THEME: Facilities
Facility Needs

In vocational agriculture/agribusiness, the facilities include all of the buildings, sites, and furnishings which are used in the instructional program. The nature of the facilities should be shaped by the competencies which students need to learn, and not vice versa. Instruction should dictate facility needs rather than facilities dictating what is to be taught.

The facilities that are available are important in shaping the quality of the education to be provided. The arrangement of classrooms and laboratories and the equipment and furniture in them comprise the available facilities. These should be adequate for the number of students and kinds of learning activities to be provided.

Needed: Modern Facilities

The age of a facility is not as limiting to an instructional program as is the nature of the facility. Old facilities can be modern. New facilities can be out of date. The key is the instructional capability of the facilities. Some facilities are not modern in terms of the kinds of competencies which can be taught. The reason some new facilities are not modern is that a modern instructional program was not planned before the facility was planned.

Individuals who are planning and designing facilities need to understand the new instructional programs. The first step in planning new facilities or facility renovation is to plan a modern instructional program. It is very difficult to have a quality agricultural program, for example, in a facility designed for teaching farm and ranching.

Traditionally, vo-ag facilities have included classrooms and shops. We must move away from this tradition. We must start to speak about practical vocationally-related learning activities and classrooms. The day when all that is needed in vo-ag facilities is a shop and classroom has passed. One additional fact is of interest. The notion that the facilities for a vo-ag department should be located behind the main school building or away from it must be changed. The position of an individual or a facility impacts prestige and respectability. There is no way vo-ag can have the high credibility it deserves when it is relegated to a physical location of low credibility. The facility for a vo-ag program must be a prominent part of the overall school facilities.

Needed: Facility Maintenance

The taxpayers of our nation have invested tremendous sums of dollars in facilities. School administrators and teachers have the responsibility of maintaining the facilities in a clean, safe, and attractive condition. Facilities need and require maintenance. Custodial personnel should be provided for vo-ag facilities just as they are for other school facilities. Teachers need to supervise students in such a manner that the facilities are not abused.

The Editor has frequently seen facilities where students have smeared paint on the walls, broken windows, and left dirty laboratories. This affects credibility. It is well to remember that the physical appearance of facilities is an important evaluative criterion applied to a teacher and instructional program by many members of the general public.

Vo-ag teachers and students should not become involved in facility repair, renovation, and construction. Some individuals rationalize that such involvement provides good, practical experience. Such rationalizations are little more than a cop-out for lack of a systematic instructional program. It is unfair for teachers and administrators to expect vo-ag students to help maintain or construct a school facility, except in rare instances.

Needed: Assistance in Facility Planning

Individuals who are planning new or renovated facilities must be futurist in their thinking. They must get the assistance of competent individuals and not be afraid to experiment with new approaches. Architects can be helpful, but their knowledge of what vo-ag needs is very limited. Part of the problem is that the new facilities are not comparable to todays' agricultural educators were not involved in the planning process.

Professionals in agricultural education need to carry out research and development activities to more accurately specify the facilities that are needed. These efforts must be based on the needs of agricultural industry today and anticipated future needs.

One of the best sources available for facility planning is BUILDINGS AND FACILITIES FOR VOCATIONAL AGRICULTURE/ANIMAL SCIENCE. This publication was prepared by George W. Sledge, Walter T. Bjorker, Theodore J. Brevik, and Virgil Martinson. Additional information on this document can be obtained from Dr. Walter T. Bjorker, Department of Continuing and Vocational Education, University of Wisconsin, Madison, WI 53706.

December, 1980

Dr. Elmer Cooper of the University of Maryland served as Theme Editor for this issue of the MAGAZINE. He has obtained several articles on facilities from various individuals. It was his hope that this issue would serve as a guide to individuals involved with facility planning.
Cooperative Planning: A Key To Effective Facilities

The writer in a vocational agriculture/agribusiness program stands first in the factors that contribute to the success of that program. However, the type, quality, and extent of some factor available to that instructor will, to a large extent, determine the long-term outcomes. There is a tendency for the innovative teacher to utilize more community resources when the tools, equipment, and laboratory facilities are limited or non-existent at the school. The phenomenon is a blessing on one hand, but can be a hindrance to good facility development on the other. Failure to have suitable facilities may sound the death knell of programs when teachers change.

This issue of The Agricultural Education Magazine was planned as a "handbook" issue. It is our hope that useful reference information will be provided for teachers, teacher educators, and superintendents, and, through these groups, passed on to planners and administrators at state and local levels. Facility planning is so complex and the potential for errors so great that cooperation is the most promising key to effective facilities. It is hoped that the material contained herein will provide practical information for improvement of facilities across the country.

Historical Perspective

Historically, vocational agriculture teachers have utilized community resources so effectively that, in some instances, school authorities have permitted programs to operate in school facilities that were inferior to other programs in the state. Many superintendents and teacher educators who had the opportunity to visit departments over the years could cite examples of "boiler room" or "under-the-sinks" classroom and shop operations.

The Vocational Education Act of 1963 and federal legislation for special areas, such as that to relieve poverty in the Appalachian Mountain areas, have done much to update facilities for vocational programs in agriculture. However, there is some evidence to suggest that many states that used such funds to build new vocational and technical centers, while facilities in many high schools were not updated. In some instances, facilities were built in accordance with inadequate program standards and specialized facilities suffered from plans developed by architects who were not familiar with effective program procedures.

Standards Are Needed

Unfortunately, many states do not have minimum building and equipment specifications for vocational programs in agriculture. Instead, such specifications are general in nature for applicability to all vocational programs or, even worse, to education in general. Thus, weak programs may be traced to unsuitable facilities which relegate the agriculture instruction to general education in content, form, and outcome.

"The Standards for Quality Vocational Programs in Agriculture/Agribusiness Education," as developed by Iowa State University under contract with the U.S. Department of Education, involved extensive input from supervisors, teachers, teacher educators, and agricultural industry representatives. This effort yielded a set of recommendations for facilities and other program components which has enabled movement toward more state standards across the nation. It is hoped that the current history of interaction between program specialists and those ultimately controlling the decision-making process will result in future facility modifications which enhance the prospects for superior program outcomes.

Facility specifications vary widely from state-to-state. In an effort to update guidelines to his own state, the writer examined the specifications for secondary vocational agriculture programs in several neighboring states. The variations in space requirements found in that tightly clustered group of states was amazing. Given such variations in facility specifications, one must wonder what the relationship is between the existence of state standards for facilities and program outcomes. This is a question which merits further study.

Research is Needed

Another problem that needs research is the relationship between what is taught and what is learned. A variety of skills and new skills are being added to agricultural education. In the early seventies, there was research in Virginia to study the noise output of selected shop equipment and to design machines modifications to reduce such noise. More recently, research was completed in another state indicating that noise from equipment found in typical agricultural machinery is disturbing. Such noise should be regarded as hazardous to persons operating the machines.

Some instructors report that, under certain conditions in which specific systems are subjected to a selected layout, there is a fools' gold to permit instructional continuity.

Planning is Needed

The rising cost of energy, the push to hold down taxation, and the current downward turn in school enrollments have placed school planners in a different ball game. Such factors create the need for effective planning in the future. At the same time, the teacher must be given an increased role in deciding what does and what does not work and what should be added. There is no opportunity for the new or renovated facilities for agricultural programs. As architects and administrators plan new facilities and renovation of existing ones, teacher educators and program specialists are advised to participate in the planning process.

Certificated and validated state standards should be in place to ensure essential features for effective programs. Similarly, instructional settings must be free of hazards which could be the source of accidents. There are noไกล that one of the Cooperative Education Association's is to provide a cooperative process that results in facilities that really work. Such facilities must be energy efficient, safe, functional, affordable, and accessible to the people of the local community.

We are indebted to those who prepared the materials on facilities contained herein. The content includes ideas and recommendations useful in planning nearly every type of facility for education in agriculture. We dedicate these ideas to our colleagues in planning and to more effective agricultural programs in the future.

From Wisconsin — Planning Building Layouts for Basic Vo-Ag Programs

There are many factors which should be considered in providing optimum buildings and facilities for departments of vocational agriculture/agribusiness. An agriculture instructor has an important responsibility in working with school officials to assess the needs for buildings and plan facilities. A primary consideration is that buildings and facilities be appropriate to meet the educational program needs of the local community. The authors recently published a 107-page bulletin entitled "Buildings and Facilities for Vocational Agriculture/Agribusiness Programs." An extensive number of agricultural instructors have contributed an interest in the departmental layouts in their programs. The workbook and the current plans, in addition to other techniques, is used to illustrate the possible organizational layouts for vocational agriculture/agribusiness educational departments.

Curriculum Dictates Facilities

It is important to keep in mind that the educational objectives and the basic curriculum will be the determinant for buildings and facilities. Therefore, one must keep in mind that rather than simply following a prescribed layout which are already in existence, the planning for adequate educational facilities must include a total assessment of program needs and be adapted to the local community. This process must necessarily include or should include citizen participation involving the local school administration, instructors of vocational agriculture/agribusiness, citizen committees, local advisory committees, FFA alumni, students, and other interested groups served by the school system. Counsel can also be secured from any other leaders or groups involved in agricultural education and from agriculture teacher educators.

In the accompanying departmental plans, it should be noted that some of the facilities are integrated with the existing school system, while others might in fact be separate. However, it is the author's belief that the integrated school building facilities are highly desirable. These plans should be studied carefully for their desirable features, and
From Wisconsin — Planning Building Layouts For Basic Vo-Ag Programs (Continued from Page 5)
well as an understanding of the features which can be improved upon.

Rice Lake
The Rice Lake (Wisconsin) High School Plan is one to accommodate multiple instructors. There are two classrooms, with the second classroom being a shared one which might be utilized by other vocational-technical departments. The plan provides individual offices with access to a common corridor and to a general laboratory from the primary classroom. The agricultural mechanics laboratory has an adjacent welding room, a lumber rack, and tool storage room. With adequate planning, use of shared facilities can be maximized in a multiple teacher department. Preferably, one of the instructors in a multiple instructor department should be designated as the chairman to facilitate overall planning and coordination of space utilization.

Wisconsin Dells
The Wisconsin Dells High School Plan shows storage over the office and general laboratory, which provides for some supplementary storage which is in the agricultural mechanics laboratory. This particular plan shows welding booths in the immediate vicinity of the overhead door. It should be noted that adequate ventilation and adequate lighting should be provided in any buildings for vocational agriculture/agribusiness education. Also, adequate storage for books, bulletin boards, manuals, posters, and other audiovisual aids should be available. The general laboratory in the Wisconsin Dells High School Plan is one of the small ones and provides for general use by students at all grade levels.

Darlington
The Darlington (Wisconsin) High School Plan highlights several features which should be considered. There is a large outdoor project area adjacent to the building for repair of large agricultural equipment and machinery. The agricultural mechanics laboratory has a drain near the overhead door. One feature of the Darlington High School Plan includes a laboratory and a study room adjacent to the classroom. It should also be noted that the instructors' teaching station position at the chalkboard provides the instructor visual observational capability into the agriculture mechanics laboratory by the inclusion of a door at the rear of the classroom, as well as two windows in the rear of the classroom. Facilities for woodworking are provided in the plan, as well as area for project storage.

Lodi
The Lodi (Wisconsin) High School Plan shows the vocational agriculture/agribusiness department as a part of a vocational building. Access to the high school building which is nearby is provided by a covered walkway. This particular facility shows an entryway which is shared by industrial arts and by vocational agriculture/agribusiness. Basically, the location of the classroom provides passage of students into the classroom and then, subsequently, into the workroom and general laboratory which is large enough for small meetings, as well as for laboratory work. An overhead storage for the laboratory equipment is needed space in the agricultural mechanics laboratory.

Verona
The horticulture facility at Verona (Wisconsin) High School shows one possible arrangement for a greenhouse and headhouse. Any school contemplating the addition of a greenhouse to its laboratory facilities must, in addition to meeting a much greater space requirement, provide for the Horticulture teacher to take into consideration the staff resources needed as well. Greenhouses need care Saturday and Sunday as well as on school days. Therefore, a greenhouse should be in the immediate vicinity of the total vocational agriculture/agribusiness buildings.

Factors to Consider
There are many factors to consider in departmental building and facility layouts. Adequacy of space associated with the curricular and program requirements is primary. Also, the consideration of flexibility, as well as supervisory capability, by the instructor(s) is highly desirable. Such features as safety, availability of support utilities, and environmental factors, including adequate lighting, ventilation, dust, and gaseous pollution control, must be given consideration. A composite arrangement of interior and exterior space is important. Adequate space, as well as achieved by adequate planning and location of equipment internally, must be considered.

In addition to the physical buildings and facilities normally associated with the school campus, one should give consideration to use in the educational program of land laboratories. Such laboratories may encompass a wide variety of uses, including conventional school farms, school forests, wetlands, study areas, horticultural gardens, arboretum areas, orchard plots, landscape areas, turf plots, nature study areas, plant material beds, experimental crop production plots, and similar types of laboratories. Such land laboratories might be used for a variety of educational purposes involving the production of crops for nonfarm and urban background students, demonstrational teaching, and/or for production sales to help support other departmental functions. The scope and size of such land laboratories will be determined by the availability of land and the utilization of such spaces for learning activities. The extent of use of such land laboratories can be enhanced by nearness to the school campus.

The final analysis is an awareness of buildings and facilities depends upon the instructor and his or her willingness to utilize facilities in a top-quality educational program. Instructors of vocational agriculture/agribusiness have a unique opportunity educationally, in that instruction of students occurs in a variety of locations and facilities. All buildings and facilities are, in essence, educational resources that are extremely important in the conduct of a broad, basic educational program in agriculture and agribusiness. It is the instructor's responsibility, therefore, to plan curricula which meet the educational needs of students and use resources wisely.
The Hereford Story . . . .
Using Community Influence to Get a New Facility

In teaching agricultural mechanics, you may find yourself faced with the same nagging problems that we have had at Hereford Junior-Senior High School in Maryland. In 1971, I was one of the teachers. We felt that our agricultural mechanics laboratory should be strengthened and brought in line with the broader needs of the community. It became apparent that our local school laboratory was inadequate and that there was no hope on the horizon for additional facilities funded by local or state boards of education.

As is the case so many times in education, we had to create an excessive need before authorities recognized the basic facts. I recall at the time an increase in enrollment wasn't anticipated when we expressed fears of strain on the existing shop facility. At no time did our supervisors agree with the course we pursued, although both were apprehensive.

Our Program
Briefly, our agricultural mechanics program is designed to cover three year period. The content of the three years is broken down as follows:

**Agricultural Mechanics I** — includes sketching and drawing, woodworking and carpentry, tractor safety and operation, welding and sharpening, metalworking (cold and hot), auto service, and radio servicing.

**Agricultural Mechanics II** — includes machinery repair, tractor practice, minor service and periodic maintenance, engine testing, and diesel and electrical systems; hydraulics; power train; drive line; SUS; and welding equipment. The new modern equipment could not be moved through the door.

**Agricultural Mechanics III** — includes masonry and concrete construction, farm and home planning, heating and ventilation, soils and water management, and electrical systems. Wood and metal mechanics are included.

New equipment was introduced, and the students were able to work in a twelve-foot-cut combine. The laboratory was being used, but the students were not really working space limitations.

**Our Strategy**
Public relations and community involvement were important in this strategy. In the community there were many very strong and influential farmers. The chairman of the school board was one of the clubs and the school principal was a member to the other. Our school district was from a large school district from within a county, which includes the City of Baltimore, Maryland. The school district encompasses only two counties, but would still have to be characterized as suburban.

In the summer of 1979, the farmers clubs became aware of the fact that our mechanics program could no longer handle the number of students electing to enter. That year they turned away 40 students. The fact that critical parts of our program were being hampered and safety practices were deteriorating was also discussed.

With this information available, a representative from each of the farmers clubs and our school principal talked with the county Board of Education and requested immediate action. A new agricultural mechanics program, separate from the existing school and of a pre-engineered, metal-frame construction, was discussed. The answer from the Board of Education was, "yes, we would like to help you." Their estimate was that the community would be able to accept the project, and they set a limit on the project. The final budget was about $18,500. We immediately moved on this project, and it was completed in six months.
Minimum Facility Standards
(Continued from Page 9)
will accommodate classes of 24 students (42 square feet per student). Multiple teacher departments should provide additional area for each teacher.

Eighty-four linear feet of storage space for text books and other teaching materials should be provided. It should be easily reached by students. The chalkboard, bulletin board, and map case should be provided from the beginning rather than added on later. Electrical considerations include lighting at a minimum of 75 feet candles at the table. This is around the room perimeter at a maximum interval of eight feet. A ceiling with acoustical type tile will improve sound conditions in the classroom.

Figure 1. Classroom facility items and minimum recommendations

<table>
<thead>
<tr>
<th>Room size (total)</th>
<th>910 sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area per student</td>
<td>47 sq. ft.</td>
</tr>
<tr>
<td>Table space per student</td>
<td>3.5 sq. ft.</td>
</tr>
<tr>
<td>Storage space</td>
<td>86 linear ft.</td>
</tr>
<tr>
<td>Magazine rack</td>
<td>8 sq. ft.</td>
</tr>
<tr>
<td>Chalkboard area</td>
<td>60 sq. ft.</td>
</tr>
<tr>
<td>Bulletin board area</td>
<td>60 sq. ft.</td>
</tr>
<tr>
<td>Entrance doors</td>
<td>60 sq. ft.</td>
</tr>
<tr>
<td>Entrance door width</td>
<td>2 (number)</td>
</tr>
<tr>
<td>Lighting (on tables)</td>
<td>3 feet</td>
</tr>
<tr>
<td>75 sq. ft. candles</td>
<td></td>
</tr>
<tr>
<td>Ceiling height</td>
<td>10 feet</td>
</tr>
<tr>
<td>Electrical outlets</td>
<td>120 volt</td>
</tr>
<tr>
<td>Sump trap</td>
<td>12 linear ft.</td>
</tr>
<tr>
<td>Compressed air outlets</td>
<td>5 number</td>
</tr>
<tr>
<td>Floor area concrete</td>
<td>8 sq. ft.</td>
</tr>
<tr>
<td>Acoustical treated ceiling</td>
<td>5 feet</td>
</tr>
</tbody>
</table>

Classroom Storage Area
A separate storage area of 160 square feet minimum should be provided in addition to the storage space located in the classroom. This will provide space to store audiovisual equipment and teaching materials not being used at the time. At least 110 linear feet of shelves are recommended within these storage rooms.

Classroom Laboratory Area
A classroom laboratory area is included as a part of the classroom is preferred over a separate room. This would require a minimum additional area of 285 square feet and 20 linear feet of work space in the laboratory. This area should not be a permanent part of the classroom and should provide for additional storage space for larger group activities, such as FFA meetings and library classes. Utilities including gas, water, air, and electricity should be included in the plan for the classroom laboratory area.

Office Area
An office area separate from the classroom is strongly recommended. A minimum area of 115 square feet per instructor should be provided. General lighting in the office should be a minimum of 80 square feet. Pre-wiring for a telephone is an absolutely essential item to include in the office plan. Careful consideration should be given to the location of the office. It should be readily accessible from the classroom and laboratories with windows between the classroom and laboratories. An access corridor should be provided directly to the laboratories from the classroom area.

Basic Agricultural Mechanics Laboratory
As the largest and most costly teaching facility area, the basic agricultural mechanics laboratory requires extra consideration. Minimum recommendations for facility items recommended for the basic agricultural mechanics laboratory are presented in Figure 2.

Figure 2. Minimum recommendations for a basic agricultural mechanics lab

<table>
<thead>
<tr>
<th>Room size</th>
<th>3000 sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area per student</td>
<td>150 sq. ft.</td>
</tr>
<tr>
<td>Open floor space</td>
<td>1700 sq. ft.</td>
</tr>
<tr>
<td>Width to length ratio</td>
<td>1.15 ratio</td>
</tr>
<tr>
<td>Width</td>
<td>40 feet</td>
</tr>
<tr>
<td>Height</td>
<td>17 feet</td>
</tr>
<tr>
<td>Overhead door width</td>
<td>24 feet</td>
</tr>
<tr>
<td>Service doors</td>
<td>2 (number)</td>
</tr>
<tr>
<td>Upper work spaces</td>
<td>80 sq. ft.</td>
</tr>
<tr>
<td>Electrical outlets</td>
<td>8 square ft.</td>
</tr>
<tr>
<td>Electrical overhead lines</td>
<td>8 feet</td>
</tr>
<tr>
<td>Tool storage cabinets</td>
<td>140 sq. ft.</td>
</tr>
<tr>
<td>Bench space</td>
<td>100 linear ft.</td>
</tr>
<tr>
<td>Dust collection</td>
<td>80 ft.</td>
</tr>
<tr>
<td>Exhaust system</td>
<td>12 linear ft.</td>
</tr>
<tr>
<td>Compressed air</td>
<td>5 number</td>
</tr>
<tr>
<td>Safety zone</td>
<td>120 square ft.</td>
</tr>
<tr>
<td>Non-skid (round machine)</td>
<td>12 feet</td>
</tr>
</tbody>
</table>

A minimum of 3,000 square feet of floor space is needed for the laboratory used for instruction in basic agricultural mechanics, not including supply and tool storage rooms. Allowing for placement of stationary equipment, welding booths, bench, and so forth should leave a minimum of 1,700 square feet of open space.

While the large modern machinery of today, it is necessary to provide an overhead door of similar proportions. A minimum height of 14 feet and width of 17 feet are recommended. A sump-type drain in the immediate vicinity of the overhead door should be provided.

Electrical service includes lighting of 80 feet candles at the work areas and 120 volt receptacles spaced no more than 8 feet apart are recommended. Overhead bus ways should provide convenient electrical access for stationary tool power tool.

A high priority item in the agricultural mechanics laboratory is the exhaust system for the welding engine areas. Although it was not within the scope of the study to determine air quality standards or cost considerations for exhaust systems, it is evident high energy costs will necessitate the selection of ventilation systems that considerably reduce the heat losses from the area. All applicable safety laws and regulations must be met by the facility.

Tool Storage Area
Tool storage cabinets located in the agricultural mechanics laboratory and organized by subject matter are highly recommended. Providing additional storage space in a separate room is a good idea, especially for portable power tools. An area of 100 square feet is the minimum recommendation for a tool room with 25 linear feet of shelves. Identification of the shelves with labels or tool silhouettes will help the instructor and student to account for each tool each class period with minimal effort. Adequate storage space in the tool room for storage specialized tools and an area to perform tool maintenance work.

Supply Storage Area
Planning for the storage of metal, wood, projects, and supplies (painting and fasteners) is of importance. Provide 340 square feet for supply storage, with a minimum length of 22 feet to accommodate metal stock in 20 foot lengths. An entrance door for the outside provides a convenient access to unload incoming supplies. Two-level storage is an option to consider which utilizes overhead space that otherwise might not be used.

Locker Area
Student lockers should be located near the wash area. A separate locker room is considered necessary as it may add to supervision problems.

Restrooms for both boys and girls must be provided if the classroom is located away from the main school building. If restrooms are provided, a logical location is near the lockers and wash area, since water and sewer lines will be closest.

Outdoor Area
An outdoor area adjacent to the agricultural mechanics laboratory is necessary for activity as construction projects. Figure 3 shows the minimum recommendations for the outdoor area.

Provide a minimum of 2,100 square feet of outdoor space adjacent to the agricultural mechanics laboratory. The area should adjoin the overhead door for supervision.


The Farm Management Manual utilizes numerous real live problem situations to emphasize the application of basic economic principles and management principles. The book contains only problem situations, therefore, students will probably need some classroom problem solution prior to or in combination with the use of the manual. Students who have had some experience in farm management classes may use the manual as a self-instructional unit.

The manual will require the student to interpret data from tables and budgets and use basic math skills in solving problem solutions.

Answers to the problems and solution logic are given for most problems at the end of the chapter. The answers provide students with immediate knowledge as to their success in teaching problem solution. The problems are designed to increase the feasibility of using the manual as a self-instructional unit.

The chapter on cost analysis covers the various types of fixed or ownership costs and variable costs. The chapter on costs has problems on interest rates, cost of loans, and loan payment combinations. The problems include prices for commodities and the effects of farm size. The other chapters on records and investments are helpful.

The manual is primarily directed at the intermediate and advanced level farm management classes. William H. Adams, Jr., Lexington, North Carolina.
THEME

Getting The Educational Laboratory You Need

The construction of an educational greenhouse laboratory is a costly undertaking. Whether it be a part of an overall new building or an addition to an existing building, proper safety and design considerations are essential to insure against later problems with greenhouses.

The impulse to select the least expensive greenhouse structure may turn out to be a costly mistake. By depending solely on the advice of an "anxious" salesman, what may appear to be a low initial investment, could grow into an overwhelming expense. Regrettably, most architects have little understanding of the features needed in an educational greenhouse.

Some educational greenhouses have been designed by heating and cooling engineers who have no practical experience with the unique problems encountered in greenhouses. Many of these have functioned perfectly, whether by design or by luck. Others have been plagued with problems since completion. Even some of the well established brands in greenhouse structures have been disasters because of cost-cutting options offered to an unknowing educator-administrator.

Unfortunately, the expert design on paper may turn out to be different in reality. Construction of any facility involves cost cutting. All too often the cost of cutting is done without consultation as to what the effect might be on the proper operation. The effect usually isn't readily apparent until the greenhouse is put to the test, often in mid-winter. It is then that one realizes that the most inexpensive heating system was not necessarily a good choice. Mistakes like this are difficult to correct. Expensive plants may have been lost, or the students may not learn the proper growing techniques, and the school will have additional expense.

A greenhouse that functions properly is an important and essential facility for effective programs in horticulture. It should be designed to serve not only regular daytime students, but others in the community including senior citizens, members of local garden clubs, and adult horticulture workers. Additional space for such programs could increase public support and meet the needs of groups that are often overlooked.

Needed Safety Features

For too many greenhouse laboratories do not meet the needs of the students and teachers in terms of design and safety. Safety in the school greenhouse should not be overlooked. The safety requirements of the educational greenhouse differ from those of the commercial greenhouse. Some important questions about safety include:

- Are the electrical outlets weatherproof covered?
- Are the outlets located at a height to prevent water entry?
- Is there an electrical "panic" button in the headhouse?
- Is there a clearly visible fire extinguisher on the appropriate size and type nearby?
- Are there any emergency exits in the greenhouse and are they marked as such?
- Is there a fire alarm in the greenhouse?
- Is steam present, are the steam valves clearly marked as to their danger?
- Are CO2 cylinders used, are they located safely outside the greenhouse?
- Is the black photoperiod control cloth of a fire retardant fabric?
- If it is a fiberglass greenhouse, is the fiberglass covering a flame retardant type?
- Are all fan blades covered with a protective screen?

Experienced teachers can add to this list as they scrutinize their facilities and seek to improve safety.

Facility Versus Equipment

Contrary to some opinions, the educational greenhouse is a facility and should be subject to the same scrutiny given all other educational facilities. It is unfortunate that many states consider them "equipping," avoiding inclusion of the important safety specifications required of other buildings.

By MICHAEL A. SEDLAK
Editor's Note: Mr. Sedlak is an Associate Professor of Horticulture at THE Williamsport Area Com- munity College in Williamsport, Pennsylvania.

Planning The Educational Greenhouse

With increased emphasis on beautification and ecology has come a growth in horticultural education programs in the public schools and junior colleges. Often the person responsible for planning the accompanying greenhouse facilities doesn't have sufficient experience to adequately design or select the structure, environmental equipment, and support systems. The result is an educationally inadequate facility which does not function well in the educational program.

Proper prior planning, including technical assistance from experienced persons in local growers' associations, the Cooperative Extension Service, and greenhouse manufacturers or reputable dealers, can eliminate many of the problems before the facility is built. Modification after construction is inconvenient, costly, and restricted due to budget constraints.

This article will show some of the mistakes that have been observed and point out some of the considerations that should be given to the development of a greenhouse facility for educational purposes. Topics covered are selecting the site and structure, creating and maintaining the proper growing environment with heating and ventilating equipment, using the facility space efficiently, and incorporating adequate support. The discussion will be most useful to the architect or planner not familiar with greenhouses. However, the horticulture instructor should benefit from the article and bibliography listed and may wish to seek out the planner to provide the types of recommendations contained herein.

Selecting the Site

The purpose of a greenhouse is to provide a suitable environment for plants, particularly during the fall, winter, and spring period when crops are not grown outside. A sunny location which avoids the long winter shadows cast by buildings and evergreen trees is a primary requirement for growing flowering or fruiting plants which need high light levels. Remember to note where the winter shadow falls. It is longer than the summer shadow. Shade loving plants can be grown in a heavily shaded greenhouse but the total variety of plants is reduced. As the season passes by deciduous trees in the summer are acceptable and often desired; in winter the leaves are gone.

For security purposes an institution should consider largeconductors or older partially enclosed areas between buildings. Fences and lighting may be necessary for security, but night lighting can affect the plants photosynthetic activity. Security lights so they do not shine directly onto the greenhouse.

Other important considerations include the relative locations of the horticultural classrooms, the work and storeroom space, and the central heating plant.

A good teaching arrangement would have the classroom, work tables, and storage facilities in a conventional building layout adjacent to the greenhouse, as illustrated in Figure 1.

By DAVID S. ROSS
Editor's Note: Dr. Ross is an Extension Agricultural Engineer and Associate Professor, Department of Agricultural Engineering, University of Maryland, College Park.

Access to utilities may determine the greenhouse site. Heat, water, and electricity must be provided and the distance to their sources will influence building costs. The site must be well drained, accessible to delivery trucks, and protected from cold winter winds.

Figure 1. Carefully plan the complete facilities for growing, work, storage, and instructional activities.

Selecting the Structure

A stock model model was selected for the necessary environmental equipment should be purchased from a reputable manufacturer or supplier. A stock greenhouse has an operating history behind it. That experience dictates the environmental equipment, such as heaters, ventilators, fans, circulation fans, evaporative pads, and thermostats, that make it functional.

One of the biggest pitfalls in institutional greenhouses is the architect to design a custom greenhouse to fit the lives of the rest of the building. The architect is generally inexperienced with greenhouse functional design and the contractors who follow are inexperienced in heating and ventilating greenhouses. The result is a greenhouse in which the environment may be difficult to control.

A second pitfall is letting contracts for equipment and installation to companies which have no experience with greenhouses. The full package contract should be given to the greenhouse manufacturer or reliable supplier. If this is not practical or economical, adequate instructions and review of the plans should be given by a capable person.

(Continued On Page 14)
Planning The Educational Greenhouse

(Continued from Page 13)

Ideally, experienced supervision should be given to prevent problems from developing regardless of the contractor.

Choice of a structure includes style, framing and cover materials, type of heating and ventilation, and type of benches or growing beds. The top-and-side greenhouse is glass on a steel or aluminum frame. Glass is pleasingly transparent so the greenhouse can be seen from outside and the structure is durable and easy to maintain. Glass is often used to provide better protection against thrown objects and does diffuse the light to lessen shadows. The best grades of greenhouse fiberglass and glass are competitive in price and light transmission qualities about the same for both. Low-cost facilities can be built using film plastic over a quonset pipe frame. Appearance, durability, and low maintenance are traded for low initial cost and higher annual maintenance cost.

Space requirements and the site will influence the style of the structure. A lean-to greenhouse provides low to moderate protection as a form of a bench or grow room wall. The lean-to style appears to be one-half of a conventional greenhouse. A freestanding or end-attached greenhouse can be used for low to high space requirements.

Energy conservation practices should be incorporated in the design from the beginning. Techniques for saving up to 50 percent of energy normally are available. Thermal blankets or curtains are drawn at night to enclose the crop zone and reduce heat loss. Air-inflated double film plastic covers reduce heat loss by 30 percent over single covers. On old glass greenhouses the double plastic cover also reduces air infiltration, thus increasing the savings. Perimeter insect or floor heating, reduced night temperatures, and other practices should be considered. Retrofitting the greenhouse is more costly and the quality often added to the building need to include improving energy conservation techniques discussed, not as a substitute for them.

Creating the Environment

Sunlight, temperature, humidity, and carbon dioxide are major factors in plant growth. The greenhouse must provide a reasonable balance of these for best results. Nature provides the sunlight for greenhouses. However, artificial lighting can be used for germination and propagation in other buildings. Solar radiation provides part or all of the mid-day heating. Nature is supplemented by providing heating, ventilation, cooling, and humidifying equipment to maintain conditions suitable for good plant growth. Carbon dioxide is replenished by ventilation air or by other means.

Institutional greenhouses must house a wide variety of plants meeting the needs of the instruction and the structure into two temperature zones with a temporary barrier. If this is desired, the heating and ventilation equipment should be designed for this purpose during the planning stage. Energy conservation may be a motivating factor toward the two-zone greenhouse.

The transparent greenhouse differs from the conventional building because its response to solar radiation and change in outside temperature is much quicker. This difference dictates the greenhouse must be handled separately for both heating and cooling.

Providing Uniform Heating in Cool Seasons

The greenhouse heating system should be independent of another building’s influence and control. In the past, a greenhouse was often heated by a boiler inside the classroom. The boiler was connected inside the classroom building. With reduced night, weekend, and holiday temperatures in the classroom for energy conservation, the greenhouse was left without sufficient heat to maintain safe temperatures. A separate heating line from the central heating plant to the greenhouse with a thermostat in the greenhouse is highly desirable. Alternate heating systems such as propane, fuel oil, or electric heaters in the greenhouse can be used for total heating needs or as backup low temperature protection to a central heating system which is not controllable in the greenhouse.

Continuous air circulation within the crop zone of the greenhouse is recommended during the heating season to maintain a uniform temperature. Air movement also helps to maintain carbon dioxide and to remove excess moisture from the foliage. For this purpose, the overhead fan and perforated tube or the horizontal air flow system is suggested. In the horizontal air flow system fans are placed on the sidewalks to move air around the greenhouse. Suggested configurations for airflow control in greenhouses are shown in Figure 2.

Mechanical ventilation

Year-round ventilation can best be accomplished by staging the fans. Staging means the low speed of a two-speed fan can serve winter-time needs, while the high speed and perhaps additional fans are activated as the greenhouse temperature continues to rise. Thermostats set at successively higher temperatures (2 to 5 degrees F. intervals) activate fans, in sequence, as the temperatures rise until sufficient fan capacity is functioning to meet cooling needs.

Evaporative cooling can be used in most areas to provide better temperature control in the summer time. Water evaporated from wetted fiber pads at the inlet louvers cools the air and raises its humidity. Inside temperatures can be kept near or below the outside temperature depending on outside relative humidity and the solar radiation load.

Using Facility Space Effectively

The greenhouse is most economically used for growing plants with as much as possible, the supporting work, storage activities, and classroom space located in the classroom building or an adjacent (insulated) headhouse. Where the greenhouse is used for group instruction try to separate the exhaust fans and other noisy equipment from the instructional area.

Institutional greenhouses need to provide more space for students to move about, so aisles should be 3 to 4 feet wide. Peninsular benches perpendicular to the length of the greenhouse provide individual growing spaces. Aisles between benches need to be at least 2 feet wide; benches can be up to 4 feet wide. Provisions for handicapped students in wheelchairs must be considered, so main aisles about 5 feet wide, other aisles about 4.5 feet wide must be provided somewhere in the greenhouse layout.

Water for plants should be provided by faucets each 25 feet or mechanical pumps. Watering boxes must be convenient to use without dripping them over benches and stored off the floor. Provisions should be made for easy access for installation of automatic watering systems. Electrical services will then be needed for automatic timers, solenoid valves, and other controls needed for watering, missing, and lighting systems.

Incorporating Safety Considerations

For safety purposes, waterproof electrical outlets should be placed overhead so supplemental lighting or other equipment can be plugged in conveniently while accidental contact is less likely. Ground fault interrupters may be required by the building code. Electrical code, electrical equipment and outlets should be properly protected by cover plates, shields, ground wires, and cut-off switches, as appropriate. Concrete walks should slope to the sides for rapid drainage. Exits should be well marked and readily opened from the inside. Pesticides must be stored in a dry, secure, locked cabinet with toxic steps to take in case of an accident.

Summary

Greenhouses are essential for effective vocational horticulture programs. Experience has shown that the adequately and carefully designed and operated facility is a real asset. Professional assistance should be sought by the architect or building planner where a greenhouse is being considered. The facility should be environmentally different from a classroom building and should be of a separate structure.

Among the planning considerations are: a sunny location; well constructed structure; independent heat control; adequate and properly-staged ventilation and cooling; water supply; growing areas; and designed with safety and energy conservation in mind. Careful planning prior to building will result in a facility with a minimum of problems for the instructor and hazards to the students.

Additional Sources of Information

Ross, D. S., "Bibliography of Greenhouse and Fleet Growth Facilities." Farm Manage 125, March 1986, Agricultural Engineering Department, University of Maryland, College Park 20742, 4 p. (About 1983 citations.)


NARES is the Northeast Regional Agricultural Engineering Service, a regional Extension activity.
Efficient Storage For The Agricultural Mechanics Laboratory

The request was to design a mechanics laboratory storage facility that would eliminate supplies and materials in the laboratory, provide storage of mechanics roller tool cabinets, and have a security cabinet for specialty tools, a safety storage cabinet, and stock storage for off-season components. Challenge? Not! "Surprise and pleasant task" is a better description of my response to the Board of Education.

Better Space Utilization

The agricultural mechanics laboratory work space is not sacrificed when adequate storage is provided. In the past supplies were obtained at an economical delivery cost. Therefore, the storage of equipment, hardware items, fasteners, and building materials was not considered essential. The cost of petroleum products has sparked the need for better storage facilities in the school mechanics instructional areas. The present cost of construction materials also encourages an efficient inventory system and better security of materials whether school or student owned.

Size and Doors

The storage area, Figure 1, is 12'x24'. The 24-foot dimension was dictated by standard lengths of pipe and steel. A more economical utilization of space could be obtained with vertical storage, but a 22-foot ceiling is more difficult and expensive to achieve in building design! The 12-foot dimension was determined by the need to store plywood and panels plus accommodate a quantity of other supplies. A sliding door covers the plywood and panel storage, and a four-foot swinging door completes the other end. The three-foot door in the opposite end could service a second mechanics laboratory. These swinging doors could be the "dutch type" which could be utilized as a check-out point for tools and supplies.

Fabrication of Storage Units

Storage unit (A) for lumber, steel, and pipe will probably need to be fabricated locally. Remember to provide 6-10 uprights with narrow spacings, 6-12", between the projected supports. The more uprights and storage supports, the greater the flexibility provided for storage of shorter lengths of material.

HEAVY DUTY WORKBENCH

A workbench is provided with a machinist vise. The location of the vise will depend whether the file cabinet (F) is a two- or four-drawer unit. Wall panels for storage can be placed at the back of the workbench and on the wall. The workbench is to be used as a repair station for tools and equipment but will probably be used more frequently for inventory control, cost analysis, and ordering of supplies. The file cabinet can have one drawer devoted to storage of operator's manuals for all tools and equipment. The waste receptacle (G) is essential for good housekeeping.

Figure 3. Sketch of Workbench.

SAFETY CABINET

The safety cabinet (K) has six shelves and a locking door. The safety storage cabinet (L) is rated 45 gallons and is to meet the OSHA requirement for storage of petroleum products, paints, chemicals, and similar materials.

Figure 5. Cabinets.

Security and Safety Storage

Small Parts Storage

To accommodate the multitude of small parts, fasteners, and hardware items, two open storage racks (I), with 56 bins each, have been recommended. The closed components parts unit (J) has 84 drawers. Providing a fire extinguisher in this storage area is desirable and the end of (J) is convenient for this purpose.

Cost

Whether this storage facility costs too much depends upon your priority for an efficient instructional program and efficient use of funds for storage equipment and supplies. Many commercial firms have these or similar units for sale. Cost within or beyond your budget may be an issue, but few will question the necessity for providing adequate, efficient, and economical storage of supplies used in the agricultural mechanics laboratory.

December, 1980
Arc Welding Exhaust Systems

By Clinton D. Jacobs
Editor's Note: Dr. Jacobs is Professor of Agricultural Education at the University of Arizona.

result of the welding process.

Ventilation Needs

Ventilation specifications which have been published by the National Occupational Safety and Health Administration established the following standards for safety of the employees in the welding occupation:

1. A minimum ventilation air flow of 2,000 cu. ft. per minute is required for welding stations; or

2. A capture air velocity of 100 linear feet per minute air flow away from the worker.

These standards are designed to protect the employee from exposure to excessive inhalation of particulates as the

Table I — Welding Fumes & Gases Health Hazards

<table>
<thead>
<tr>
<th>CHEMICAL AGENT</th>
<th>SOURCE</th>
<th>ROUTE OF ENTRY</th>
<th>HEALTH HAZARDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>Alloy element</td>
<td>Exposed skin</td>
<td>Inhalation of hair follicles — metallic taste — stomach distress</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Alloying element</td>
<td>Breathing fumes</td>
<td>Inhalation of arsenic</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Electrode coating (tuna)</td>
<td>Breathing fibers</td>
<td>Inhalation of mucus membranes — skin irritation</td>
</tr>
<tr>
<td>Beryllium**</td>
<td>Alloying element</td>
<td>Breathing fumes</td>
<td>Acute exposure — chemical pulmonary long term effects accumulate: fatigue and weakness</td>
</tr>
<tr>
<td>Cadmium*</td>
<td>Alloying element</td>
<td>Breathing fumes</td>
<td>Severe lung irritant — long term exposure causes emphysema and kidney damage</td>
</tr>
<tr>
<td>Chlorinated</td>
<td>Engine degrease</td>
<td>Breathing fumes</td>
<td>Heat and ultraviolet radiation from arc form highly toxic phosgene gas</td>
</tr>
<tr>
<td>Hydronation</td>
<td>Cleaning compounds</td>
<td>Breathing fumes</td>
<td>Heat and ultraviolet radiation from arc form highly toxic phosgene gas</td>
</tr>
<tr>
<td>Chromium</td>
<td>Alloying element, stainless steel</td>
<td>Breathing fumes</td>
<td>Extremly toxic to skin, eyes, mucous membranes</td>
</tr>
<tr>
<td>Fluoride*</td>
<td>Electrode coatings</td>
<td>Breathing fumes</td>
<td>Irritant and accumulative effect — bone damage and fluid in lungs</td>
</tr>
<tr>
<td>Fluoride*</td>
<td>Welding flux</td>
<td>Breathing fumes</td>
<td>Irritant to nasal passage, throat and lungs — Long term effect on lungs</td>
</tr>
<tr>
<td>Iron Oxide</td>
<td>Principle element in steel</td>
<td>Breathing fumes</td>
<td>Metallic taste in mouth — long term effect on lungs</td>
</tr>
<tr>
<td>Lead (Lead Oxide)</td>
<td>Alloying element</td>
<td>Breathing fumes and ingestion</td>
<td>Metallic taste in mouth — long term effect on lungs</td>
</tr>
<tr>
<td>Mercury*</td>
<td>Frost protective</td>
<td>Breathing vapors</td>
<td>Kidney damage: respiratory failure — long term exposure — tumors, emotional and nervous problems</td>
</tr>
<tr>
<td>Mercury*</td>
<td>Frost protective</td>
<td>Breathing vapors</td>
<td>Kidney damage: respiratory failure — long term exposure — tumors, emotional problems</td>
</tr>
<tr>
<td>Nitrogen Oxide</td>
<td>Atmosphere</td>
<td>Breathing fumes</td>
<td>Irritant — hard to detect, dangerous concentration.</td>
</tr>
<tr>
<td>Ozone*</td>
<td>Gas produced by arc reaction on air</td>
<td>Breathing fumes</td>
<td>Irritant to mucous membranes — exsues produces fluid in the lungs</td>
</tr>
<tr>
<td>Silicon Dioxide</td>
<td>Electrode coating (tuna)</td>
<td>Breathing fumes</td>
<td>Long term exposure leads to silicosis</td>
</tr>
<tr>
<td>Zinc</td>
<td>Metal casting</td>
<td>Breathing fumes</td>
<td>24 hour metal fume factor</td>
</tr>
</tbody>
</table>

*Require mechanical local exhaust ventilation with sufficient air flow to maintain a capture velocity (from worker) of at least 100 linear feet per minute

**Above plus MSHA approved air-supplied respirator

3. Vapor — A liquid droplet suspended in the air (such as steam).
4. Gas — Lacking substance of a liquid or a solid (such as air).

The relative size of airborne particles may range from .001 microns (gas) to 10,000 microns (dust). Particles larger than 10 microns are visible to the eye. An electron microscope is necessary to see particles less than .1 micron. The visible smoke that is generated from welding is composed of metals and chemicals which are heated to the gaseous state and resolidified. These particles include oxide of metals, vaporized oils, and smoke generated by compounds and chemicals in the welding process.

Classes of Gases

The classification of hazardous gases includes ozone, nitrogen oxide, and fluorides. These particulates in quantities of more than .1 part per million are considered hazardous to the health. The immediate effects of poor ventilation identified by both instructor and student are burning eyes and nostrils, nose and headaches. The instructor is more likely to be exposed to the accumulative effect of hazardous fumes and gases. A summary of the elements associated with welding which constitute a health hazard is presented in Table I.

Systems of Ventilation

A common system of ventilation used in many agricultural mechanics laboratories is to open the doors and turn on a large exhaust fan to bring in outside air and evacuate the room air. This causes a tremendous loss of heating or cooling energy.

Another method is to equip the arc welding instruction area with a common intake hood mounted over permanently located arc welding booth. A single exhaust fan with sufficient volume to achieve the 2,000 cu. ft./min. air flow at each station is connected to the hood to remove the smoke and fumes. This type of system has several disadvantages. The fumes move upward toward the hood and into the welding helmet of the student or instructor. In the process, some of the fumes enter the face shield where they are confined and breathed. The high discharge rate of the exhaust fan removes considerable heat from the building which may be more than economically desirable. The high cost of the materials and machinery is often a deterrent to installation.

The energy crunch has caused many schools to investigate the recirculation of filtered air in agricultural mechanics and other school laboratories to reduce the heating and cooling cost. Recirculating systems may be the electronic precipitator or the bag type filtering methods. Figure 1. The installation cost of these units is approximately $1.50 per cubic foot of air movement. When properly maintained, they are effective for removing dust and some fumes. They are not capable of filtering hazardous gases unless equipped with activated charcoal elements.

Figure 1. A Suspended Recirculating-Type Filter — removed dust but no hazardous gases.

(Continued on Page 20)

Figure 2. Cross-flow ventilation (A). Removes fumes and gases at the source exhausting it to the atmosphere (B). Intake hood raised for out-of-position welding (C). System should provide an air movement of 100 linear feet per minute.

Cross-flow ventilation systems are designed to pick up and exhaust the fumes and gases that are developed at the point of generation. In this system, Figure 2, a small volume of air moves at a velocity of approximately 2100 linear feet per minute in a 45 degree angle away from the student welder. The intake hood is adjustable to permit the pick up of materials to be exhausted when performing out-of-position welds. Hazardous gases and most of the fumes are evacuated to the atmosphere with a greatly reduced chance of inhalation. The design of this system may include
Arc Welding Exhaust Systems
(Continued from Page 19)

Figure 3. Conceptual fresh air recharge for a cross-flow welding area exhaust system. Outside air is moved into the flow path of the exhaust duct reducing the loss of room heat/cooling energy. For detailed plans of a cross-flow ventilation system, contact Agricultural Education Department, University of Arizona, Tucson, 85721, and ask for Guide No. 36.

provisions to allow the recharge intake of fresh air from the atmosphere in the vicinity of the student welder or welding station is a volatile gas released by the exhaust. As illustrated in Figure 3, a recharge duct provides outside air and projects it into the air flow pattern of the cross-flow ventilation system. The combined system will provide fresh air at the welding station with a reduction in evacuation of previously heated or cooled air within the laboratory.

It is recommended that the cross-flow evacuation and recharge system be used in combination with the recirculation system to reduce the hazards from fumes and gases and maintain a healthful environment in the agricultural mechanics laboratory.

Protection is Essential

In conclusion, the problem of providing adequate ventilation for hazardous environments is quite complex. However, students and instructors must be protected from these hazards. A study of recommendations by the National Occupational Safety and Health Administration and other safety promoting agencies should be helpful in this regard.

School authorities are encouraged to consider the energy saving advantages of recirculating systems such as the electronic precipitator and/or the bag-type filtering methods. In view of hazards from toxic gases which cannot be removed by work devices, automatic gas detectors for introduction of fresh air must be considered. This may include the cross-flow evacuation and recharge system. Such systems are recommended for the treatment of individual systems which introduce huge volumes of fresh air to the building and result in excessive energy consumption for heating or cooling.

THE RUSSELL STORY... Land Laboratories for Rural and Urban Students

The Russell, Kansas, vocational agriculture department set out to enrich both land and laboratory experience in 1976. Justification was based upon program trends in the late 1970s and 1980s. Hall of the vocational agriculture students were urban students with limited means for anything more than simulated occupational experience programs. Several of the students had vocational interests, but lacked the required training as part of those students with definite vocational interests. The ranches and farms in the school district were continually increasing in size and becoming fewer in number. Year-round educational opportunities were discussed with the continued importance of program justification.

A successful "school farm" had existed for years, and it needed complete renovation due to urban expansion and changing program needs. With the advice and support of the school administration, local advisory committee, and back-school board, plans for renovation were finalized. The laboratory now provides the resources necessary to meet the needs of a diversified group of students.

Establishing the Laboratory

Renevalization of the Russell School Laboratory offered a multitude of learning experiences for rural and urban students alike. The value of experiential learning and the concept of "learning-by-doing" became immediately evident. Junior and senior students were assigned to separate groups to tour numerous livestock handling facilities and to develop a plan for a student laboratory. A final plan was developed using ideas gathered from the farms and ranches visited.

Freshman and sophomore students spent several weeks reworking fences, salvaging lumber from old buildings, testing soil, and clearing the area for construction of the livestock laboratory.

Working cooperatively with the local county extension agent, fifteen different wheat varieties were obtained from the Fort Hays Experiment Station and planted. Freshman and sophomore students constructed and painted metal signs identifying each of the individual wheat variety plots. These same students carefully measured and staked out the one-acre wheat plots and located the signs.

A young farmer and former vocational agriculture student was hired to disk the wheat ground and a wheat drill was used for drilling the seed. Students carefully seeded the variety plots and an additional 12 acres of wheat were fenced.

Fencing the cow-calving area and seeding broom grass were two activities accomplished. Materials were secured from the local cooperative and a tractor and post hole digger were brought in by a vocational student. The area was laid out using a farm level, and the fence was constructed in less than a week.

In the spring, students accomplished a variety of learning activities. These include seedling plots, landscaping the area, installing livestock waterers, and constructing and hanging gates.

Activities for the Laboratory

These is obviously an unsurmountable number of activities for which the facility could be used. Safety must be kept foremost in mind. SOE livestock and enterprises should be kept to a minimum with greater emphasis placed on teaching basic skills in animal production. Cooperative SOE projects with livestock and crops have great potential. Providing plots for town students is still another potential.

The following is a partial list of the activities and the experiential learning opportunities that the laboratory provided.

BOAC-State Gold Edition — Governor's Citation (1978)
Food for America Program
Livestock Judging Contest
Kiddie Barnyard
Land Judging Contest
Parent-Greenhand Watermelon Feed
Display Area for Projects Constructed in Agricultural Mechanics Lab
Cooperative Livestock Projects for Urban Students
Cooperative Crop Projects for Urban Students
Wheat and Grain Sorghum Variety Plots
Chemical Test Plots
Computing Area for Urban Students
Concrete, Welding, Plumbing, Carpentry, and Electrical Skills
Livestock, Ag Science, and Farm Management Skills
Soil Conservation, Village Alternatives, and Energy Conservation
Agricultural Landscaping and other Horticultural Activities
Career and Occupational Development
Decision-Making Skills

Summary

A land and livestock laboratory is very useful. Several obstacles must be overcome before a laboratory becomes a reality. Careful consideration should be given to site, distance and transportation problems, financing, safety, and instructor supervision. In vocational agriculture at Russell, Kansas, the laboratory became a reality. Urban and rural students have access to a school-owned and operated facility that provides tremendous experiential learning experiences.
LETTERS

"Letters to the Editor" is a feature to encourage dialogue among readers of the Magazine. Selected letters will be printed without comment or editing. Your letter will be welcomed! Send letters to: Editor, The Agricultural Education Magazine, P.O. Drawer AV, Mississippi State, MS 39762.

Editor:

As authors of the article entitled "Why Use Realia," Vol. 53, No. 3, August 1980, pp. 4-6, we must clarify an omission in your printing of Dale's Cone of Educational Experiences (Figure 2, p. 6). We incorporated the cone to show the greater interactive efficiency and increased directness as one uses the realia "down" the cone and increasing abstraction "vertically" up the cone.

We hope this point of clarification makes the figure more useful to those who plan to increase their use of realia. Our best wishes to you as editor.

-Floyd G. McCormick, Head, Agricultural Education Department, and David E. Cox, Lecturer, The University of Arizona.

BOOK REVIEW


This book in agricultural construction is well written and easy to read. It is intended for those interested in farm structures.

The book is divided into two parts: Part I deals specifically with planning and construction, fasteners, concrete and masonry construction, building tolerances, foundations, cost estimation and others. Each chapter includes a list of references and problems.

The principles outlined in Part I are applied to specific examples for livestock housing in Part II. Housing needs for dairy and beef cattle, poultry, sheep, and horses are discussed with special attention paid to requirements for heating, cooling and ventilation.

A chapter on solar energy is presented with different energy-saving designs and alternatives discussed. The information available in this chapter is potentially useful for anyone interested in energy efficiency.

Part II concludes with a look at greenhouse construction, food storage structures, and machine and shop construction. The section on machine and shop construction could be useful to vocational agriculture instructors.

Mr. Whitaker is a past editor for the North Atlantic Region of the American Society of Agricultural Engineers. He has held numerous research positions abroad in addition to serving as Agricultural Engineering Advisor in India. He is a graduate of Cornell University and is presently Professor Emeritus of Agricultural Engineering at the University of Connecticut.

This book is suitable for courses in agricultural mechanics and agricultural engineering at the college level. Because of its technical nature, it would be inappropriate for high school students. The book would be a good reference text for vocational agriculture instructors, especially those involved in adult education.

John G. Cowan
University of Idaho
Moscow, Idaho

FFA PAGE

Preserving FFA Heritage

By KERRY BARRICK
Editor's Note: Dr. Barrick is Assistant Professor of Agricultural Education at The Ohio State University.

What Resources Are Available?

Once the decision has been made to start the project and the required help has been secured someone will ask, "Where do we begin?" This list of resources in not exhaustive, but it should provide a beginning for securing historical data.

1. Former FFA members—In compiling the history of Johnstown, key alumni were contacted at the beginning. Those former members, including two chapter officers, were helpful in laying the groundwork for information and providing old pictures of chapter activities.

2. High school yearbook—Class rosters, helped match people to years and group pictures of the FFA and officers (some were not captioned) were invaluable.

3. FFA record—Secretary, Treasurer, and Reporter books, if available, and other department records are helpful.

4. High school alumni records—Current addresses are kept for all alumni at Johnstown-Monore High School by year of graduation and as other interested persons locate information.

Who Should Take the Lead?

In every local FFA chapter there is a person who should take the lead in compiling the FFA history. That person could be the chairperson of vocational agriculture and FFA advisor. The teacher's knowledge of the community and FFA's access to records and files is essential to starting the project. The teacher can serve throughout the project as director and coordinator, lending support and assistance as other interested persons locate information.

How Can Help?

Since the local teacher may not be a native to the area, the community must be defended to understanding that the local FFA Alumni affiliate is obviously a key group to get involved. Alumni interest and knowledge cannot be equaled by any other group. Alumni may be called upon not only to collect information but perhaps to do the actual writing of the history.

By JERRY BARRICK
Editor's Note: Dr. Barrick is Assistant Professor of Agricultural Education at The Ohio State University.

What Should Be Included?

In addition to the narrative tracing the history of the vocational agriculture department and FFA chapter, a comprehensive appendix is to include the following: years to serve as the official record for years to come. Items in the appendix may include:

- List of teachers and advisors.
- List of members by graduation year.
- State and American Degree recipients by year.
- State and national officers by year.
- Chapter officers by year and office held.
- State and area chapter and individual awards.
- Honorary members by year.
- Chapter officers.
- Top local awards.

Start Now

Whether your chapter is 50 years old or just getting started, the opportunity for preserving the rich heritage of the FFA is before you. Start now to enlist help and support in preparing the FFA Chapter's history, and keep it up to date through good records of the chapter's success.
Stories in Pictures

Open spaces for student projects and see-through windows to office and classrooms are important features of a modern agricultural mechanics laboratory.

A well-organized magazine and chart display and storage area. (All photographs courtesy of Walter T. Bjaraker, University of Wisconsin.)

Many departments have effective storage by utilizing overhead spaces. Permanent stairs, railings and kickboards are essential for safety in such areas. Care must be taken to provide appropriate lighting and to manage such areas carefully to avoid hazards to students.