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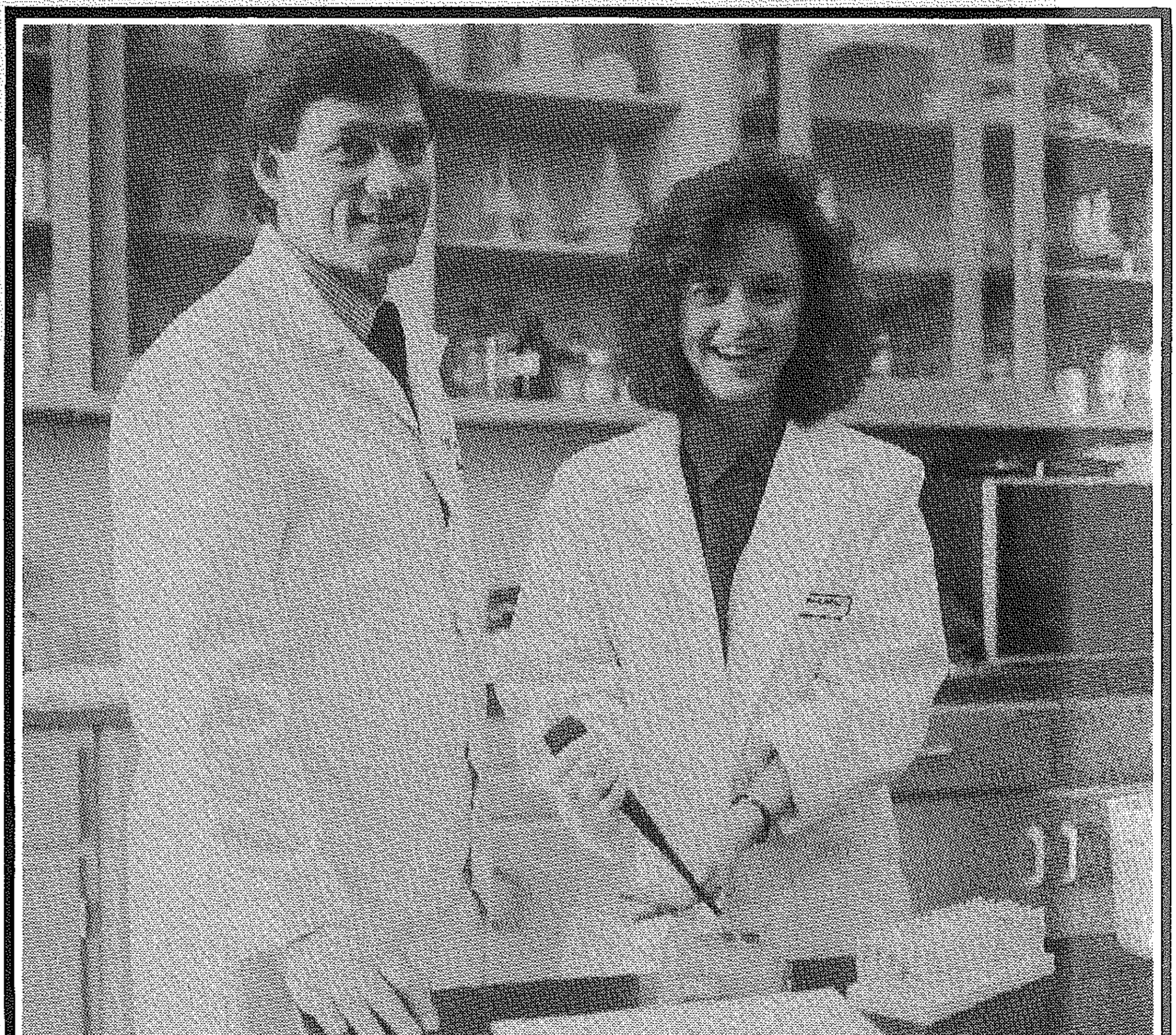

Laboratory Instruction

THE
AGRICULTURAL EDUCATION
MAGAZINE

April, 1992 — Volume 64 — Number 10

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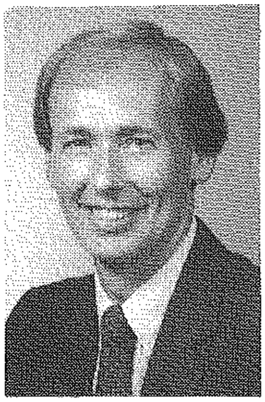
The Need for Experimentation



By Ed Osborne, Editor
Dr. Osborne is associate professor and program chair of agricultural education at the University of Illinois.

Just like the music of the 50s, 60s, 70s, 80s, and now 90s, agricultural education is moving to a different beat now than as recently as five years ago. Agriculture curricula in secondary and community college settings have undergone significant change in just a few short years. But we cannot change what we teach without also changing how we teach; we can't change the music and continue to do the same dance. With dynamic science and business-based agriculture programs gradually becoming the norm, methods used to teach agriculture, and in fact our whole approach to laboratory teaching, need to be modified.

Laboratory instruction must continue to be a key instructional component of agriculture programs. But we can no longer equate lab teaching with "working in the shop." Like our efforts in agricultural education to become more than vocational education, our laboratory instruction needs to become more than skill development. Historically, laboratory instruction in agriculture has involved students in performance, practice, or manipulation activities. We need to add experimentation to this set of student activities when we teach in lab settings. Our traditional activities have been aimed at psychomotor skill awareness, proficiency, or in some cases, mastery. Experimentation activities will allow us to (1) deepen students' understanding of basic principles and concepts and (2) strengthen students' process skills. These process skills primarily include broad and specific thinking skills, such as problem solving, scientific inquiry, comparing, inferring, observing, interpreting, predicting, and similar skills. These are the baseline skills that will allow our students to be successful in any pursuit. The **process** of science is the basis for research and management in agriculture, and the best way for students to learn this process is through experimentation.

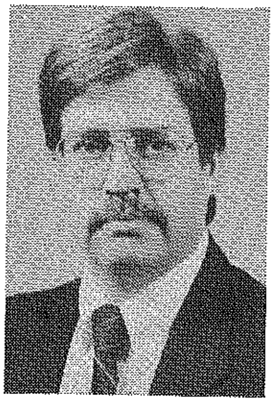
Experiments are a perfect technique to use in teaching agriculture. Literally hundreds of experiments can be conducted by students. Elaborate procedures and expensive materials are desirable, but not required. Many of the new curriculum products released in the last few years contain numerous laboratory exercises that involve experimentation. A little less construction and psychomotor skill development and a little more experimentation would be one of the best things we could do to improve secondary agricultural education, from both an image and a content standpoint.

Teachers often use demonstrations to support their lab teaching. However, using the definition of laboratory instruction cited earlier, demonstrations per se do not constitute laboratory teaching because students are engaged in a cognitive (observation) rather than psychomotor mode of learning. Demonstrations are an excellent teaching technique, but we should recognize that students are usually functioning in a relatively passive mode of learning even when this effective teaching technique is used. No other technique measures up to experiments when we consider the potential to improve thinking, reasoning, research, and inquiry skills.

Finally, there is yet another term used over the years in agricultural education that needs to be retired. With the current trends in science and business-based curricula in agriculture, we need to think about laboratory teaching versus "going to the shop." More than 25 laboratory settings could be listed for teaching agriculture, and a mechanics lab (not shop) is just one of these. Experimentation as a teaching technique can be effectively used in any of these laboratory settings. Agriculture is a technological field borne out of science. Nearly all areas of agriculture are science based. Science is understood and advanced through experimentation and scientific inquiry. Agriculture is improved through research and application. Therefore, the use of experiments in teaching agriculture is a natural.

Even when all subject areas are considered, today's students are not acquiring science process skills; they complete laboratory courses, but they do not develop scientific inquiry skills. A recent study revealed one of the major problems in laboratory instruction in today's schools — rarely do high school science laboratory exercises provide students the opportunity to be creative and inquisitive. Almost →

Accentuating What We Do Best: Laboratory Instruction



By Thomas H. Bruening

Dr. Bruening is an assistant professor of agricultural and extension education at Penn State University.

Quality laboratory instruction in agricultural education can be a model of reform for all of education. A significant number of agriculture teachers have successfully integrated highly technical laboratory instruction into their total programs. What has set agriculture apart from other high school sciences is the emphasis teachers have placed on the practical application of ideas, principles, and skills in the laboratory. Students study complex concepts in the classroom, then go directly to the laboratory and practice these skills. There is virtually no better way for students to learn in a school setting.

So what's the problem? The problem lies in the content areas we teach and the methods we use in the laboratory. Nonetheless, teachers indicate that they are ready for the challenge because what we are teaching is rapidly changing. It's not uncommon to visit schools and find that the large metal and woodworking tools have been pushed off to the side and recirculating fish tanks put in their place. Many teachers have also recognized that student interest and restructured curricula must come before tradition and teacher interest. This means that teachers will need to be retrained! If teachers want to effectively teach laboratory experiments related to food science, or if they want to be able to conduct water quality tests or to use electrophoresis (for genetic coding and mapping) as a teaching tool in biotechnology, they will need more education. These concepts and areas of instruction represent a significant change from those found in agricultural education just a few years ago.

Traditionally, psychomotor skills have been an integral part of the agricultural laboratory experience. In the future they will continue to play a large role as we teach students how to manipulate tools, use measuring instruments, and work effectively in an ever-increasing technological society. However, let's not confuse laboratory instruction with "shop activities." The days are over when we can afford to spend a semester teaching students how to "run a bead" or other manipulatives associated with welding and skills-only activities.

Integration of more math and science into agricultural curricula will require that we teach using process education techniques. Traditional laboratory activities frequently emphasize product development. These can be valuable teaching tools; however, we must avoid the temptation to feel that product development is as important as the teaching/learning process we desire for our students. Many students have trouble performing even the most simple tasks. Teachers often identify simple linear measurement as one of those tasks. Why do seemingly capable students not remember from one day to the next how to use a simple tape ruler? Is it because we are more interested in the products students produce rather than the process students should use to learn measurement principles? To be effective in laboratory settings, we must answer these questions.

Agriculture teachers need to develop lab activities that transfer learning principles to other aspects of agriculture, such as a

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The Need for Experimentation

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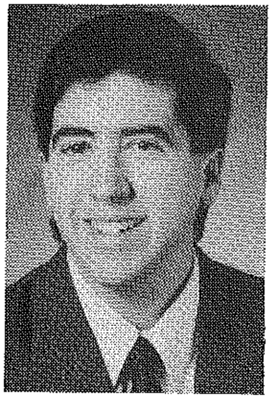
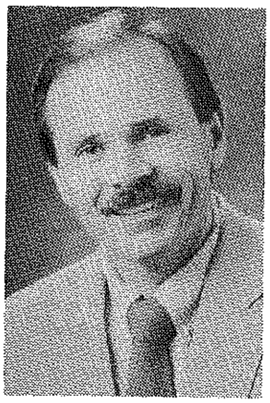
always, laboratory exercises are reduced to mechanical performance of the activity, with the problem, procedures, and answers given. By contrast, true experimentation involves thoughtfully looking behind a closed door, rather than glancing through an open window. We need to challenge our students to gradually develop the ability to independently design and conduct investigations on agricultural topics. We won't always be there to tell them what to do next. Using experiments in laboratory teaching is one of the few ways we can enable our students to become independent-minded learners. ■

Laboratory Instruction on Hydroponics: The Basics





By DAVID L. MARRISON and MARTIN FRICK

Mr. Marrison (top) is a graduate assistant and Dr. Frick is an assistant professor of agricultural education at Purdue University.

In recent years, the idea of hydroponics — growing plants without the use of soil — has emerged and greatly changed the way that many people view plant growth and development. Similarly, hydroponics presents agricultural educators with a new and imaginative way to instruct students on the growth of plants and their interaction with the environment. With carefully constructed laboratory hydroponic units, students can gain valuable hands-on experience with growing plants. Careful record keeping will also give students valuable insights into the economics, finance, and marketing of intensive agricultural production.

What Are The Requirements for Hydroponic Plant Growth?

Plants grown by hydroponic methods require the same general requirements as field-grown crops. The main difference is the method by which the plants are supported and how inorganic elements needed for growth are supplied. The following factors should be kept in consideration when setting up a hydroponic laboratory:

1. **Temperature** — Plants grow well within a limited temperature range. Most flowers and warm season vegetables need a temperature range of 60°-75° Fahrenheit. Cool-season vegetables (lettuce) should be grown between 50°-70° Fahrenheit.
2. **Light** — Plants need adequate light to be productive. Hydroponically grown vegetables need 8 to 10 hours of direct sunlight. Artificial lighting is a poor substitute for sunshine, as most indoor lights don't produce enough light intensity. Incandescent lamps can be used with natural sunlight to grow transplants. High pressure sodium lamps can be utilized as an alternative light source (yet expensive) as they provide over 1000 foot candles of light.
3. **Oxygen** — Plants need oxygen for respiration. In soil, oxygen is usually adequately supplied. In a water culture system, the plants will quickly exhaust the oxygen supply. Supplementary oxygen can be supplied by using an aerator. It is usually not necessary to add oxygen to an aeroponic or continuous flow system.
4. **Water** — Adequate water must be provided to the plants at all times. In water culture, this is usually not a problem, but it could be in an aggregate system (see Figure 2). Water quality needs to be taken into account. Softened water may contain dangerously high levels of sodium. Salt levels over 320 parts per million can cause an imbalance of nutrients and poor plant growth.
5. **Mineral Nutrients** — The essential nutrients that plants need are nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur. Micronutrients required are iron, manganese, boron, zinc, copper, molybdenum, and chlorine.

Hydroponic Systems

An agricultural educator is limited only by imagination when it comes to setting up a hydroponic laboratory. These systems can be set up anywhere — in a closet, patio, rooftop, lab or even the principal's office.

There are four main types of systems that can be utilized in a working hydroponic laboratory system. These four systems are water culture, aggregate culture, aeroponics, and continuous flow systems.

The water culture hydroponic system is the easiest to install (see Figure 1). In this system, plants are grown with their roots submerged in a nutrient solution, with the stem and upper parts of the plant held above the solution. The design can be of any nature (fishtank, child's wading pool, or pail) so long as it provides means to support the plant above the solution, aerate the solution, and prevent light from reaching the solution.

The second type of system that can be utilized is an aggregate culture. In this methods, aggregates such as sand or gravel are used to support the plant roots (see Figure 2). This system is often preferred over water culture as the aggregate helps support the root systems of the plants. →

The aggregate system is designed much like the water culture system. The nutrient solution for the aggregate system is held in a separate tank and is flooded into the aggregate tank to moisten the roots when needed. Commonly, this flooding process happens every ten minutes and is allowed to drain for no longer than 30 minutes.

The best aggregates to use are silica gravel, granite, basalt, or a smooth, inert, river-bottom rock. Perlite, styrofoam, and

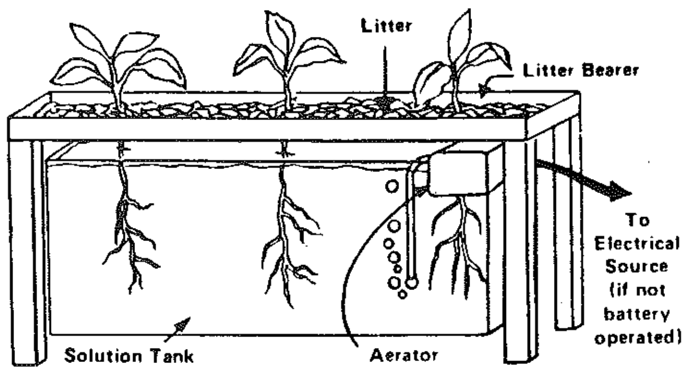


Figure 1. A water culture hydroponic system.

crushed marbles can also be used in small experiments. Care should be taken when selecting the size of the aggregate. Larger aggregate size will require the tank to be moistened more frequently, whereas smaller aggregates will take longer to drain.

Aeroponics is a system of hydroponics in which the roots of the plant hang in the air and are misted regularly with a nutrient solution to keep the roots at 100 percent relative humidity to prevent drying. Column pots and A-frames have become two very popular forms of aeroponics.

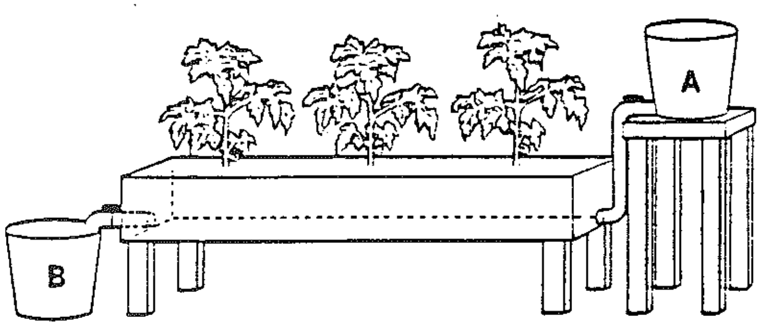


Figure 2. An aggregate culture hydroponic system.

The hydroponics system that most commercial operations utilize is a continuous flow system. In this system, nutrient solution flows constantly over the plant roots. One very popular continuous flow system is to use polyvinylchloride (PVC) pipe, commonly used in household plumbing. One inch diameter holes are drilled in the pipe and the plants are placed in rookwool cubes and placed in the pipe. The nutrient solution for the plants is held in a large tank or bucket and pumped or allowed to move by gravity through the PVC pipes.

Plants can be grown aeroponically. These Hungarian wax peppers are growing in hanging column pots.

A Simple Hydroponic Demonstration

Growing plants hydroponically is a straightforward procedure that can produce results that keep students interested. Following is a demonstration which can be utilized to demonstrate hydroponics and its principles in a very cost-effective manner.

Materials Needed

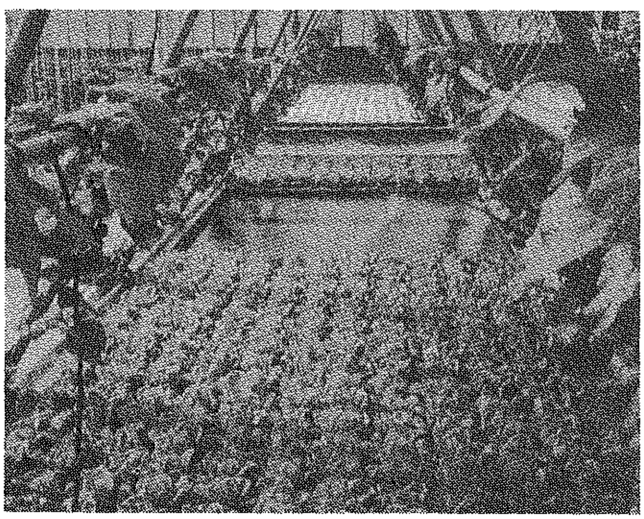
* **fish aquarium**
* **fish aquarium aerator**
* **polystyrene board** — foam board - 1 inch thick, available at most insulation companies and hobby stores.
* **fertilizer** — (Rap-id-gro, Miracle-gro, or any complete water soluble fertilizer with minor elements, available at lawn and garden centers.
* **Jiffy-7 Pellets** — Available at most lawn and garden centers.
* **plant seeds** — lettuce, spinach, kale, etc.

Procedures

1. Cover the sides of the aquarium with a dark material to prevent light from entering from the sides. This will →

prevent algae growth in the nutrient solution.

2. Set the aquarium in a south window to allow the plants to receive full light, or use a strong artificial light. Be careful not to burn the plants.
3. Fill the aquarium with nutrient solution. Follow the instructions on the label when mixing the nutrients with water.
4. Use the aerator to supply the water with oxygen.
5. Expand the Jiffy-7 pellets by adding water, or set them in a pan of nutrient solution.
6. Cut the polystyrene so it will float on top of the solution. Cut holes (one inch in diameter) in the foam about 6-7 inches apart to hold the Jiffy pellets.
7. Insert the pellets firmly into the holes in the polystyrene. Plant two seeds in each pellet. If both seeds germinate, pull out one seedling, leaving the healthier one to grow.
8. Keep the aquarium filled with nutrient solution. The plants will use very little of it when they are small.



Lettuce growing in a water culture system.

In the winter, approximately 10-14 weeks are needed to grow plants to an edible size. In summer months, it will take only 6 weeks due to the greater number of daylight hours.

Hydroponics and The Problem Solving Approach to Teaching

Hydroponics and its applications lend themselves well to the problem solving approach to teaching. Hydroponics presents students with the opportunity to gain valuable hands-on experience with a real-life simulation. Newcomb and others (1986, p. 40) stressed that

> *supervised practice contributes optimally to the attainment of learning outcomes when students practice in situations that resemble as closely as possible the actual situation in which they are to apply and use the knowledge, skills, and attitudes that are being learned.*

Indeed, a hydroponic laboratory would give agriculture students the opportunity to solve challenging problems in a supervised arena. Many experiments can be undertaken to facilitate this process. These experiments can be of any nature; many limited only by an educator and student's creativity. Listed below are some for you to consider; use them to think of practical experiments that you can use to implement hydroponics into **your** classroom.

Experimental Ideas

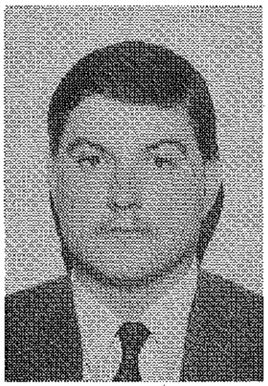
- **Effects of Nutrients on Plants** — There are 13 elements in the nutrient solution that plants require to grow. Plants will show deficiency and toxicity symptoms if the nutrient concentration is too great or too little. You can add additional amounts of any one of the 13 elements and see how the plants do. You can even vary concentrations of the same element. Caution: elements are required in very small amounts. Read about plant nutrition in a botany book before undertaking any experiment.

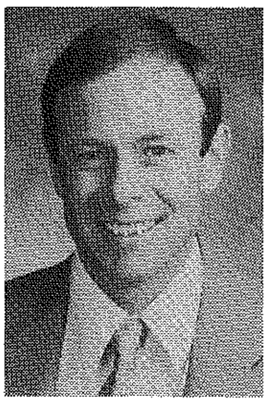
- **Effects of Light Quality and Quantity** — Place two or more hydroponic systems in areas which differ in light intensity (in normal room light, near a window, under grow lights). One could also purchase more than one set of grow lights and use colored filters to change the quality of light affecting the plants. Students should notice changes in shoot and root growth. (What other changes can they notice?)

- **Oxygen and its Effect on Plant Roots** — Plant roots respire like every other living organ. Try comparing plant growth with and without an aerator in the floating system. Note: Even without an aerator, enough oxygen may still dissolve (or be already dissolved) in the water to support the plants. The warmer the water, the less oxygen it will hold.

- **Effect of Growing Systems** — Have students grow the same cultivars in different growing systems (field grown, aggregate grown, water culture). Yield, disease resistancy, growth, and water usage →

Zuni School Farm: A Bridge Between Vocational And Academic Education





By MARVIN MARTIN and TOM DORMODY

Mr. Martin (top) is an agriculture teacher at Zuni High School, Zuni, New Mexico. Dr. Dormody is Assistant Professor, Department of Agricultural and Extension Education, New Mexico State University.

"My grandfather told me there were vegetable gardens everywhere . . . My uncle told me this whole area was planted in corn in the old days . . ." Statements like these are heard quite often in school and family settings by Native American youth from the Zuni Pueblo in New Mexico.

These youth have an innate love and nurtured respect for their land. This nurturing has always been based in Zuni's agricultural traditions. However, agricultural production has been steadily declining in Zuni. While cultivated acreage has dropped from about 8,000 to 1,500 acres since 1911, each generation has moved further away from the tribe's agricultural roots. When the Zuni Public School District obtained a 10-year lease agreement from the Zuni Tribe for 25 acres of farmland, the Zuni High School agriculture program was given a unique challenge: develop a farm or laboratory and curriculum to strengthen the tie between the Zunis' two most valuable resources, their land and young people.

The Zuni Pueblo is on the western edge of New Mexico. Being an isolated rural community, it has no developed commercial or industrial enterprises to provide the working public with jobs. Traditionally, the Zuni economy was in agriculture. However, encroachment and erosion on tribal lands have radically changed land use over the past 100 years. The loss of Zuni's agricultural economic base and the fact that the community has no industry have combined to create a community in which 65% of the cash income is derived from arts, crafts, and wage labor. Because of this situation, many students have difficulty finding any value in their high school diplomas. When parents or teachers tell them that getting a job or performing well in the workplace depends on doing well in school, many students are skeptical. It is hard for them to see any connection between school and work, because, when they do leave high school they end up working at jobs that demand few, if any, academic skills.

The Zuni community has worked hard to respond to longstanding, unmet educational needs and conditions of Zuni students. Creation of the Zuni Public School District in 1980 has led to some dramatic changes in the educational experiences and conditions for students. The dropout rate at ZHS was 43% in 1980; in 1990 it had fallen to 9%. The academic scores of Zuni students, measured by CTBS and ACT scores, have risen steadily each year since the district was founded. →

Laboratory Instruction . . .

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are some components that can be compared.

Hydroponics — Is It For Me?

When properly planned and executed, hydroponic experiments can stimulate student interest. Hydroponics allows you to teach basic and some rather unique scientific principles in an experimental fashion. Your equipment need not be elaborate and expensive. If you are a novice, start out with simple experiments. Challenge your students to design new experiments that are not found in a book or manual. Use your imagination and have fun!

References

Cooper, E.L. (1990). **Agriscience - Fundamentals and Applications.** Albany, New York: Delmar Publishers, Inc.

Hydroponics as a Hobby. Illinois Extension Circular 844.

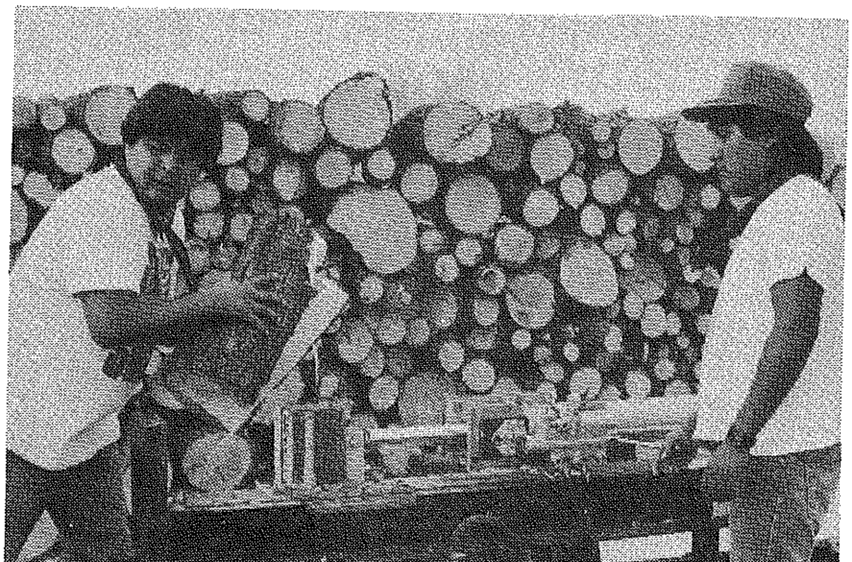
Hydroponic Demonstration for Students. Circular from the Land Agriculture Office from the EPCOT Center at the Walt Disney World Company.

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

Stephens, J.M. **Vegetable Crops Fact Sheet.** Florida Cooperative Extension Circular, VC-10. ■

Although the district has been operating for a little over 10 years, in many ways Zuni schools are just beginning to address some of the serious problems and concerns created by being isolated from jobs that require academic learning. These problems are reflected in the fact that most Zuni teenagers have short-sighted priorities. They do not see how they might be candidates for jobs requiring reading, writing, math, problem solving, and an ability to keep learning.

The Zuni School Farm Project is one way the district is trying to address the needs of its young people. The 1989 lease agreement between ZPSD and the tribe for 25 acres of farmland was made to establish a school farm or land laboratory for the agriculture program. Shortly thereafter, ZHS teacher of agriculture Marvin Martin was awarded a Christa McAuliffe Fellowship and an award for improving secondary teaching. As the only 1991 New Mexico recipient of the fellowship, he received a year's sabbatical to research and develop an innovative interdisciplinary curriculum that uses the school farm and hands-on, cooperative learning activities to improve academic learning and to prepare students to make informed choices once they graduate. Money from the teaching award was also used for these ends.



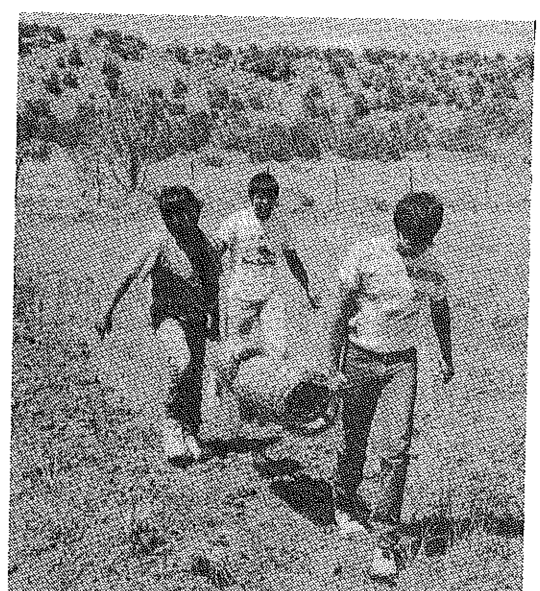
Zuni students are motivated to learn academics when they are provided hands-on learning activities. (Photo courtesy of Tom Dormody)

The Curriculum

In cooperation with New Mexico State University and Zuni High School, a curriculum is being developed to use agriculture and natural resource classes to teach science and other academic subjects. Agriculture and natural resource competencies will be cross-referenced with those from science, math, language arts, and history. By linking vocational and academic education, the students will be made aware of the need for a solid academic education. An integrated approach will help build basic skills and will bridge the gap between vocational and academic subjects. Presently, an outline for the curriculum has been developed. The outline addresses agricultural production, agricultural business, horticulture, forestry, natural resources, and agricultural mechanics. Specific units, competencies, and learning activities will follow.

The School Farm

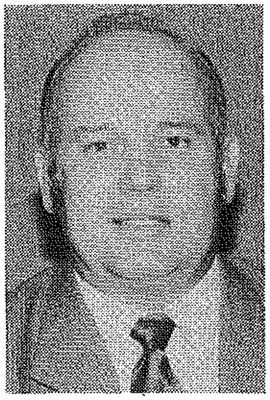
Shortly after acquiring the land for the school farm, students began to develop it by fencing the area and starting construction on two storage sheds with the help of a $2,350 community improvement grant. Although there was some existing fence, most of it had to be repaired. Students were responsible for calculating materials needed and their cost. Approximately 350 new posts were cut from Zuni forests by students. The farm produced its first hay crop last year. Development plans for the farm include construction of a greenhouse and livestock pens, planting of native trees and shrubs for reclamation work and landscaping, fruit trees, and vegetables. Modern and traditional farming methods will be taught. Historically, Zuni vegetables were produced in "waffle gardens." Waffle gardens, with their square and connecting catchment basins, were ideal for trapping all available rainfall, eliminating erosion, and reducing →



Zuni agricultural education students rebuilding the fences on the new school farm.

THEME ARTICLE

Urban Laboratory Experiences in Natural Resource Management



By L. DEVERE BURTON

Dr. Burton is a state supervisor of agricultural education in Idaho.

Idaho is a state with a tremendous endowment of natural resources. A combination of rich volcanic soils, pure water supply, pristine wilderness and forest lands, and abundant wildlife in the region provides many opportunities for teachers in our agricultural science and technology programs to provide experiences for students in the management of natural resources. Much of the land area of the state is owned by the state or by the federal government and is managed by government agencies. Idaho citizens have access to these public lands, and many of our people make frequent use of them.

The very existence of an abundance of natural resources within our borders has created an awareness by our people of the many controversies that surround different uses of natural resources. Some people want to expand the wilderness areas to prevent use of timber and minerals, and to restrict access by humans. Others want to eliminate all restrictions by government over the use of public lands and resources. Still others subscribe to the multiple use concept of managing public lands to allow users of many kinds to benefit from proper management of the resource.

Environmental issues have become very important to those who use the natural resources of the state. Education of our citizens on the proper use and management of natural resources has taken on an urgency in recent years, and agriculture programs are expanding their learning activities to include environmental and conservation education. A new curriculum was adopted for Idaho Agricultural Science and Technology programs in 1989 that contains a number of offerings with a distinct focus on natural resource science and management. They include the following courses:

- Forestry and Wildlife Management - A course designed to examine the importance of forestry, wildlife, and outdoor recreation with emphasis on efficient use of natural resources.
- Botany/Forestry Science - A course designed to introduce students to the biological, environmental and ecological concepts encountered in a temporal forest environment.
- Botany/Range Science - A course designed to acquaint students with principles of conservation, natural resources, ecology, and range science.
- Ecology/Natural Resource Science - A course to teach the concepts of conservation, natural resources, ecology, and fish/wildlife science. →

Zuni School Farm . . .

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weeds. This method of farming will be rekindled on the school farm as a historical demonstration.

The farm borders a riparian area, ideal for teaching about wildlife and habitat improvement. Because of the strong principles of land resource stewardship in Zuni culture and religion, the farm will be operated using principles of sustainable agriculture. Agricultural production and economic returns will be compatible with the long-term improvement of the land and surrounding environment.

The farm will be made available on a district and community-wide basis. Primary students will be able to tour the farm, becoming aware of the vital role agriculture plays in their community. Community members, and other secondary teachers and their classes will also be involved in school farm learning activities.

Summary

Because Zuni agriculture students now have a place to apply what they've learned in the classroom, interest in SAEP and FFA, which has been low and steadily declining in past years, is expected to increase. But more important, the use of an integrated curriculum, with the opportunity for hands-on learning on the school farm, should help students to see the connection between what they learn in school and the world of work. By reconnecting their young people with agriculture, Zuni's traditional tie to the land will be strengthened. ■

- Zoology/Fish and Wildlife Science - A course designed to examine the importance of fish and wildlife science, outdoor recreation and natural resources.

Idaho is a rural state with much of the population living on farms or in small communities separated by large tracts of forest, rugged mountains, and/or desert land. Many of our people depend directly upon the use of natural resources for their employment. Wood products and farm commodities of many kinds fuel the economy of the state. Many of our programs in Agricultural Science and Technology are located in isolated areas of the state where it is relatively easy to implement instruction on management of natural resources, but even those that are located in the population centers have found ways to involve students in natural resource management.

. . . agriculture programs are expanding their learning activities to include environmental and conservation education.

The Boise Fish and Wildlife program is a unique program that draws students from three high schools located inside the city limits of Boise, Idaho. Not a single student in this program is involved in traditional production agriculture. The resources of this program are very much focused upon environmental issues and appropriate uses of the fish and wildlife resources of the city and the state. Students who are enrolled in this program are exposed to some distinctly non-traditional supervised agricultural experiences (SAE) and laboratory experiences.

A close relationship has been cultivated between the school and the Idaho Department of Fish and Game. Students have worked with conservation officers in recent months to provide beaver damage control along the Boise River Greenbelt. The river runs right through the center of the city, the Greenbelt preserves habitat for many species of wildlife. In the absence of predation, beavers have multiplied in the area and have posed a serious threat to trees and shrubs in the Greenbelt and on private property. People like to see wild beaver along the river and they object to killing them, so other methods of control have been implemented. Students have helped protect vulnerable trees by installing protective guards made of wire mesh. They have also been involved with conservation officers in trapping and neutering beaver to limit their rate of reproduction. Many of the animals have been trapped and moved to other areas of the state in an effort to start new colonies.

Students have also worked with Fish and Game officials compiling vital information on big game animals and game birds as the animals pass through hunter check stations operated by the department during the annual hunting seasons. Students who work at the check stations must become familiar with hunting and fishing regulations so that they can assist officers in detecting violations of the law.

The state Fish and Game department recruits student participation in some of their education programs. Students act as group leaders for public tours through the nature center, located in a public park. Two students are involved in a project to update and replace the signs on a self-guided nature tour in Hull's Gulch in the foothills above the city. Most of the students have also been involved in cleaning up trash from potential wildlife habitat or planting brush and other plants to restore habitat in damaged areas. One popular learning activity is planting steelhead and other species of fish in the Boise River. Directed by Idaho Fish and Game officers, students take part in the process of transferring excess steelhead from the hatchery traps beneath large hydro-electric dams to fishing areas within the city.

Students and school officials are enthusiastic about the educational experiences that are gained when the science laboratory is expanded beyond the walls of the school.

The National Birds of Prey Preserve located south of the city of Boise is the headquarters for a national raptorial research center. Students have become involved in the care of birds that are confined due to gunshot injuries and other disabling injuries. Other related projects include the construction and placement of platforms for eagle nesting sites along the canyon walls of the Snake River.

Other supervised experiences related to natural resources include working in the sales departments of local sporting goods stores, caring for animals in the Boise City Zoo, and learning to provide animal care at local veterinary hospitals. Advanced students also learn some of the basics of bird and animal physiology by participating in a class taxidermy project. This year the students will be mounting a golden eagle obtained from Idaho Fish and Game officials.

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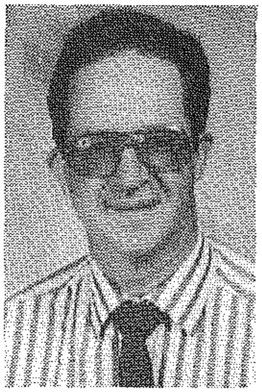
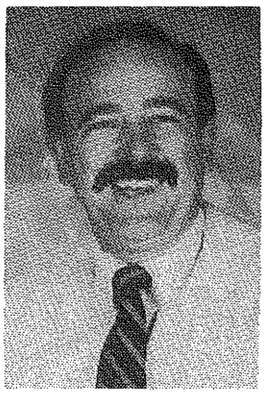
Future Laboratories





By KENNETH B. RHODES, JOHN BIERBOWER, AND THOMAS BRUENING

Mr. Rhodes (top) and Mr. Bierbower (bottom) are agriculture teachers at Derry Area High School, Derry, Pennsylvania. Dr. Bruening (not shown) is an assistant professor of agricultural and extension education at Penn State University.

Dreaming the Impossible

It's 4:55 p.m. and it's Friday. You're still at school, and you told your spouse you would be home early today! So what else is new? You just helped Jeff repair his welding project, a head gate you know you saw before, and you helped him load it into his Ford pickup. You sit down in your office chair, close your eyes and prop your feet after another long week at school. You lean back, close your eyes and instantly fall into a deep sleep. Your brain floats off to Never Never Land. You start dreaming about . . . of all the things, your "school laboratory?" Your brain gets the idea that you could have a new lab — boy, we really are dreaming now! But, yes, yes, keep it coming! A voice says, "If you could select a new laboratory for your students, what would you choose?"

Immediately, exciting questions flood your subconscious mind exploding the possibilities! How would it look? What type of equipment would I order? What type of teaching materials would I select? What type of lab tables would I get? "Well I could finally get . . ." The dream begins to darken as the principal enters the dream scene, but no — it's good news this time, she wants you to identify all the features you want in a new laboratory. She floats back out and you begin to think about how well the current lab has served for the past 50 years. Then you ponder about the future, and wonder if the rapid changes which are occurring now will continue. Yes, you are sure they will. The dream darkens again as you think about the cost constraints, size limitations, and tight budgets. But you fight these negative thoughts, and the dream brightens when you think about how well the students could excel and achieve in a positive lab environment. You soar to greater heights as you think about the high achieving students waiting in line to get into your program.

Obviously you want this new lab to reflect the major shifts in the new agriculture curriculum. You want the lab to be dynamic and interesting to the students. You want it to be bright and open and comforting. No more running back to the main building for lockers and restrooms. You are on a roll! Keep dreaming! You want the labs to be flexible to move equipment in and out so you could control all aspects of the teaching situation. You're finally in control of your total laboratory world! Ringggg. It's 5:00 p.m. and you almost fall out of your chai[r] as the telephone awakens you. It's your spouse, who wants you to bring home a loaf of bread! The dream's over!

We Have a Dream

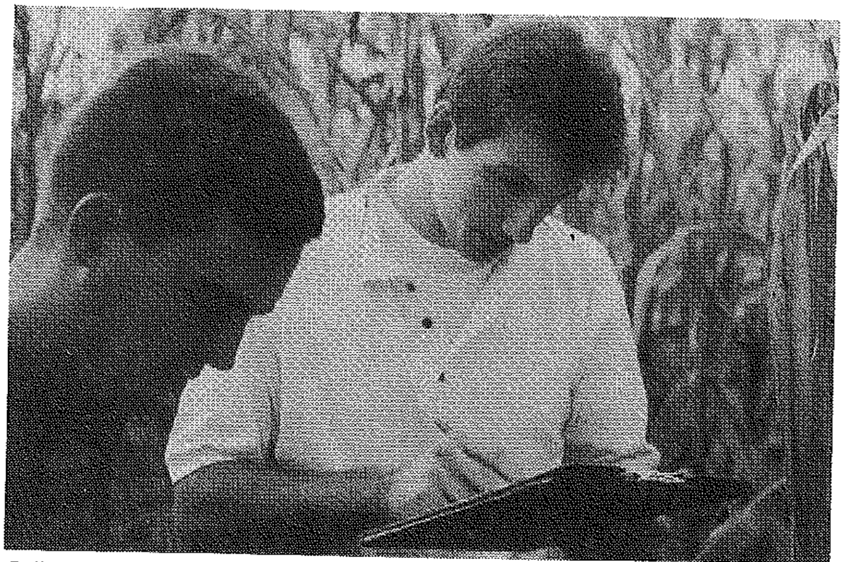
Dreams are a means by which we can think the seemingly impossible. At Derry Area High School our dream turned into reality. Several years ago we realized that the old facilities had to go; we needed to make drastic changes in our labs to meet the needs of new students in our new agriculture curriculum. At Derry we had a unique opportunity to work closely with the school board, administration, architec[t] and advisory committee to plan a completely renovated and new agriculture building. This renovation was part of a comprehensive school remodeling project. Although 95% of this building is a totally new teaching facility, the entire structure was planned around the teaching labs. →

Urban Laboratory Experiences in Natural Resource Management

(continued from page 11)

Is it any wonder that students leaving this program often aspire to work in jobs related to the management of wildlife and the habitat upon which wild birds and animals depend for survival? Program instructor Dave Milton has been so successful in attracting students to the program that it has expanded to include two additional part-time teachers this year. Students and school officials are enthusiastic about the educational experiences that are gained when the science laboratory is expanded beyond the walls of the school to include the mountains, forests, deserts and streams that make up the ecosystem upon which both people and wildlife are dependent.

The Derry Area School District, along with the Derry community, has undertaken the challenge to become one of the "new generation of American schools." All parties of the school and community must be



College students prepare to manage a land laboratory by participating in a corn yield check at Penn State University.

lifetime learners. One example of Derry's commitment to these principles can be found in the agriculture/horticulture program, which has been recognized by the Pennsylvania Department of Education as an exemplary model program for the state.

Students practice making sales to the public in the Derry High School floriculture sales area.

Approximately 15% of the total high school population is directly involved in the Derry agriculture/horticulture program. The high school is located on the boundary between Derry Borough, with an approximate population of 3500, and Derry Township, with an approximate population of 22,000 spread over 98.4 square miles. Derry is agriculturally oriented with agriculture entrepreneurship becoming the second source of income for the family. The average farm is about 150 acres in size with dairy cattle, beef cattle, sheep, swine, truck crops, and cash crops being the main enterprises. Traditional dairy farms have been replaced with less labor intensive farms to permit additional employment for the family members. Horticulture has shown an increase in production of crops and employment positions over the past 15 years. Greenhouses, flower shops, and landscape garden centers have increased in the township and the surrounding employment area.

In 1990-91 the Derry Area School Board and Derry community invested heavily in the future of our area by initiating a $26 million renovation project at the middle school and high school. The agriculture/horticulture complex has become one of the most modern in the state of Pennsylvania. The unique feature of the non-traditional facility is its emphasis on marketing agricultural products and its focus on student involvement and management in two simulated agriculture/horticulture businesses, locally known as the Trojan Country Market and the Trojan Florist.

The Trojan Florist or floral shop simulates a retail flower shop, which is complete with a refrigerated display, sales and wrapping station, wedding and funeral consultation area, glass and wooden display shelves, and niches. Even a helium balloon display and preparation area is included in this modern flower shop.

Located adjacent to the flower shop is a floral design laboratory complete with 18 work stations for individual designers. It is well lighted with a demonstration table complete with a deep bowl sink, chalk board, and group work area. Included next to the floral design room is a flower preparation room used to handle cut flowers and prepare them for the cooler. This room also is an area for tissue culture, complete with a laminar flow hood. Off the preparation room are faculty restrooms.

A 20′ x 40′ glass greenhouse is attached to the flower preparation room. It is divided into two sections, one is presently being used for more traditional plant propagation and the other section is used for aquaculture and hydroponics. Students produce tilapia fish for human consumption. Also in the greenhouse are several tanks of brood stock, as we are a licensed fish hatchery for the state of →

Pennsylvania. In addition, we have a hydroponics experiment where we are growing lettuce in nutrient-rich fish water.

A walk-in 8′ x 12′ cooler is used by horticulture students for fresh flower storage, cooling of bulb crops, holding market flower crops, and providing cold storage for stock material.

Students practice making arrangements that will be sold to the public in Derry's floriculture laboratory.

A 30′ x 60′ production-size fiberglass greenhouse is used to produce commercial crops of poinsettias, Christmas cactus, chrysanthemums, lilies, tulips, hyacinths, daffodils, iris, cyclamen, African violets, calceolaria, primula, spring bedding plants, vegetable plants, hanging baskets, geraniums, as well as a few specialized crops each year. This greenhouse is surrounded with an outside, covered potting and preparation patio or terrace, a soil lab for potting and soil analysis work, as well as a work room which is used primarily for storing and mixing fertilizers, pesticides, growth-controlling chemicals and hormones.

Students are accommodated with a locker room, complete with a shower facility, restroom, and wash area. For classroom instruction students utilize the horticulture classroom, which has a folding wall that can be opened into the agriculture classroom for team teaching, large group instruction, FFA meetings, and social activities. The entire facility is set in a fifteen year old arboretum of shrubs and trees. A 40′ x 80′ existing metal building in back of the new facility is presently being used for production of swine, sheep, beef, rabbits, and poultry by the agriculture students. A two acre nursery, 20 acre agriculture crop in woodlawn area, turf, and four interior court yards in the high school-middle school complex help to complete the laboratory areas available for hands-on instruction.

At Derry we had a hard decision to make when the school decided to do a major renovation project which was to include the agriculture program. Should we catch the new wave and update to attract that science-minded student, or should tradition rule and we stay with the corn, cows and carpentry?

With input from our advisory committee and administration, we decided to develop an agriculture program that would not lose our roots in production, yet stress new technology that was being developed in the agricultural industry.

Foremost in our minds was to provide students with marketable skills in today's job market. Production of food and fiber has always been the cornerstone of a successful agriculture department. The emphasis in the agriculture program is on the simulation of work experiences in various agricultural areas. Our labs are being developed in a manner so students are in a variety of situations similar to those encountered on the job.

Water quality is monitored on a daily basis in the Derry High School aquaculture laboratory.

The agriculture marketing area will be utilized to draw all learning together. Our labs will function on the production of a product in which the student had a direct hand in producing. Here the students will learn skills and responsibility and develop an understanding of what is involved in producing and marketing agricultural products. The sales area is student run, and quality equal to that in industry is stressed for all products. This area is presently equipped with a cash register, various display racks, and a glass-fronted display freezer and refrigerator. And what was one of the first products? What else but Penn State Creamery ice cream! →

How about apples graded, weighed, wrapped and priced in the food science lab? Maybe fruit baskets for the holidays or smoked sausage or how about sauerkraut . . .

The objective of the food science lab is to provide students with an area to develop skills relating to the food industry. The students will be given an opportunity to research, develop, and process food products to be marketed in the sales area. Equipment in this area includes a fruit press, meat grinder/stuffer, a smoker-oven, a walk-in cooler, ice cream freezer, fryer, wrapper, scales and a pricing unit. Other equipment will be added as the area is expanded and different products are produced.

The agriscience lab was developed to provide students with an opportunity to perform practical laboratory procedures. This lab is equipped to do a large array of tests in areas such as soils, water, grains, forage testing, dairy products and plant tissue evaluation. Students perform various tests for area farmers to provide practical experiences in testing procedures, as well as provide a service to our farmers.

Through the animal science lab, students develop many skills related to animal production. Various animals are kept as projects at the school farm. The school maintains a small flock of Dorset sheep, which students show at area fairs. Depending on what units are being taught and the interests of students, various animals are kept throughout the year. These may include hogs, capons, rabbits, veal calves, exhibition poultry and quail. Responsibility is a major objective of this area, as this is the first time many students have ever worked with animals.

Our agricultural mechanics lab is in all respects a traditional mechanics lab. Students are taught basic skills which they can build on as they progress through the program. With the new facility, emphasis will be shifted to constructing projects that may be marketed in the sales area.

Even as our laboratories continue to develop, we hope to constantly offer an interesting curriculum that will address the needs of all levels of students. The first and foremost concern of the instructor should be to provide skills that will help students in their career choices. In order to do this we must develop quality programs that not only provide technical training but also provide facilities in which the student can gain valuable hands-on work experience. Students cannot learn customer relations, wrapping, pricing practices, soil testing, or welding skills if they are not frequently involved in these experiences. Remember, the laboratory is an exciting teaching tool. It's like learning in 3-D!

"If You Build It They Will Come"

We wanted to build laboratories and facilities at Derry which are futuristic and which stimulate the academic development within each of our students. We wanted the best and brightest students in the high schools to be part of our agriculture program. We weren't satisfied getting students that other teachers didn't want. We feel that our laboratories and new facilities will allow our students to compete in agricultural colleges and universities and at the workplace. The positive enthusiasm which the teachers feel toward the program is contagious. Students come ready to learn, and teachers are already dreaming about how the entrepreneurial aspects of the program can generate more dollars to add more labs to the agriculture department. The attitude of the existing students in the program toward learning has already improved. Since the building has been finished and the labs are in place, we also see improvement in the quality of students coming into the program. As we look to the future, we have still more dreams . . . "there is this new putting green that I would like to build." ■

Coming in May -

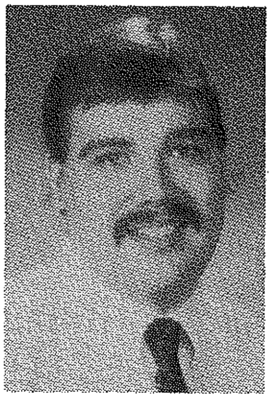
- Feature articles on laboratory teaching, hydroponics, and classroom techniques.
- Theme — Teaching Agriculture in the Elementary Schools

About The Cover

Don McNutt, Conrad Weiser agriculture teacher, and Michele Troutman, student, are preparing to work on a biotechnology laboratory experiment. (Photo courtesy of Thomas Bruening)

THEME ARTICLE

Laboratory Instruction In An Urban Horticulture Program



By GARY B. JACKSON
Mr. Jackson is a doctoral candidate in agricultural and extension education at Penn State University.

During the last decade much has been written and discussed about change in agricultural education. Many questions have been raised. What is our purpose? What subject areas should we emphasize? How do we recruit quality students? Do we have an image problem? These are just a few of the questions that scholars have attempted to answer, discuss, or provide suggestions concerning change in agriculture programs at the secondary level. These questions are a result of an overall decline in student enrollment in agriculture programs, a declining farm audience, a changing workplace, and failure to supply skilled workers for the business and industry sector. Agricultural education has realized that it must keep pace with the changing times or become obsolete. As a result, innovative changes have been made in agricultural education. One of these changes includes the establishment, implementation and promotion of agriculture programs in urban settings.

Urban Agricultural Education

Agricultural education has been in existence in urban areas for a long time. However, urban programs have become more important in recent years because they support the continued existence of agricultural education. Agricultural educators have also realized the need for urban students to know and understand agriculture. Others began to identify the large number of agricultural businesses and industries located in the urban setting. We finally realized that the opportunities for strong urban agricultural education programs are excellent.

Urban areas have a tremendous need for agricultural products and services. Urban agricultural education programs now attract large numbers of students by providing classroom and laboratory instruction and supervised agricultural experiences in areas such as agribusiness, agricultural engineering, and horticulture. One of the goals listed in the National Council's *Strategic Plan for Agricultural Education* includes providing updated *"instruction in agriculture and expand programs about agriculture."* This goal is a firm commitment to provide agriculture programs to all people in the nation, including those in urban settings.

Agriculture programs must continue to focus on meeting the needs of urban students.

Agriculture programs must continue to focus on meeting the needs of urban students. Agriculture instructors will need to continue to learn how to work with and fully understand a multi-ethic classroom and laboratory and how to meet the unique needs of urban students and communities. Student and community characteristics have always had a tremendous impact on the development and success of a program. By understanding urban students, their environments, and their learning styles; teachers can provide innovative classroom and laboratory instruction that will motivate students and cause them to acquire the necessary competencies needed for successful employment in agriculture.

Laboratory Instruction

Agricultural education's purpose or objective is to prepare individuals for success in life by acquiring knowledge and skills in agriculture. Agricultural education occurs in a variety of ways. Teachers communicate knowledge and skill to students through various teaching methods and techniques. Books provide organized bodies of written information which can be comprehended by students.

Agricultural education can also be obtained from school laboratory experiences, which provide the individual an opportunity to learn by doing. Agricultural education has used laboratories as a vehicle for implementing instruction since it existence. The agriculture laboratory allows the students to practice or apply classroom instruction, which is very important to an urban agricultural education program's success. Many urban programs have become vital to the school and community because they duplicate in the school →

laboratory activities found in business and industry. Through laboratory instruction, agriculture teachers prepare students for employment in urban supermarkets, food processing facilities, food distributing centers, agricultural equipment centers, garden centers, nurseries, floral shops, landscaping services, and many others.

Horticulture Programs in Urban Settings

Horticulture has been an area of agricultural education that has experienced a tremendous amount of success in urban areas. Horticulture broadly conceived includes greenhouse management, ornamental plant production, floriculture, and landscaping. By encompassing such a spectrum, many horticulture programs provide a variety of laboratory activities and projects through flexible instruction, different types of laboratory facilities, supervised agricultural experiences, and job placement.

The horticulture program at Millsaps Vocational Center in Starkville, Mississippi, was initiated in 1977. The one-teacher program was started as a result of the need for employees in local horticulture businesses. During this time, Starkville — a community of almost 20,000 — was expanding, producing a need for more agribusinesses, greenhouses, nurseries and landscaping firms. From 1977 to 1991, the program consisted of two 2-hour classes of first-year horticulture and one 2-hour class of second year horticulture. During the current school year, the program has added a one-hour agribusiness class to provide more opportunities for students to develop skills in advertising, marketing, recordkeeping, and computer application.

. . . facilities have been important to the program's success because most of the urban students do not have the opportunity to obtain these experiences outside of the school laboratory.

Perhaps the most important aspect of quality laboratory instruction is quality laboratory facilities. Millsaps Vocational Center's facilities are excellent because they provide the students with an opportunity to comfortably work in every area of horticulture, including landscaping. The facilities include a landscape design laboratory equipped with drafting tables and drawing materials required for designing landscape planting designs, a soil testing laboratory, a headhouse, a cut flower cooler, a 40′ x 80′ evenspan greenhouse, a lathhouse, and equipment storage areas.

Certain areas of the school campus have also been used for laboratory experiences. These facilities have been important to the program's success because most of the urban students do not have the opportunity to obtain these experiences outside of the school laboratory.

Each area is equipped with the necessary equipment and materials needed for laboratory activities. For example, the greenhouse contains many different plant materials that are used for identification, watering, fertilizing, pest management, etc. Landscaping tools and materials that include a small tractor, implements, various handtools, measuring equipment, and plant materials are used around the school campus for landscaping projects. The latest project included developing a large planting design (spelling the high school's letters) near the baseball stadium. The designs were then evaluated and one was chosen for implementation. These types of laboratory projects have helped some students decide to purse careers in landscape architecture and contracting.

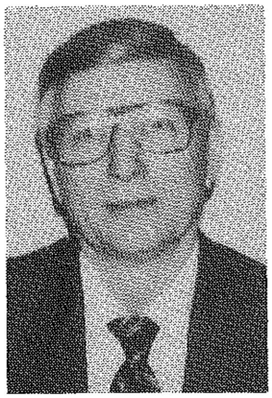
Teachers must constantly restructure and develop new and improved teaching methods, techniques, curriculum, and projects to use in the laboratory setting.

The majority of students enrolled in the program are from the urban area. Most of the first-year students enter the program knowing little about agriculture, horticulture, and related areas. However, from the first day until the completion of the second year, they are introduced to many different areas of horticulture. A large portion of the experience students receive comes from laboratory activities.

For example, the greenhouse and nursery laboratory provide students with an opportunity to learn how to develop different soil mixtures, pot various plants, properly water and care for plants, propagate plants, fertilize, and apply safe pest management principles. The students also produce many different crops including poinsettias, geraniums, marigolds, petunias, ferns, tomatoes, and peppers. Each student is required to operate and manage all phases of the greenhouse and nursery operation, which include plant production and controlling the greenhouse environment (photoperiod, temperature, →

THEME ARTICLE

Management of Instructional Laboratories in Agricultural Education



By THOMAS A. SILLETTO

Dr. Silletto is an associate professor in the Department of Biological Systems Engineering at the University of Nebraska.

Identification of the future role of instructional laboratories is a growing concern for agricultural educators. Direction for laboratory use has not been made clear, and de-emphasis of agricultural mechanics education topics has frequently been cited as one solution to program concerns. Agricultural mechanics specialists stress the importance of instruction in the physical sciences as well as the biological sciences. They state that agricultural mechanics education provides solid foundation for almost all instruction. Agricultural educators, including agricultural mechanics education specialists, have frequently expressed need for direction. Facilities which exist must be used or they won't be available. They would be redirected to other program uses.

It is not difficult to justify hands-on activities in the laboratory. Learning while doing and saying results in the highest level of recall. Thus, it would seem that laboratory instruction will be as important in the future as it has been in the past.

. . . it would seem that laboratory instruction will be as important in the future as in the past.

Granted, laboratory activities must be more than "going to the shop" as an alternative to organized and directed classroom sessions. Laboratory activities must complement classroom instruction and contribute to development of a sound educational foundation which students will need in the future.

A review of the evolution of labora- →

Laboratory Instruction In An Urban Horticulture Program

(continued from page 17)

etc.). Students are also assigned to manage specific greenhouse crops such as poinsettias.

Perhaps one of the most important parts of laboratory instruction is student evaluation. As an inexperienced teacher, I often had difficulty rating students on laboratory exercises. After a lengthy discussion with my assistant vocational director, we developed a rating scale based on a point system.

. . . one of the most important parts of laboratory instruction is student evaluation.

The evaluation required that each student be graded on eight different areas, which include quantity of work, quality of work, use and care of tools and equipment, use and care of materials and supplies, problem-solving analysis, safe work habits, work habits with other students, and the degree to which the student controls his/her feelings and emotions. These eight areas extensively cover the evaluation process for most laboratory activities in horticulture.

Future Laboratory Instruction

As an agricultural educator, I believe instruction must improve, change, and grow. Rapid change in technology, work procedures and processes, and the rural and urban environment are occurring everyday. These changes will demand flexibility in the way to provide laboratory instruction.

We must also explore and develop new ways of providing laboratory instruction on a continuing basis. Teachers must constantly restructure and develop new and improved teaching methods, techniques, curriculum, and projects to use in the laboratory setting. Through quality laboratory instruction, innovative technologies, and new concepts and ideas, specific skills can be effectively obtained by urban students, enabling them to work in various areas of horticulture. After all, everyone should be given an opportunity to become involved in the wonderful world of agriculture.

References

The National Council for Agricultural Education, **"The Strategic Plan for Agricultural Education."** The National Summit on Agricultural Education. (May, 1989) p.4.

tory instruction from the 1920s to the present time reveals background information and insight into the importance of laboratory instruction throughout the existence of agricultural education.

Evolution of Instructional Laboratories in Agricultural Education

Public school teaching experiences of my father, over 30 years; my experience, 5 years; and of my students, representing the past 15 years, provide a view of changes which have occurred during most of the existence of agricultural education. My father taught vocational agriculture boys to forge-weld steel and forge tools in the *Farm Shop* beginning about 1920. They debated use of animal versus tractor power and open-pollinated versus hybrid corn. They mixed and sold tons of mineral supplements for livestock. Initiating production record keeping was an important part of that early program.

A few years later, at a different school, he taught other boys *Farm Mechanics Shop* skills. They learned, by forging, to draw out the teeth of spike tooth harrows. They also learned how to safely use hand and power tools and install electrical circuits. Gas welding and cutting, electric arc welding, and building hog houses and cattle self-feeders were common shop activities. They tested milk and soil samples and candled eggs. Artificial insemination of cattle was an interesting topic for discussion - what if the calves were born with glass legs was one argument. A new crop, soybeans, was discussed for its potential as a cash crop and its ability to improve soil fertility. Plants were observed to review the growth of nodules on the roots.

One class accepted a project to prune grapes which had never produced a crop. The vines were overrun by several years' growth, so the pruning resulted in removal of a huge pile of canes. The farmer and his wife thought the vines were killed by the students. That fall, however, all of his classes were invited to a celebration of the crop of grapes, and of yellow watermelons, too! The students saved all the melon seeds for the farmer, and that was the beginning of several discussions of plant selection and genetics.

He and his students laid out miles of terraces to improve soil conservation practices. He started at least one FFA chapter and took the seniors, who had seldom been out of the county, on trips across the country. It is easy to see that his community was his laboratory and that was where "his ag boys" learned a great deal about production agriculture, life, and the ongoing changes of the agricultural industry.

In 1968 my teaching days began and we worked in the *Agricultural Mechanics Shop.* The students learned to weld, to complete pre-service checks of combines and setup of machinery. They built squeeze chutes, loading chutes and conducted a tractor tune-up day. The students learned about hydraulics, horsepower, electricity, electrical wiring and motors. They debated about the best color of farm equipment and whether diesel or gasoline engines were best. Discussions of artificial insemination of swine reminded me of earlier discussions about AI for cattle. The students saw red calves which were produced by black angus cattle and learned about recessive genes.

Both boys and girls who enrolled in the classes helped build plant growth chambers and cold-frames. They developed a landscape plan for a house. The students started a flower garden, which was frequently visited by their parents. Enrollment tripled due to the semester courses, and most classes included laboratory instruction. The FFA farm, corn demonstration plots, employment experience as a senior, and fruit sales were good experiences for the students. FFA trips were fun; I sometimes wondered how we all returned home unscathed. My father and I had both experienced significant, but different, agricultural changes and had continually initiated laboratory instruction changes.

Teacher training opportunities arose and my most recent students were soon teaching in *Agricultural Mechanics Laboratories.* They were teaching students about wire welding, plastic welding, several uses of computers, electrical wiring, motors, controls and sensors. As learning facilitators, they involved students in hydroponics, aquaculture, floriculture, computer-aided drafting, embryo transplants, genetic engineering, and components of a new generation of technology which surpasses anything imagined!

They teach less shop skills but more about the physical sciences. They have less construction of large projects; many of their students don't live at a home farm or ranch! They are increasingly concerned about liability and meeting students' needs as well as keeping up with technology throughout the agricultural industry. →

Description of the On-Going Program

Over the time periods, similarities can be identified: 1) the community was the school laboratory; 2) students were involved in important and real, foundation-for-life activities; 3) students were learning by doing through experimentation and practice; 4) physical science concepts and activities were integrated with biological sciences in both the classroom and laboratory activities; 5) new technology was constantly being included in classroom and laboratory instruction; and, 6) students were generally having FUN working at hands-on activities. Laboratory instruction can add a foundation useful for life through numerous hands-on activities!

It's not difficult to see that laboratory programs have been expanding for years. Technology advances, education strives to keep up, and sometimes the terminology is changed; literacy also becomes increasingly important. The description for laboratory instruction is not new - it's on-going. **It is instruction in principles and concepts, demonstration, practice, and experimentation. It includes quality instruction with involvement of students in activities which promote higher-level thinking throughout integrated agricultural education laboratory programs in a broad field of advancing technologies.** It has been effective instruction which has evolved to present strengths, but it must be improved continually by use of updated information and activities, as well as renewed efforts to use facilities in a most effective manner.

Finding Direction for Future Instructional Laboratory Programs

A Carl D. Perkins grant project was undertaken to provide direction for broadening and improving laboratory instruction in Nebraska. The project was administered by the Nebraska State Department of Education. Broadening and improving laboratory instruction in agricultural education was the purpose of the project conducted in 1991 with Dr. Richard Foster. The project included development of a 184-page notebook titled, "Management of Instructional Laboratories in Agricultural Education." It emphasizes that the agricultural mechanics laboratory should have an expanded role as the site of several types of laboratory activities. In addition, a classroom laboratory was recommended for initiation of activities which require more specific equipment related to the rapidly advancing "HI TECH" arena.

The Introduction included mathematical applications, safety, liability, use of an advisory committee, and development of laboratory resources. Instructional laboratories for agribusiness, animal science, food processing, natural resources, plant and soil sciences, and agricultural mechanics were listed. Each section included information about the need for that instruction, a list of competencies, suggested references and resources, a description of the laboratory facility and equipment needed, and example laboratory activities. The examples were provided using a form which emphasized written student response to higher-level thinking through discussion of the importance of each activity.

Appendices included Management Practices, Safety Rules, Nebraska Eye Protection Law and related materials, Agricultural Education/Agriscience Competency lists for Nebraska Laboratory Programs, General References and Resources List, and Sample Laboratory Activity Forms.

Suggested uses of the notebook materials included: 1) serving as a companion manual to the Nebraska Agricultural Education Scope and Sequence and Program Management Guide (Foster, 1990); 2) laboratory program update and development for the State; 3) ideas for renovation of existing facilities to expand the laboratory programs; and 4) development of plans for new programs.

Several appendices may be copied for use as laboratory posters to enhance laboratory instruction. The Laboratory Activity Form is suggested to be used by teachers to formalize higher-order thinking activities throughout the laboratory programs. To reinforce that undertaking, teachers were challenged at their state conference in 1991 to share newly developed laboratory activities with their colleagues.

Summary

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.

As a part of a Carl Perkins Grant project, materials were developed to provide direction for future laboratory instruction with emphasis on managing, conducting, updating, broadening, and evaluating laboratory programs. The materials include ideas for laboratory instruction which emphasize six instructional areas as

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Industry Involvement in Laboratory Teaching

By DONALD L. JOSKO
Mr. Josko is a horticulture instructor at Southeast Vocational-Technical Institute, Sioux Falls, South Dakota.

While touring visitors through our new Nexus state of the art greenhouse, I was asked how our program was able to secure the cutting edge technology while other schools and programs at the postsecondary level appear to be in a bind for equipment to provide laboratory experiences for their students. The answer to this question puzzled my visitors. I ask them 3 questions:

1) How many instructors and programs have industry certifications?

2) When was the last time a program invited industry in to evaluate laboratory needs to keep pace with industry changes?

3) How many programs or instructors have an excellent working relationship with the administration and come to the table with funding proposals and solutions?

These are all critical points in maintaining a "high-tech" postsecondary laboratory program.

Industry Certifications

Maintaining a working profile with industry is very beneficial in developing the needed contacts and expertise to futuristically plan for laboratory experiences, equipment, and sites for students to work. Through obtaining industry certifications for the instructor our program demonstrates to industry that we are serious about establishing high quality standards. With this recognition the program can work with industry to secure lend-lease agreements, reduced price consideration, or short period loan of equipment to train students. Our program has developed agreements with numerous companies to expose our students to top quality equipment. Another interesting concept is to require students to obtain industry certifications in their field of study. Our program now requires students to certify in the areas of arboriculture, nursery, and pesticide. Through this certification our students account for 54% of all of the certified nurserypersons in the state. This recognition has benefitted our laboratory experience because area industries provide materials and worksites for our students.

Industry Involvement in the Program

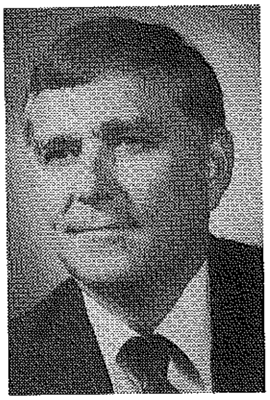
The use of advisory councils for program upgrade is a common practice for postsecondary programs to utilize. But in many cases these boards are superficial in nature and activity. An active advisory council will improve laboratory experiences, if the boardmembers are encouraged to participate in the program. We have chosen to select advisory members to come into the program and participate with students to gain a better understanding how students are taught. Many of the advisory members will bring along equipment, samples, and other materials to add to the class. Lately, our program was invited to a trade meeting where an advisory board member introduced us to a displayer at the conference, and we walked out with 12 new chainsaws to be supplied to the program on an annual basis, all because our advisory board member knew we had a need. Agricultural educators at most levels do not use industry enough in seeking out materials to maintain a state of the art program. Ask!

Working Relationships

While some programs look to administration as an adversary, successful programs seek a working relationship within their own school. Our program tries very hard to work with administration to plan the future for program and laboratory expansion. To work with administrators, instructors must develop realistic equipment and facility needs that will meet the needs of industry. Include administration in frequent advisory meetings and map out a five-year plan of development. This allows the administration to plan effectively, and it improves relationships and trust for future ventures. Be willing to wait patiently for your turn at expansion and improvements. We waited three years after our new campus was built before our new horticulture facility was considered. Now we are nearing the point of groundbreaking for a half million dollar complex to add to our facility.

Remember the new laboratory of tomorrow is here today only if you have invited industry to participate and have demonstrated to industry that you are interested in its standards. Your administration also must be included if the program is to continue to grow in the laboratory. ■

Computerized Time Management



By GARY MOORE
Dr. Moore is a professor of agricultural education at North Carolina State University.

During the past 10 years computers have drastically changed the way we approach many common tasks. Time management is one area that has benefitted greatly from the computer age. The yellow notepad and pencil as a time management device has given way to computers in many instances. In this article we'll examine some of the computer software programs used in time management.

Personal Information Managers

A whole new category of computer software identified as Personal Information Managers (PIM) has recently emerged. This software typically has the following functions:

A. **Appointment Scheduling** - Appointments up to a year in advance can be scheduled. Repeat appointments such as teacher meetings the first Monday of every month or bi-weekly FFA officer meetings can be entered once, and with a push of a function key, automatically be entered for the next several months. An alarm can be set in conjunction with an appointment and the computer will buzz when it is time for the appointment. The alarm can even sound if you are using another computer program.

B. **Task List** - An electronic "to-do" list allows the user to keep track of tasks that need to be done. Tasks can be prioritized in a variety of ways (due date, assigned importance, category of task). Every day the "to-do" list is automatically updated and the number of days remaining to complete the tasks is displayed. Some programs even allow a person to keep track of tasks delegated to others. As with the appointment schedule, repeating tasks such as preparing monthly reports, can be entered only once and told to automatically appear at the appropriate time.

C. **Note Management** - Most programs have some type of function to allow the user to record and retrieve information. This feature ranges from primitive to sophisticated, depending upon the specific program.

D. **Address and Phone Directory** - Most programs (but not all) have automatic phone dialers that will dial phone numbers at the push of a button, provided the computer is hooked to a modem and phone. Lists of addresses or phone numbers can also be printed.

The PIM software can be extremely helpful as a time management tool. One desirable feature is that past records can be archived. If you need to retrieve a record of your appointments and completed tasks for a specific past date, this is easily done. A variety of reports, such as a weekly schedule, tasks to do, a listing of subordinates, and tasks delegated to each can easily be generated.

Most of the PIM programs can be run as "resident" programs. This means they can automatically be loaded every time the computer is turned on but are not visible unless the user chooses to access the program by touching a combination of "hot keys." A person can be in the middle of preparing a lesson plan using a word processing program and immediately switch to the PIM to list a task or schedule an appointment then switch back to word processing.

The PIMs range in price from $69 to $395 and can be simple or highly sophisticated with a bunch of "gee whiz" features. The primary disadvantage of PIMs is they are not portable. Most people don't carry computers around with them. If you are in a meeting away from your desk (and computer) and need to determine a date for a meeting, it might be difficult. As we move into the age of powerful, inexpensive notebook computers this disadvantage will diminish.

A partial listing of the lower cost PIMs follows, along with an approximate price:

ON TIME — $69.96
Campbell Services, Inc.
21700 Northwestern Hwy., Suite 1070
Southfield, MI 48075

PRIMETIME PERSONAL — $99.95
Primetime Software Inc.
P.O. Box 27967
Santa Ana, CA 92799-7967

INSTANT RECALL — $99.95
Chronologic Corp.
5151 N. Oracle, No 210
Tucson, AZ 85704

WHO-WHAT-WHEN — $189.95
Chronos Software Inc.
555 DeHaro St., Suite 240
San Francisco, CA 94107

Management of Instructional . . .

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integrated components of the program. The materials encourage the continuation of the identified model used particularly in agricultural mechanics education, but also as it applies to other laboratory areas. The project result is a roadmap for managing future programs to help students develop a foundation useful for life through numerous hands-on activities which are undertaken in expanded instructional laboratory programs!

References

Heating, Ventilating and Cooling Greenhouses. (1989). American Society of Agricultural Engineers EP 406.

Hoerner and Bear. (1986). **Planning, Organizing and and Teaching Agricultural Mechanics.** Hobar Publications, St. Paul, MN.

Manual For Providing Effective Eye Protection in Nebraska Educational Institutions. (1985). National Society to Prevent Blindness - Nebraska Affiliate. Omaha, Nebraska.

Newcomb, L.H., J.D. McCracken and J.R. Warmbrod. (1986). **Methods of Teaching Agriculture.** The Interstate Printers & Publishers, Inc. Danville, IL.

Occupational Safety and Health in Vocational Education (1979). National Institute for Occupational Safety and Health. Cincinnati, OH.

Safety Color Code For Educational and Training Laboratories (1988). American Society of Agricultural Engineers EP 415.1.

Silletto, T.A. (1991). A Planning Guide For Development and Renovation of Agricultural Education Facilities. BioSysEngr. UN-L, Lincoln, NE.

Silletto, T.A. (1991). Agricultural Education/Agriscience Competency List For Nebraska Laboratory Programs. BioSysEngr. Dept. UN-L, Lincoln, NE.

Silletto, T.A. (1991). Laboratory Management Practices, BioSysEngr. Dept. UN-L, Lincoln, NE. ■

Accentuating What We Do Best:

(continued from page 4)

hydroponics lab. In this lab, we could show the need for oxygen in plant systems. This is a valuable principle that has wide application in the field of plant science. A question we could pose to our students might be, how is it possible that we can grow lettuce using hydroponics? Lettuce plants are sometimes grown on a floating piece of styrofoam with the roots totally immersed in a water culture. We know that corn plants quickly turn yellow and die when the plants stand in water in a field. However, by running a number of experiments using an aquarium pump and varying the amount of oxygen available to plant roots, students can easily discover that oxygen is the limiting factor.

Laboratories can also help meet societal needs for students by providing people skills. Many employers note that their most valuable employees can communicate and interact successfully with their coworkers and supervisors. While laboratories can be one of the most difficult arenas in which to manage students, they also present wonderful opportunities for students to develop cooperative skills needed by today's workers. As we begin to do a better job of designing laboratories, we need to consider how to arrange these labs so students can develop their human interactive skills. Students, given the opportunity to practice work in a school-based work setting, will have a better idea of how to cope with the business world. (Please read the article about Derry High School.)

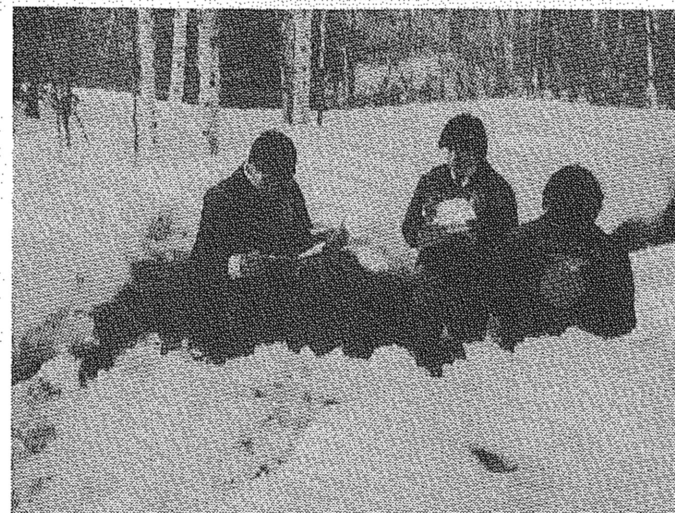
There is no substitution for quality: quality students, quality teaching, and a quality program. Quality begets quality. The better things are, the more people want to be associated with the program. Consequently, quality must be a driving force behind what we expect from students in our laboratories. Our future is dim if we treat laboratories like "shops" and we continue to produce 1950s types of projects. The challenge lies in our ability to change our attitude to meet the current needs of our standards.

Progressive, science-based agriculture laboratories will be dynamic arenas where exciting demonstrations, thought-provoking experiments and student-centered activities will occur. Topics such as food science, biotechnology and hydroponics will be taught. These laboratories will be intriguing areas that provide teachers with flexible use possibilities (future laboratories won't have ten power tools bolted to the floor). Furthermore, as painful as it might seem, it would be better to close old, outdated laboratories than allow students to work and learn in places that do not meet minimum quality standards.

On the other hand, as the quality of instruction improves, the quantity of students served will naturally increase. The number of students served will continue to be a major issue in education. As the cost of education continues to increase, expensive laboratories will be scrutinized with a cost-cutting administrative eye. Therefore, innovative teachers will have to take a proactive approach toward the justification of maintaining or developing expensive laboratories. As you read this issue, please keep in mind the endless possibilities we have to provide outstanding laboratory instruction in agricultural education. The laboratories featured in this issue range from hydroponics at Epcot to land laboratories in New Mexico. This theme on *Laboratory Instruction* also features significant changes in the way we think about and how we can teach in agricultural laboratories. ■

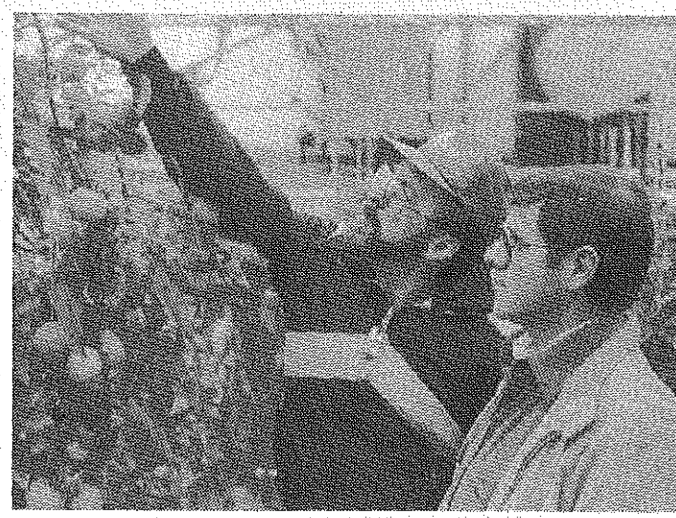
STORIES IN PICTURES

Scott Berry of the North Pole FFA Chapter spreads grain for waterfowl who migrate through Fairbanks, Alaska in the early spring. The Chapter has a wildlife project with the Creamer's Field Wildlife Refuge managed by the Alaska Department of Fish and Game. (Photo couresty of Carla Kirts)



It is April in Alaska, otherwise known as springtime anywhere else, but participants in the Alaska Land Judging Contest have to deal with a snow covered landscape. (Photo courtesy of Carla Kirts)

African Violets are watered very carefully in the Derry High School greenhouse. (Photo courtesy of Tom Bruening.)



Teachers observe a commercial hydroponics tomato operation at Saxonburg, PA. (Photo courtesy of Tom Bruening.)