begins with the teacher understanding the students.

In my last article (see March, 1993 issue) we discussed the idea that many factors affect student-teacher classroom interaction. These factors include the student's background and experiences, the teacher's background and experiences, and even the nature of the community in which the classroom(the student-teacher interaction) exists. In short, just as we know that all students do not come to us with the same set of skills and understandings, neither are all teachers nor communities created equal, and these factors are also related to student learning. (Refer to the Mitzel model, 1960, and Dunkin & Biddle, 1974.)

As learners, we each approach a problem (or the world) from our own unique perspective. How you see a problem that you have assigned to your class may be perfectly clear-- to you! But, students' backgrounds and experiences may cause them to approach the same problem from an entirely different perspective. If they lack the background information which is foundational to the problem, they may not be able to understand it at all. What compounds the issue is that you (the teacher) may possess the foundational information and assume, without thinking about it, that your students possess it also. Now, if this occurs, whose fault is it if the students fail to have the same perspective as you, or any perspective at all? To further compound the problem, agricultural educators have long prided themselves on using the problem-solving approach to teaching. We create "problems" for our students to "solve"!

Recently, on the way home from fourth-grade basketball practice, my kids and I stopped to buy a drink ("pop" at our house). The convenience store had it in those cute little new Coke bottles with the crimped-on lids (the only thing we had when I was a kid). I told the kids that we needed a bottle opener. "A what?", the middle one asked. "A bottle opener, a unique mechanical device to pry the lid off of this bottle," I replied. (This was obviously a teaching moment.) The problem was that my 10-year old had never seen a Coke bottle or an opener. My 14-year old thought he "could remember seeing one once in a museum", and the 5-year old didn't care. I felt that they had "wasted" their youth with aluminum cans and those funny little tabs. The point is that they and I were approaching the problem (bottled soda pop) from entirely different sets of background experiences. Finally in the middle of my explanation on the art of pop bottle opening one of these whippersnappers said, "Enough about the old days, Dad. Why don't we just buy the pop in cans?" Insult to injury, I thought. Not only did they view the problem differently, but their solution was quite different than mine also. Instead of looking for an opener--the paradigm from which they were working. I went home feeling old. I'm sure I would have felt older still if I had tried to explain to them that "paradigm" means "model."

What I needed to do in order to be successful in helping my young charges solve the problem was to understand the problem from their perspective. **When a similar situation presents itself** to you in one of your classes, how likely is it that it will occur to you that your young charges may not approach the problem from your paradigm? If it does occur to you, **will you know enough of your students' backgrounds and experiences to be able to use them** as a model from which to work toward solving the problem, instead of using your model?

This author will bet that this issue is not unique to any teacher who uses a problem-based approach to teaching (lecturers excluded). But how can we be expected to get into our students' lives enough to be able to see problems as they see them? To begin, if your program is a federally funded vocational program, **it's required by law.** The Smith-Hughes Act of 1917 requires that each student of vocational agriculture have a supervised experience → program (Shepardson, 1929). That permanent legislation was never repealed; it is alive and well, and only subsumed under the current legislation. So, it really is your job to get to know your students outside of class.

Additionally, the FFA is legally an "integral" part of your program. It is a "teaching tool" (Hunsicker, undated) which is as legitimate to use in class as is the overhead projector or a chalkboard. I can't imagine trying to teach without any of them. The FFA is an organization which provides you with a perfect opportunity to get into your student's lives, and to get them into your life. Few other teachers have either of these avenues into their students' experiences.

When I was in high school, my agriculture teacher used to volunteer to be the announcer at the home football games (in addition to all the countless other activities he did). Later, when I taught, I used to run the gate and serve as scorekeeper at basketball games (again, in addition to countless other activities). Why did either of us do these activities, which were not directly related to teaching agriculture? Because our students participated in them, and it was yet another way to understand something about their lives.

Effective teaching is not a 40-hour per week job. It is not even a 140-hour a week job, if you confine yourself to your program. Effective teaching begins with understanding your students.

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Laboratory Facilities Impr. . .

(continued from page 4)

utilities, including hot water and adequate drains, large power sources, and a temperature-controlled environment. There must be limited access and high security. Biotechnology laboratories must be clean and well ventilated. It may be desirable that the laboratory provide a secure access for science teachers and their classes.

The illustration on the front cover is an example of a spatial arrangement which might meet the needs of a biotechnology/horticulture curriculum and a complementary agriscience curriculum staffed by two teachers.

In conclusion, all new facilities and modifications to older facilities must have a focus on quality facility planning and safety. Time spent developing a detailed plan with all variables considered will result in a functional and manageable facility. ■

Lab Facilities Imp. for Tech. Trans.

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improve an existing facility. However, the new facility will probably become out-of-date twice as quickly as the existing facility did. There are several strategies we can use to work with the rapid technological changes.

First, seek active, viable support from business and industry, including production agriculture. The latest strategies of "on-farm research" are significantly decreasing the gaps between research and production agriculture applications. Directly involve these innovative agriculturalists in your instructional program.

Second, design facility improvements based on the concept that innovations are quick to change. Do not invest large amounts of time, money, and effort into single technologies and innovations. Diversify your instructional laboratories and facilities. For example, a computer must be utilized in a variety of applications before it should be considered. A series of instructional modules seems to make more sense than adding additional units of the same equipment which you presently have.

In conclusion, technological innovation and adapting to change is as much an attitude as it is knowledge and skill. Your instructional facilities will reflect more your attitude to technological innovation than it will your knowledge and skills. Therefore, base your laboratories upon teaching basic skills and concepts. A clean laboratory and an effective learning environment will produce greater long-term results than the latest technologies piled in a heap in the corner. Base your laboratory facilities upon the fundamental concepts of effective technology transfer, total quality management, and innovative instructional technologies. Learning to do, and doing to learn is a fundamental component of our instruction for the future. ■

Upcoming Themes:

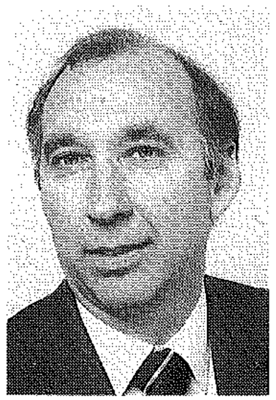
July — Strengthening Programs

August — Motivating students

September — What Teaching Is Really Like

October — Teaching Agriscience

FUTURES and OPTIONS Tools For Livestock Producers



By J. Errol Baxter

Mr. Baxter is the director of Commodity Marketing and Education at the Chicago Mercantile Exchange in Chicago, Illinois.

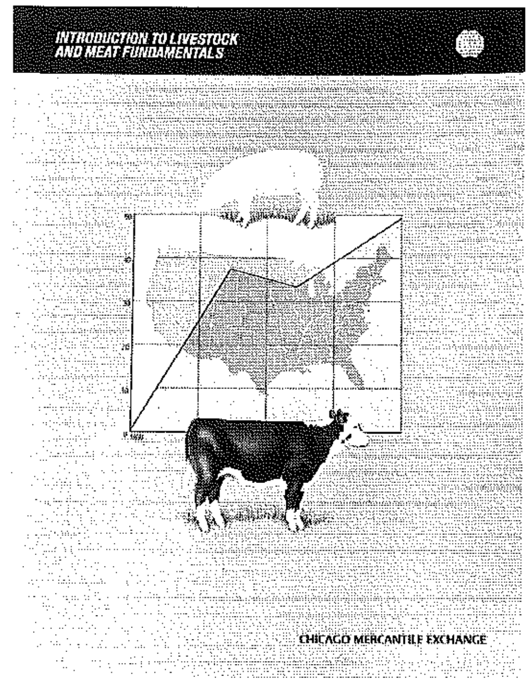
Today, livestock producers are faced with many financial challenges, where business management and marketing are as important to survival as top-notch production techniques. Producers have to work smart, and agricultural educators need to have an arsenal of information to inform both students and adults. Gone are the days when teaching management practices and sizing up the newest production methods constitute the entire agriculture curriculum.

Although futures markets have been around a long time, the concept of forward pricing and developing marketing plans has not been at the top of producers' interests lists. Albeit, this lack of interest has been reflected in agriculture programs.

Both existing producers and future farmers/ranchers need to understand the role of futures markets to their overall operations. Futures markets do not create profits. They do, however, extend the reach for profitable market opportunities way beyond the day or week the livestock is to be marketed. In many instances, there is only a window of profitability during a livestock marketing period. Thus, a lack of understanding on how to use futures markets can result in a lost opportunity.

In order to make futures markets more accessible, option contracts on futures were developed in the early 1980's. Options provide "market insurance" that prevents loss (disasters) without shutting out increased profit opportunities. So, if the market starts moving favorably after the options insurance is in place, producers can gain the price advantage, while still having their pricing insurance intact. But the advent of options brought about a flurry of new terms like "put," "call," and "strike price", which challenged both contract users and agricultural educators.

Even though the primary function of The Chicago Mercantile Exchange (CME) is to provide a central marketplace for the forward pricing of livestock, broilers, and lumber via futures and option contracts, the CME feels that part of its function is to provide "tools" to assist educators in teaching others how to use the markets properly. The ultimate challenge to agricultural educators is to learn and teach how to tie the best marketing strategy, or combination thereof, to a variety of market pricing conditions. Since futures and option contracts require an understanding of terminology concepts and the ability to know when to use them, the CME has developed an array of informational pieces. Although all materials relate the mechanics of using futures and option contracts, each piece relates the concepts in a slightly different context. The CME understands that with futures and options, it is important that a comfort factor be developed. Seeing the same information presented differently helps accomplish this goal.



***Introduction to Livestock and Meat Fundamentals** is a 28-page booklet designed to help students understand how animals make their way to the retail market.*

For example, the *Commodity Marketing Teachers Guide* includes a complete lesson plan, while other informational pieces may cover only one facet of the mechanics of trading.

The following is a review of the CME's newest assortment of futures and options booklets, videos, and seminars that teachers may wish to order for their library. There are costs associated with some of the "tools" and for bulk orders. Educational rates do apply, however, and the CME is committed to supporting agricultural educators. For more information, please contact Errol Baxter or Teri Huffaker, Commodity Marketing Department at the CME, 30 South Wacker Drive, Chicago, IL 60606.

BOOKLETS AND BROCHURES

The Merc at Work

A light hearted, fun-to-read guide that will give students an overall understanding of what futures and options are, who trades them and why, and what takes place on the trading floor. The brochure consists of 20 pages of colorful illustrations and lively, entertaining, and informative copy. This publication is recommended for all (not just agricultural) secondary students.

A Self-Study Guide to Hedging with Livestock Futures

A 36-page business guide to livestock futures markets and how they work. Packed with helpful, down-to-earth examples and charts. This brochure helps teach the mechanics of futures and answers the most asked questions on hedging. (The self-study guides on futures and options serve as good reference material for teachers participating in the FFA Commodity Marketing Program and/or those teaching adult education programs.)

A Self-Study Guide to Forward Pricing with Livestock Options

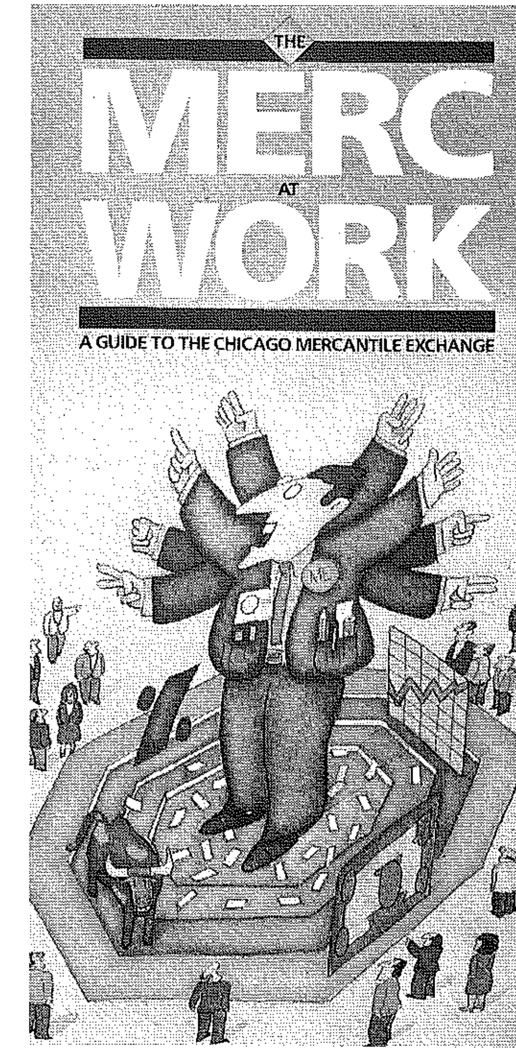
Learning to use options, like any tool, requires the same attention that most new skills require: a little time and patience to become familiar with the vocabulary and to develop a comfort level with the concepts. This 16-page booklet summarizes the steps of using options for forward pricing livestock. Specific applications of basic options pricing strategies help relate the many ways livestock options can help reduce the uncertainty of making marketing decisions.

Ten Strategies for Forward Pricing Livestock Using Livestock Futures and Options

This 25-page publication is intended for livestock producers who are comfortable with their basic knowledge of how to use livestock futures and options but want to know more strategies and add greater flexibility to their arsenal of marketing tools. *Ten Strategies* covers the mechanics of strategies that are becoming widely used in the livestock and meat business to manage pricing opportunities on a daily or weekly basis. (This publication is more applicable to adult marketing classes.)

Live Cattle Futures & Options Facts
Live Hog Futures & Options Facts
Feeders Cattle Futures & Options Facts

Three individual pocket-sized guides detailing key futures and options contract specifications, plus a listing of important phone numbers at the Chicago Mercantile Exchange.



***Merc at Work** is an easy to use guide that gives students an overall understanding of what futures and options are, who trades them and why, and what takes place on the trading floor.*

Risk Management for Ag Lenders

This 32-page brochure offers guidelines on policies and procedures for financing the use of livestock futures and options. Discussion includes evaluating hedge loan requests, documentation, monitoring hedge loan terms, and more. Agricultural lenders have a special interest in this brochure.

Managing Purchase Prices

A stage-two learning guide written for livestock buyers who want to learn about applied →

strategies in the use of futures and options. (Like *Ten Strategies*, this publication is for the more advanced marketer.)

Introduction to Livestock and Meat Fundamentals

A 28-page look into the cattle, hog, and broiler industries that has been designed to give the market participant a point of departure, background information about each industry, and some analytical forecasting tools. Students should come away with a picture of what each industry looks like, how animals make their way to the retail market, and what is meant by the barrage of industry jargon.

CME COMMODITY INSIGHTS: Understanding The New Volume-Weighted Feeder Cattle Cash Settlement Index

This 4-page brochure explains the new cash settlement of Feeder Cattle futures contracts effective with the January 1993 Feeder Cattle contract. Also included in the brochure are comparisons of the new index to the old cash settlement index and basis estimations at selected locations with the new index.

CME Agricultural Spread Charts

Intra-commodity and inter-commodity spreads are included in this 92-page booklet of agricultural spread charts. The focus of the chart book is lumber and livestock markets. Each page in the booklet depicts a single spread during each of the previous five years and a five-year average of the spread. (This booklet is recommended for experienced traders and marketing clubs.)

VIDEOS

The Agricultural Marketplace

This 19-minute video is intended for all segments of the agricultural marketplace. The video shows the link between individual producers and CME operations and sets out the purposes of livestock futures and options for the producer. (An excellent overview of the marketplace for both secondary students and adults.)

Livestock Producers Talk Futures and Options

This 20-minute video follows several real-life producers and the actual forward pricing strategies they have employed. A great way to learn by example. (This video serves adult education programs better than secondary programs.)

Financing the Ag Hedger

This 12-minute video has been designed to show agricultural lenders how futures and options, as part of a marketing strategy, can help protect their customers from falling prices, while at the same time, helping safeguard their own loan portfolio.

Pit Talk

This video introduces three Exchange members and illustrates how they execute buy/sell orders in the Exchange's trading pits. They answer the most frequently asked questions the public wants to know about the actual mechanics of trading. (The video serves as an excellent introduction to futures markets for teachers to peak interest and take away the mysticism of futures trading.)

VIDEO TRAINING

NEW! Understanding the Livestock & Broiler Markets

To help all in the livestock industry better understand price management, the CME offers this intensive, introductory home-study course that covers the fundamentals affecting these markets. Separated into five modules, the 200-page workbook contains exercises, case studies, price charts, graphs, and more. And to supplement the workbook, the course includes a 4-hour videotape that leads the student through each module of the manual. (The material presented is more suited for college level and adult education courses.)

LIVESTOCK FUTURES AND OPTIONS SEMINARS

National Seminar Series

To help both teachers and producers learn the tools of forward pricing, the CME Marketing and Education Staff travels the nation each year putting on one-day risk management conferences, specifically designed to each market. There are seminars for producers concerned with feed cattle, finished hogs, and calves/stockers. Seminars are also scheduled for agricultural lenders. Each program starts with the basics of futures and options and quickly moves on to real-world exercises, examples, and customized work sheets to help attendees pencil out their own uses of livestock price management strategies. (These sessions can provide educators with ideas and resource materials to use in the classroom.)

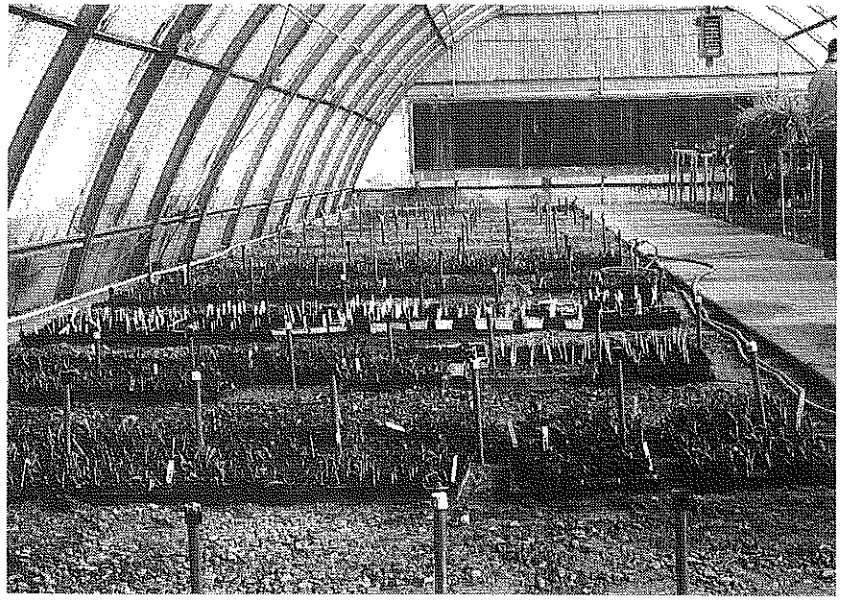
Educational Seminars for Educators

The CME sponsors an NVATA professional training workshop (annually in Chicago) for up to 30 teachers on forward pricing of livestock and poultry. The National FFA Foundation →

Planning for Change

(continued from page 9)

depend upon the curricular emphasis of the program. Teachers should be cautioned to avoid allowing the equipment to drive the curriculum.



These sand beds have polyethylene tubing buried beneath. The tubing is used to circulate hot water.

The curriculum should determine *what* equipment is purchased and *how* it is used.

The Dirty Room

The typical "dirty room" for any agriculture program is the mechanics laboratory. In designing this room it is important for teachers to think beyond the usual agricultural mechanics boundaries. Leave open space and plenty of electrical/compressed air outlets for future use.

The Greenhouse/Potting Shed

The size of the greenhouse will depend upon program enrollments and the program's emphasis. The author's program is a specialized horticulture program with an enrollment of approximately 200 students. Consequently, the reader won't be surprised to learn that our greenhouse is 2700 square feet. There are many good books available to assist teachers in designing and equipping greenhouse construction with local business people.

Students are shown working in the Peoria High School greenhouse.

The greenhouse in the author's program is equipped with hot-dipped galvanized steel tables on one side and sand beds on the other. Running throughout the sand beds are polyethylene tubes which carry warm water. The water is heated by a spa heater and recirculated using a pump which is wired to a thermostat. Most of the greenhouse tables and beds are watered by overhead sprinklers. However, there are a few tables which have a drip system for house plants. An injection system is used to inject both acid and fertilizer into the water. The entire irrigation system is run by automatic clocks.

If at all possible, some sort of potting shed should be located near, or preferably connected to, the greenhouse.

The potting shed should be equipped with adequate storage space, bins for soil, racks for flats and pots, a sink, and table. Ours also has a rack which hangs over the propagating table. The rack holds the pruning shears, labels, markers, and rooting hormones.

Conclusion

This is where this writer's advice must end. Other teachers whose programs focus on other curricular areas such as golf course management, fisheries management, small animal care, and other areas are invited to share their thoughts on facilities design and development in future issues of *The Agricultural Education Magazine*. We need to hear from you. Rest assured there is another Peoria somewhere beginning the process of facility development. Let's help them get it right—the first time. And remember this: Plan for change! ■

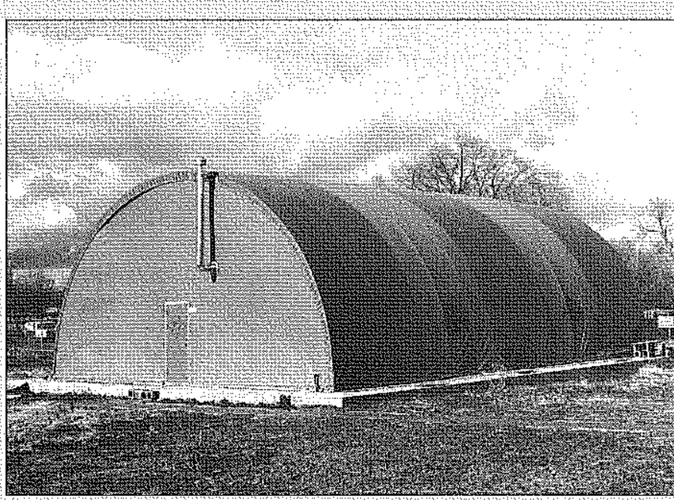
Futures and Options

administers the selection part of the program.

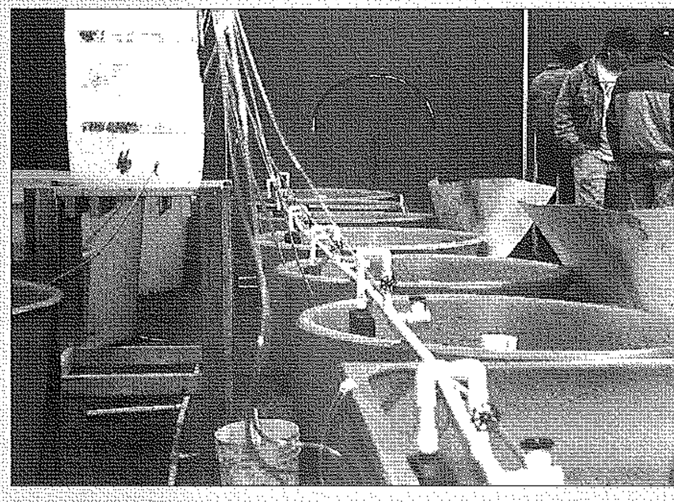
Classroom applications are taught to those attending the two-day conference at the CME. Also, inservice training sessions are held throughout the country for agriculture instructors participating in the Commodity Marketing program and for state agriculture teacher association summer meetings. ■

STORIES IN PICTURES

(Photos courtesy of Glen Miller and Doug Daley, University of Arizona)

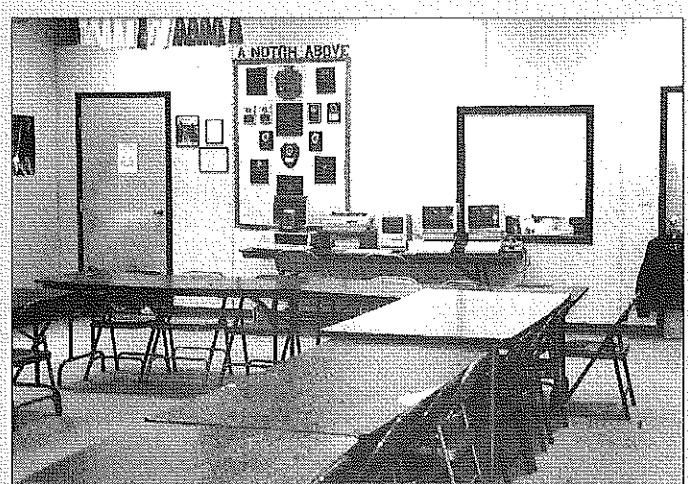


A specialized structure houses the aquaculture facility in Chino Valley, Arizona.



Planning is required for equipment arrangements to be functional and efficient.

This translucent structure filters ultraviolet light to reduce algae growth in the Chino Valley aquaculture facility.



Classrooms need to be planned with traffic flow and additions of equipment, such as computers, in mind.