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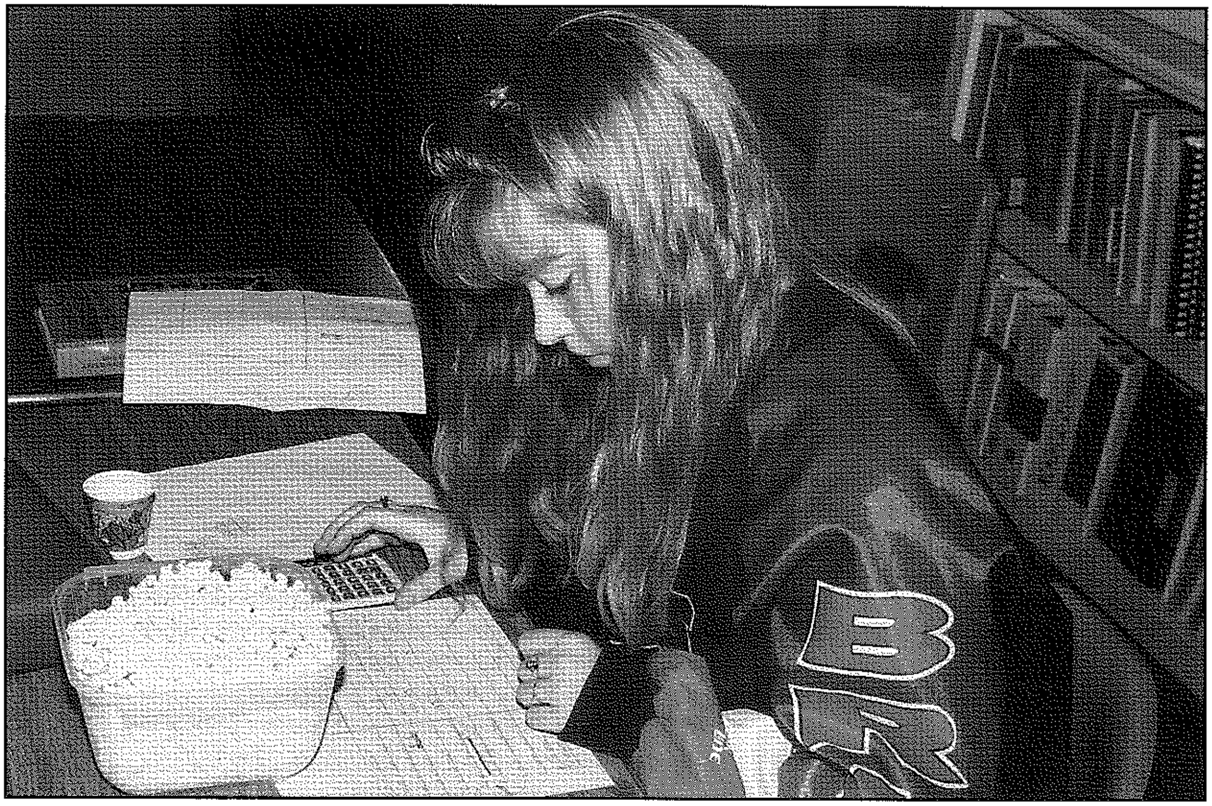

Sample Data Summary Table - Chemistry of Popcorn

| Characteristics | Brand A | Brand B | Brand C |
|---|---|---|---|
| a. Weight of measuring cup | | | |
| b. Weight of cup and corn | | | |
| c. Weight of corn | | | |

# Teaching Physical Science Applications in Agriculture

THE
# AGRICULTURAL EDUCATION
MAGAZINE

April, 1996 Volume 68 Number 10



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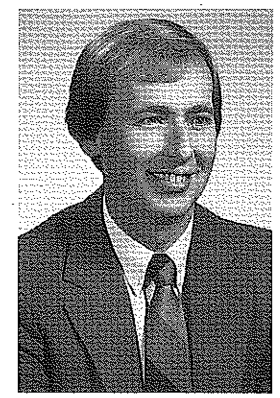
# Preparing Teachers to Teach Agriscience



BY: EDWARD W. OSBORNE

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

We have now reached the point in secondary agricultural education where agriscience defines much of what we are about. As agricultural education is increasingly perceived as science-based instruction in agriculture, we must make sure that such a perception is, in fact, reality. Our curricula must readily convey an agriscience dimension, and our teachers must be able to effectively teach science applications in agriculture. Much of the revitalization of secondary agricultural education over the past six years or so has been driven by curriculum redesign, and this focus has been essential in bringing about the transformation of agricultural education. However, ensuring that teachers have the ability to effectively teach agriscience courses equally demands much thought and effort. This is especially true since agriscience has not been designed as a single curriculum unit, but rather, as an initiative that often cuts across the entire secondary agriculture program. We cannot assume that teachers are technically and pedagogically ready to effectively teach a science-based agriculture curriculum.

### Problems and Needs

In order to effectively design agriscience pre-service and in-service teacher education programs, we must consider the problems and needs that characterize each of these two teacher groups. In two recent studies (Osborne & Dyer, 1996; Osborne & Dyer, 1995), science teachers and parents of secondary agriscience students were uncertain whether agriculture teachers had adequate preparation in science. This finding should not be surprising for a number of reasons. In the view of this author the following circumstances suggest that this finding is valid: (1) university agriculture courses usually taken by teacher candidates often focus predominantly on management practices and secondarily on the scientific bases of these practices; (2) university agriculture courses often treat the science and management of agriculture as two distinct, incompatible areas of emphasis; (3) especially in college, students almost exclusively learn science as a set of abstract concepts; (4) when applications of science are examined in college courses, the settings rarely involve agricultural examples; and (5) laboratory experience in college science classes follows a "cookbook" approach that allows limited opportunity for students to genuinely investigate and discover.

Older graduates have forgotten much of what they learned in their science courses due to course focus on concepts as abstract ideas, and new graduates do not have a working knowledge of science for the same reason. Thus, a gap exists in the technical preparation of agriculture teachers for teaching agriscience. Today's teachers must understand the science behind agricultural practices - an understanding and proficiency in agricultural practices is no longer enough. In addition, effective methods of teaching biological and physical science applications in agriculture must be explicitly addressed in pre-service and in-service courses and programs. Many teachers have found that different teaching methods are needed when teaching agriscience courses as compared to other agriculture courses, especially if these courses are lab-intensive.

### Possible Solutions

What are our options for ensuring that agriculture teachers are well prepared to teach science applications in agriculture? Several possible solutions for addressing the pre-service needs of teachers warrant our consideration. These include (1) a specially designed course(s) taught by teacher educators, (2) team development and teaching of a special course by agriculture, science, and agricultural education faculty, (3) integration of technical and pedagogical content into existing agricultural education courses, and (4) assignment of this responsibility to cooperating teachers as students complete their student teaching. Each of these options has clear advantages and disadvantages.

A Cooperating Teacher Responsibility? (Option 4)

Cooperating teachers are in the best position to model effective agriscience teaching, and therefore, may arguably be in the best position to teach undergraduates how to teach agriscience. However, this view has several major flaws. This option assumes that cooperating →

teachers are themselves solidly grounded in the technical and pedagogical aspects of teaching agriscience. As was stressed earlier, this may often not be the case, due to a variety of factors mostly out of the teacher's control. The extent of teachers' content and pedagogical expertise in teaching agriscience will be dependent to a large degree upon the nature and extent of agriscience in the agriculture curriculum at the cooperating center. Thus, the major drawback to this option is that pre-service teachers will not be uniformly prepared to teach agriscience.

Integration into Existing Agricultural Education Courses? (Option 3)

The content and methods of teaching agriscience could be integrated or infused into a number of agricultural education courses. The major advantage of this approach is that continuing attention can be given to teaching agriscience throughout the four-year teacher preparation program. In addition, the problems and questions addressed could be selected to match students' stage of development toward becoming an effective teacher. Such an integration strategy, however, is probably not a sound solution to this problem for several reasons. An integration approach implies that the "content" must be segmented and then these pieces taught in specific courses in the agricultural education program. This strategy may result in several pieces "falling through the cracks," and thus, fragmented and incomplete preparation of teachers. This strategy also requires extensive and continuous communication among faculty teaching the various courses. Such an approach is also likely to fail in giving students "the big picture" regarding teaching agriscience. Thus, for several reasons, integrating or infusing the technical and pedagogical content for teaching agriscience into the Agricultural Education sequence of courses is not a viable option by itself.

Team Teaching with Content Area Faculty? (Option 2)

Agricultural educators could team up with agriculture and/or science faculty to develop and teach a course designed to prepare students for teaching agriscience. This option offers several advantages: a high level of subject matter expertise, increased resources, more credibility, and the benefit of complementary strengths of two or three faculty. On the other hand, a number of problems are associated with this option. These include less control over course content and methods by the agricultural educator, greater difficulty in coordinating teaching activities in the course, a notable risk of the course being delivered in a disjointed manner, and difficulty in finding suitable partners with whom to team up to teach the course.

An Agricultural Teacher Education Responsibility? (Option 1)

Another possible solution is for the agricultural teacher education faculty to step forward to develop and teach one or more science applications in agriculture courses for agriculture teacher candidates. This strategy would provide a solid link to agriculture units and improve the views held toward agricultural education by other faculty and administrators in colleges of agriculture. Such a highly focused course would allow the course content to be directly targeted toward the technical and pedagogical needs of agriculture teachers. Course content should parallel that taught in secondary agriscience courses. This course should be designed as a lab-intensive course such that students learn through experimentation, demonstration, and inquiry. Such a course, perhaps simply titled "Teaching Agriscience," might become popular for non-Agricultural Education majors, but teacher education students should receive top priority when enrolling. The course instructor would need to constantly update course content and search for new labs. Because many university agricultural education programs are very small with respect to faculty FTEs, teaching a lab-intensive course like this may require additional teaching FTEs in some departments.

The content of an agriscience methods course should be structured around major agricultural systems and major management practices in agriculture. (See Buriak & Osborne, 1995, for a suggested systems format.) Both biological and physical science applications in agriculture should be addressed in the course. Students should have the opportunity to actually perform key labs that they would likely teach to their own high school students (see Osborne, 1994, as an example source). As each lab is performed, the class must be challenged to consider the most effective teaching approaches and methods that they can use in teaching these labs to their students.

**Can Teacher Educators Deliver?**

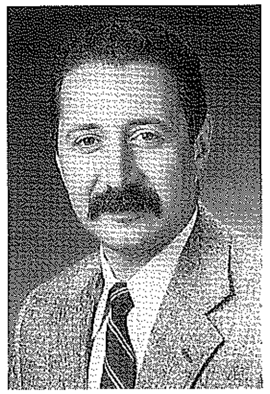
Teaching an agriscience methods course could cause great anxiety for many agricultural teacher educators. Like high school agriculture teachers, teacher educators would also have a wide gap in their technical knowledge base in agriscience. Getting prepared to teach the technical content of the "Teaching Agriscience" course would require many hours of self-study and professional development. However, teaching a course such as this would allow teacher educators to establish strong connections to the field of agriculture and faculty colleagues in agriculture. In addition, teaching this course

*(Continued on page 23)*





# The Physical Sciences and Agriculture



*BY: PHILLIP BURIAK*

*Dr. Buriak is an associate professor of agricultural engineering at the University of Illinois, Urbana.*

Physical Science Applications in Agriculture: Why an issue of The Agricultural Education Magazine devoted solely to the physical sciences? Many agricultural educators may think that the physical sciences are synonymous with, or limited to, agricultural mechanics. Many teachers who teach in programs of horticulture, natural resources, environmental sciences, and plant and animal production may immediately choose not to read this physical science issue. I hope this narrow view is not the case with our national emphasis to enhance science instruction in agriculture.

The physical sciences explain or control all aspects of agriculture, from production through processing through distribution. Water quality, water movement/flow, soil physics, soil fertility/chemistry, and soil and water interactions are explained according to physical laws and principles. The physical sciences also explain and control many biological processes critical to plant and animal growth, e.g., water and nutrient uptake in plants and chemical and energy cycles in animals such as the conversion of ATP (adenosine triphosphate) to ADP (adenosine diphosphate). These topics are important to study in horticulture, production agriculture, and environmental sciences, as well as agricultural mechanics.

The structural and environmental control systems used in agriculture also behave according to physical laws and principles. Housing for animals and plants and storage facilities for production inputs and products cannot be studied without some understanding of the physical sciences. Physical properties of materials, air-water vapor-temperature relationships, and heat transfer are just a few topics found in structural and environmental control systems. We must also consider the biological products and materials (grain, plants, animals) and how they interact with the environments that we design and control for them.

The study of energy, power, and machine systems is founded in the physical sciences. Advances in technology and efficiency are achieved only when the body of knowledge called science is understood. Processing systems such as freezing, drying, cooling, extruding, and chemically preserving, are physical processes. Even explaining how popcorn pops cannot be done without an understanding of the physical sciences. The physical sciences explain or control all agricultural processes and applications.

This magazine issue also focuses on Agricultural Applications. Agriculture is an applied science, and therefore agriculture obviously has strong connections to science. It is not sufficient to teach and learn science as a set of terms or concepts for recall to take a test. This learning is inauthentic; it is not real. We must teach students so that they learn science in an authentic, real way, developing a true understanding of the way things work. Agriculture provides the rich examples needed to teach real science. The National Research Council says that students should learn science by conducting experiments rather than memorizing information from a textbook. Agriculture and our problem-based teaching is a perfect vehicle for teaching experimental, process-based science.

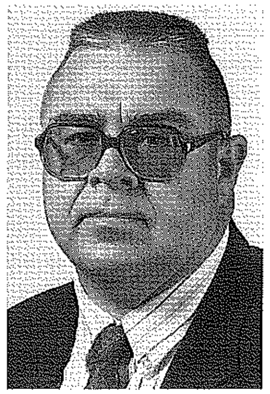
Physical science and its agricultural applications fit with all programs and allow us to teach science as knowledge and process. I hope this issue spawns your thinking on how you may incorporate the physical sciences and apply them to your areas of interest. ■

## COMING IN FUTURE ISSUES . . .

***"Go to the Head of the Class"***

A column by Dr. Gary E. Moore, professor of agricultural and extension education at North Carolina State University, Raleigh, and historian for the American Association for Agricultural Education.

# Using Experiments To Teach Agriscience



*BY: GLEN M. MILLER*

*Dr. Miller is an associate professor in the department of agricultural education at the University of Arizona, Tucson.*

YOU ARE DIFFERENT!!!! YOU ARE UNIQUE!!! STUDENTS LIKE TO COME TO YOUR CLASS!!! STUDENTS LEARN FROM YOU!!!! STUDENTS REMEMBER WHAT YOU TEACH!!! STUDENTS **APPLY** WHAT YOU TEACH TO THE REAL WORLD!!!

Many teachers are really worried about increased science being integrated into the agricultural education curriculum. They ask themselves "What will keep the principal from replacing me with a science teacher?" Relax, you really are different, and what makes you so special is what makes agricultural education so special - it is real.

Experiments in agriscience are old and they are new. They are as old as seeds wrapped in paper towels to check germination rates, and they are as new as recombinant DNA.

This is not new. We have always taught the scientific principles which form the foundation of agricultural mechanics. We have not always named the principle for the student. Agricultural mechanics is a perfect vehicle to teach physical science. Scientific experiments are directly translated into applications in agricultural mechanics. I would like to share some experiments I find useful in teaching scientific principles through agricultural mechanics. One experiment that develops student interest and can be directly translated into an agricultural mechanics wood construction activity, is the holding power of different fasteners. In this experiment, I assemble several different stud and plate configurations using glue, 8 penny smooth box nails in a toenail configuration, and 16 penny smooth box nails nailed on an end grain basis (see photo 1).

**Photo 1.** *2 x 4 studs fastened with glue, 16 penny nails, and 8 penny nails. (Photo courtesy of Glen M. Miller.)*

The lumber is placed in a device developed by Dr. Clinton Jacobs. This device consists of a lever arm that has a fulcrum with a 10 inch to 4 inch ratio. The end of the lever arm has a 1/2 inch square hole which accepts the drive end of a torque wrench. A bending beam type foot pound torque wrench is then placed in the hole and the lumber is pulled apart (see photo 2).

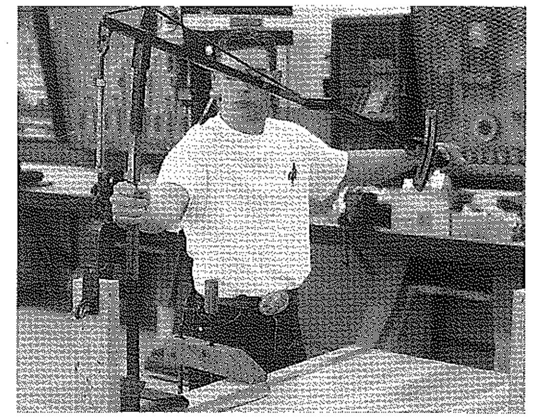


**Photo 2.** *James Perry prepares to apply a destructive load to a wood joint. (Photo courtesy of Glen M. Miller.)*

Allow the students to predict the force required to destroy the joints. Students will almost always assume the nail joint will be the strongest. In the test done for the photographs in this article, the 8 penny toe nail joint read 70 foot pounds on the torque wrench while the 16 penny end nailed joint produced 100 foot pounds and the hot glue joints require a pressure of 145 foot pounds. (Note: Be careful if you choose to duplicate this experiment. The glue joint will fail forcefully without warning.)

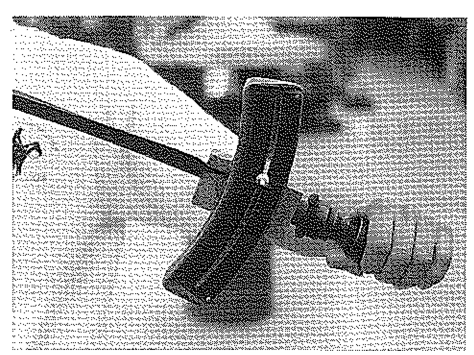


**Photo 3.** *Torque is measured and the principles of the lever are used to calculate force. (Photo courtesy of Glen M. Miller).*

Another effective translation of physical science in agricultural mechanics was created by Dr. Phillip Buriak. Dr. Buriak developed an outstanding exercise in the conservation of energy that can be translated into power train exercises on production or horticulture machinery. In this experiment, students can visualize gear ratios and speed on a familiar ten speed bicycle. Photo 5 below shows a simple modification of a ten speed for class use.





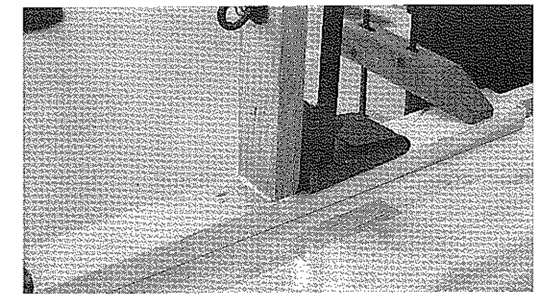


**Photo 4.** *Hot glue makes a very strong joint vertically. Great force is required to cause failure. (Photo courtesy of Glen M. Miller).*

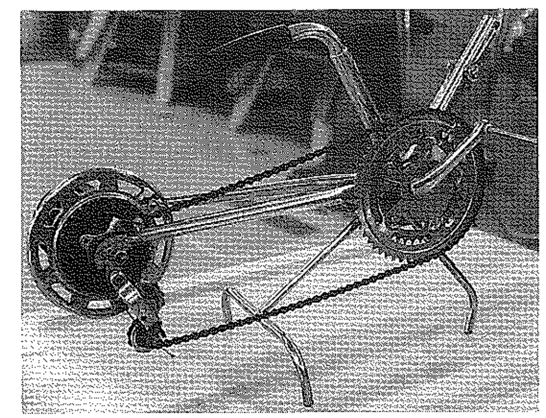


**Photo 5.** *The ten speed bicycle is an experimental device used to teach the conservation of energy. (Photo courtesy of Glen M. Miller.)*

The scientific concept of the conservation of energy is illustrated in the Photo 6 below.

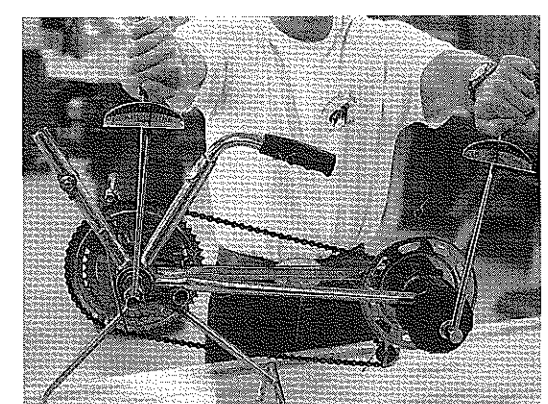


**Photo 6.** *Speed and torque can be compared using the ten speed bicycle. (Photo courtesy of Glen M. Miller.)*

By placing an inch pound torque wrench on each axle, the input and output torque of the ten speed can be measured through all ten gears. Students can then directly observe the relationship between a speed ratio and torque ratio. The principle of the conservation of energy is revealed on a familiar speed bicycle. Dr. Buriak has included this activity is the book he co-authored with Edward W. Osborne entitled Physical Science Applications in Agriculture (1996) published by Interstate Publishers, Inc., Danville, Illinois.

The scientific principle underlying the practical use of electricity is a mystery to many. Students have great difficulty visualizing magnetic lines of force and the induction of current in conductors. One experiment that helps students visualize magnetic lines of force is the placing of a bar magnetic on the screen of your overhead projector. Place a piece of acetate over the magnet and turn the projector on. Sprinkle iron filings or shavings out of the metal cutting band saw on the acetate. The filings will align themselves with the magnetic lines of force. Dr. James A. Walters published a terrific experiment in the May 1990 issue of the School Shop (Tech Directions) magazine. In his experiment, he constructed a device consisting of four pieces of copper pipe placed one inside of each other. The pipe sizes are 1 1/4 inches, 1 inch, 3/4 inch, and 1/2 inch by 36 inches in length. The pipes are placed one inside the other with short lengths of 14 gauge copper wires used as spacers and soldered in place. See photos 7 and 8 that follow.

The experiment consists of dropping a cow magnet (purchased from a veterinary supply house) through the inner most pipe. Then drop a piece of 1/2 inch cold rolled steel cut and shaped to resemble the cow magnet. Students will immediately notice the difference in speed between the cow magnet and the piece of 1/2 inch mild steel. See photo 9 below. →

*(Photos courtesy of Glen M. Miller.)*

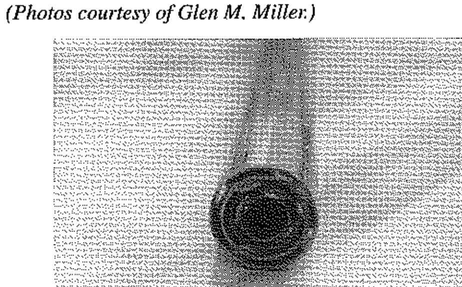


**Photo 7.**

**Photo 8.**

Photo 9.

The obvious question to ask the students is WHY? Why does the magnet fall at a slower rate than the mild steel. The magnet falling through the copper pipe induces a current in the pipe. It is the same scientific principle involved in the generation of electricity, the operation of an electric motor, the ability of a coil to step up or step down electricity. As the current is induced, a magnetic field is also created which is the same polarity as the magnet. The magnet is repelled by the magnetic field it is creating.

A very simple experiment can be used to illustrate several important scientific principles. The operation of a venturi is a concept that is easily demonstrated with a soda straw, a cup of water, and an air source. See the photo 10 below.

**Photo 10.** *(Photo courtesy of Glen M. Miller.)*

The air is discharged across the top of the tube at a high speed, just as a venturi in a carburetor speeds the air above the tube that reaches into the gasoline supply. The effect is the same, but much less flammable. See the photo 11.

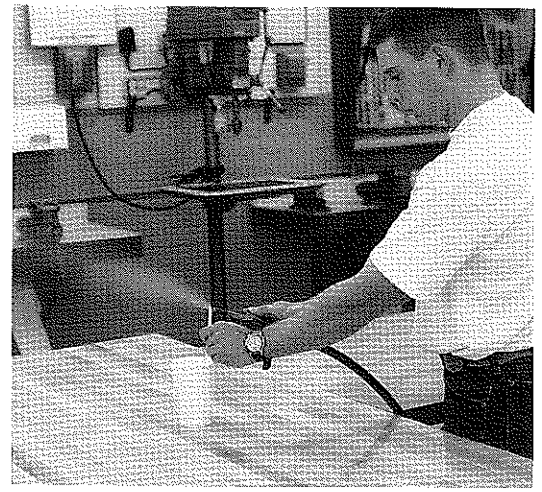


**Photo 11.** *(Photo courtesy of Glen M. Miller.)*

This same experiment can be used for thermodynamics illustrations. The mist coming from the tube immediately cools the air in the area. This mist can be safely directed toward students to illustrate the principle of evaporative cooling. As the water changes to a gas, it absorbs heat. As refrigerants evaporate inside an evaporator, they also absorb heat. You can probably think of other experimental uses for this activity.

Other experiments I find useful include the principle of work. Using a tool box, I call a student forward to lift the tool box. The student is asked to hold the tool box, and the other students are asked to tell me what is happening. It is relatively easy to get the concept that the student holding the tool box is applying force to the bottom of the box. The concept of work follows when then students think through the process of lifting the tool box from the floor. Two measurements are then taken, the weight of the tool box and the distance it was lifted. You and the students can then compute the foot pounds (distance x weight) required to move the box.

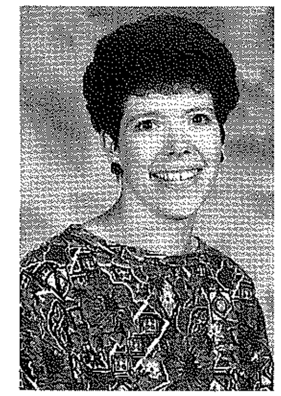
The concept of torque is also easily illustrated in a humorous way. Ask a student to come forward and hold one end of an eight foot 2 X 4. The instructor can then use a spring scale, such as a fish scale, to place a load on the far end of the 2 X 4. Instruct the student to resist the effort to twist. Of course, the leverage of the 2 X 4 easily overcomes the strongest student. Only a few pounds of force is required to twist the student.

A wealth of experiments exists that make teaching exciting. A great way to share your teaching experiments is through our professional organization and the Ideas Unlimited Contest. Take a moment today and share one of your great teaching experiments with someone else.■





# Oooh-Ahh: So That's How It Works!!



*BY: DIANA LOSCHEN*

*Ms. Loschen is an agriculture instructor at Tri-Point High School in Cullom, Illinois.*

Have you heard your students oooh in amazement lately? Ever? Well, if the answer is no, perhaps teaching some Physical Science Applications in Agriculture (PSAA) labs, or incorporating some labs into your current curriculum is the answer. As agricultural educators, we have available to us a multitude of resources—in fact so many that there often is not even time to review all of them, much less utilize them. Don't let PSAA, or BSAA (Biological Science Applications in Agriculture) for that matter, fall into the overlooked category.

I'll never forget the first time I utilized a PSAA lab! I had been teaching for approximately 6 years. At the time, one of the classes I taught was a semester of electricity. I decided that I would incorporate a PSAA lab dealing with insulators and conductors into the course. The lab was going to be set up to incorporate various items into an electrical circuit to see if the light at the end lit, proving, of course, which items were conductors (the light bulb lit) and which were insulators (no light). The students and I surveyed the list of items suggested in the lab, and each student added another item to the list. We then formed our hypothesis on each. I recorded everyone's "guesstimation", and promised a prize to the one who got the most correct as revealed by our testing. Among the items added was a gum wrapper. Most students failed to realize its ability to serve as a conductor. When the gum wrapper was inserted into the circuit, and the light bulb lit—there were many involuntary sighs of amazement! It was a good lab; however the greatest thing for me, as a teacher, was hearing those ooohs and ahhs. We don't get to hear this often at the high school level!

Not time to rework your entire curriculum? No room for new curriculum? Don't worry, utilizing Physical Science Applications in Agriculture labs is a great way to reinforce topics which you already teach. Incorporate the labs as a reinforcement of things which are currently taught. This allows students to see a practical, hands-on application related to agriculture for the scientific principles which they learn. What's even better, you don't have to be teaching physical science to incorporate PSAA lessons. It nicely complements many agricultural mechanics concepts which we teach in our agriculture departments.

Teachers looking for ways to challenge the student who excels in class might find PSAA labs as the perfect enrichment activity. There is nothing "watered down" about the principles in PSAA. Completing the lab to the depth and comprehension which is recommended and possible, it requires the student to use upper level cognitive skills, and to truly comprehend the concept being studied. This is not a matter of giving a student information which he or she can memorize and spew back in a few days. PSAA is thorough, requiring in-depth understanding of the topic.

The hands-on aspect of PSAA appeals to many teachers and students alike. As educators, we all know that students learn in different ways. While one student may learn best by group work, another may learn most effectively by lecture and /or discussion. However, I would wager that most students will learn best and retain comprehension most effectively when their instruction involves hands-on, laboratory exercises to compliment the theory behind the lab.

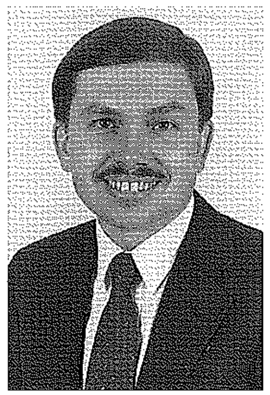
What are some of the challenges of teaching PSAA? First and foremost, you, as the instructor must do adequate planning. It does take some time to asses the lab, inventory materials to see what you need to acquire in order to perform the lab, and to do a trial run of the lab. Of course acquiring materials does require some funding. While some of the items required for the labs will necessitate purchases, many of the items needed are common household or laboratory item. Many of the items needed are already located in your agriculture laboratory, and many of the items which need to be purchased can be found at the local discount store. I would encourage you to select labs during the summer and order/secure ALL materials you will need at that time. After the school year starts, we typically don't have time to worry about ordering more supplies. It is much easier to order all items at once.

I have found that in teaching a lab oriented class, the students have an even bigger adjustment! No longer is their grade based on an

*(Continued on page 22)*

THEME ARTICLE

# Keeping Agriculture in Agriscience




BY: JEFFERY W. MOSS

*Dr. Moss is an adjunct associate professor in the department of agricultural education at the University of Illinois, Urbana.*


For agricultural education, the decade of the 90s belongs to agriscience. Schools now offer agriculture classes which count for science credit towards high school graduation, and in some states these courses are also recognized as laboratory science classes for college admission. Six years ago there was one agriculture textbook with agriscience in the title, today there are nearly a dozen. The National Council for Agricultural Education has provided instructional materials and teacher in-service on agriscience using Fast Plants and Bottle Biology, Food Science, and Applied Environmental Science. The attention given to agriscience is significant; curricular changes are occurring rapidly.

Actually, the merging of science and agriculture isn't just a 1990s phenomenon. Agriculture was taught as a science when it first became part of the school curriculum, and that was 20 - 25 years before the Smith Hughes Act of 1917. The concept of learning science principles through agricultural applications was being written about in the 1890s as well as the 1990s. Although the concept of agriscience may be 100 years old, the content is certainly different, as the knowledge level for both science and agriculture has become more sophisticated.

### Benefits of Agriscience

Does agriscience represent an improvement in agricultural education? Most people seem to think so. Agriscience programs are attracting a new group of students to agricultural education. These students aren't particularly interested in a career as a farmer, driving a combine or managing a farrow-to-finish swine operation. But, they are enrolling in agriscience courses because you can *learn* [science and agriculture] *by doing* [science and agriculture] in these classes. In general, agriscience has given agricultural education its new image of being more than farm animals and machinery (you know, the sows and plows metaphor). Agriscience is also perceived as a more rigorous curriculum, probably because of its non-vocational focus and link to a traditional academic subject, science. In an era of school reform, a more rigorous curriculum is another positive for agricultural education. And finally, agriscience is providing education about agriculture, functioning as an agricultural literacy course which is recognized as a critical need for the future. With all these benefits it's hard to imagine any drawbacks to agriscience.

But wait a minute. In our attempt to integrate science and agriculture and in our rush for a new more sophisticated image are we sacrificing anything? I think it's possible that we are. Unfortunately, I believe what's being lost from a few of our agriscience programs is the agriculture. I don't think it has happened by design. But, as attention shifted towards upgrading the science content of agriscience classes, it shifted away from agriculture in some programs. As new agriscience curricula evolved, it focused on the content and process of learning science primarily through experiments conducted in the classroom. If students get science credit, they need to learn the science, agreed. Does that mean learning less agriculture? Is FFA less intracurricular in agriscience? Is SAE less important for agriscience students? I don't believe so, and it may only require that we re-examine our methods of teaching agriscience. In our search for something new, we don't have to leave behind certain components of agricultural education which have made the program unique. A strength of agricultural education for the past 70 years has been the integration of classroom instruction, FFA, and supervised agricultural experience. We need to be sure that the curriculum for agriscience includes the proper mix of all three of these components. If agriscience is to serve a function of agricultural literacy, then agriculture must remain a focus of agriscience courses.

### Agriculture is the Application

Agriculture and science are a natural combination. Jill Bucher, a science teacher in Pekin, Illinois who recently took her first agriculture course, a methods of teaching biological science applications in agriculture class, said it quite well. "The key to science education today is to not only have a general understanding of the biological vocabulary and processes but to be able to apply this information to solve problems. [Agriscience] lets the student go beyond just the basic knowledge and actually apply the biological information." The real


*(Continued on page 15)*




# Sharpening Twist Drills


Jack McHargue, Instructor
Dan Hood, Leading Actor and Technical Consultant
Department of Agricultural Engineering


The ability to sharpen twist drills by hand is a very valuable skill for anyone who spends time in a metal shop. Even though there are drill sharpening attachments for grinders, they require setup time and often have complicated instructions. Time is a critical factor since many shops charge at least $40 per hour for labor. The short time required to sharpen drill bits pays dividends in faster production and increased longevity of drill bits.

*Use and Care of Twist Drills*, which can be purchased for $1.00 from Cleveland Twist Drill, discusses parts of drill bits and terminology.

## Starting Position

1. Hold the cutting end of the drill between thumb and forefinger of right hand and lay the forefinger on the grinder rest. The finger will be kept stationary and should not be lifted from the grinder rest during sharpening (Fig. 1).
2. Hold the shank of the drill between thumb and forefinger of the left hand as in Fig. 1.
3. The cutting edge of the drill should be parallel to the top of the grinder rest as in Fig. 3.
4. The drill should be held at a 59° angle to the centerline of the stone (Fig. 1).
5. The center line of the drill should point slightly above the center of the stone as in Fig. 2.

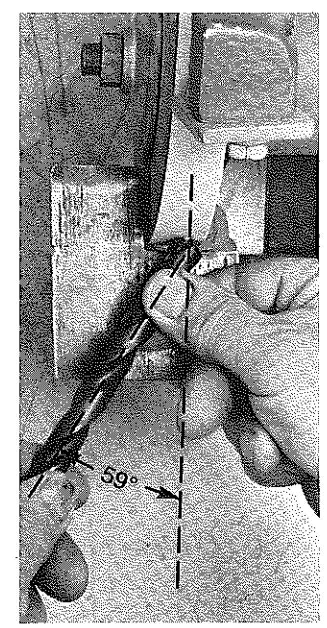



**Figure 1**

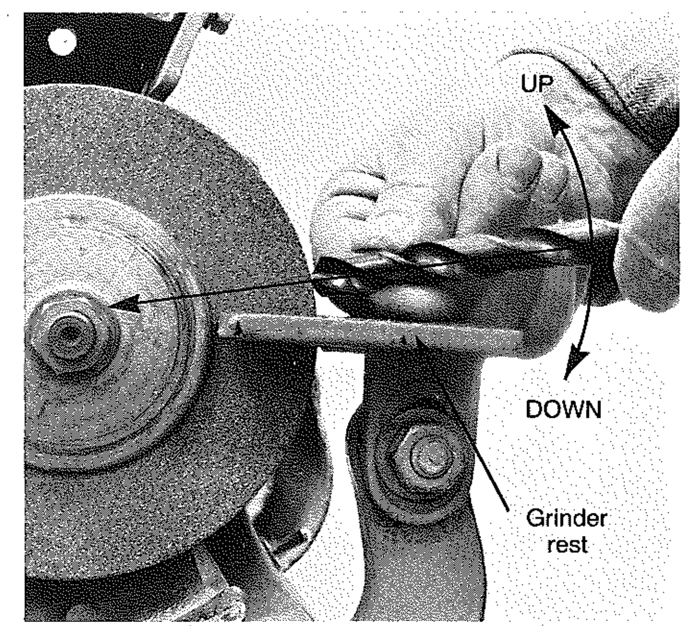



**Figure 2**

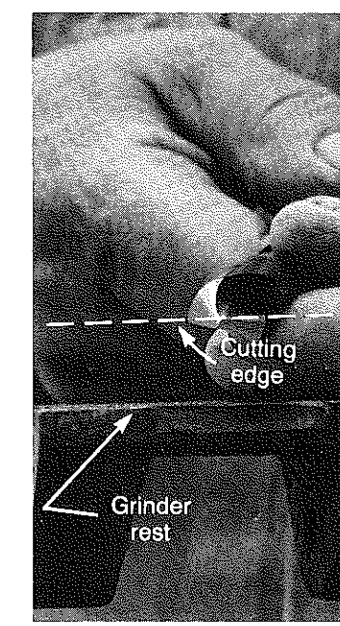



**Figure 3**

University of Idaho
College of Agriculture

## Grinding the Drill

Move the drill to the stone and as the grinder makes contact, rotate the left thumb and forefinger down and to the left as in Figs. 4 and 5. The knuckle of the left forefinger indicated by the X in Figs. 4 and 5 should act as a pivot and should not move. The drill will rotate about 1/6 turn because of this motion as can be seen by the rotation of the grid attached to the drill in Figs. 4 and 5. Do not rotate the drill between left thumb and forefinger as this would cause rotation of more than 1/6 turn and would cause an S-shaped chisel point. An S-shaped chisel point decreases the length of cutting edges and requires excessive pressure while drilling.

Do not jab the drill into the stone—use even pressure throughout the grind.

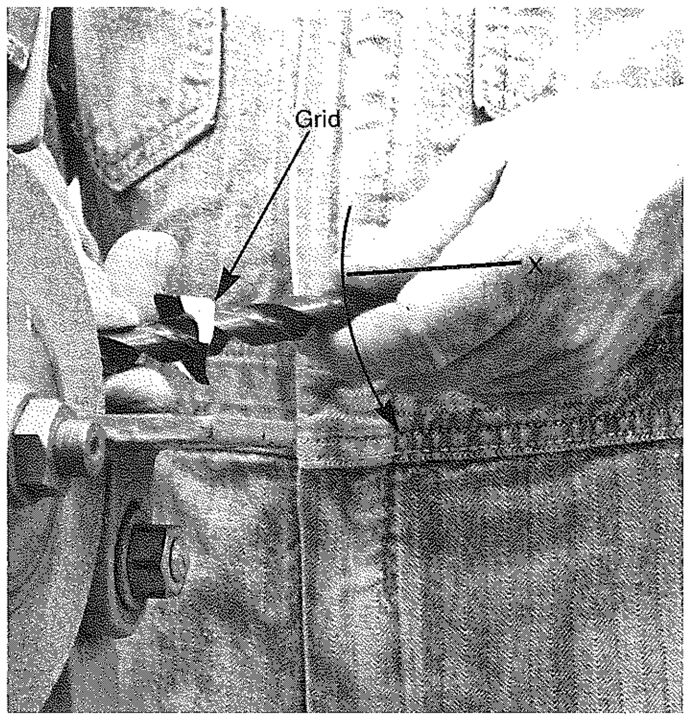



**Figure 4. Starting position**

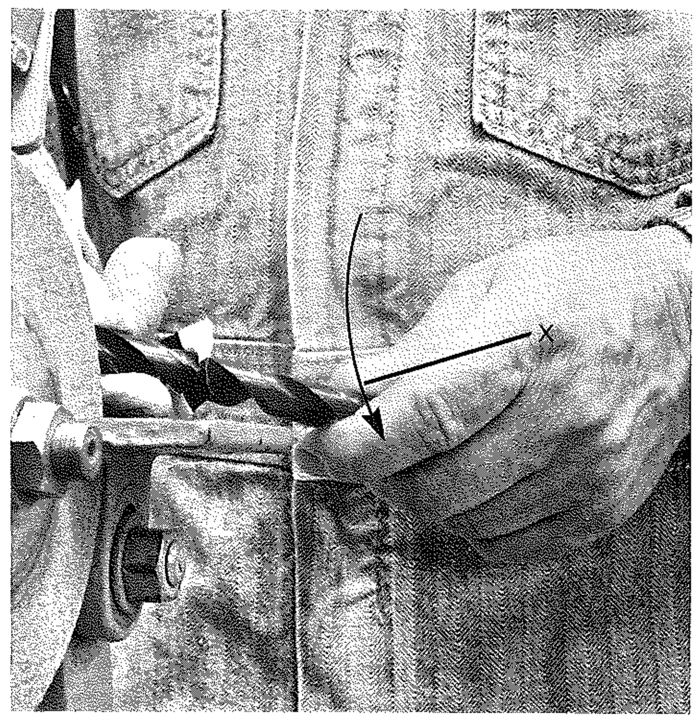



**Figure 5. Ending position**

Repeat this grind, alternating between cutting edges, until the cutting edges are sharp, both cutting edges make a 59° angle with the axis of the drill, lengths of both cutting edges are equal, and there is an 8° to 12° lip clearance. The chisel point should be straight and form a 120° to 135° angle with the cutting edges.

## Measuring Twist Drills

1. Use a drill bit gauge or protractor head square to make sure cutting edges form a 59° angle to the axis of the drill (Figs. 6 and 7).
2. Use a drill bit gauge or dividers to make sure lengths of cutting edges are equal to each other (Figs. 6 and 8).
3. Use a protractor head square to measure lip clearance. Lip clearance of the drill in Fig. 9 is 90° minus 79° = 11°.
4. Use a transparency made from the Cleveland drill book that shows the cutting end of a correctly sharpened drill to measure lip clearance at the cutting point. When the transparency is overlaid on the drill in Fig. 10, it is evident that the angle formed between the chisel point and the cutting



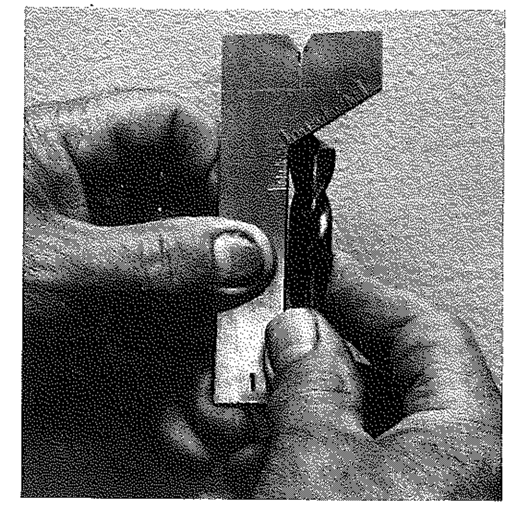


**Figure 6**

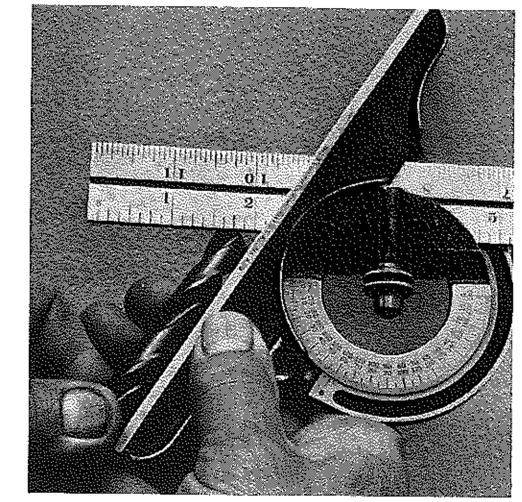


**Figure 7**

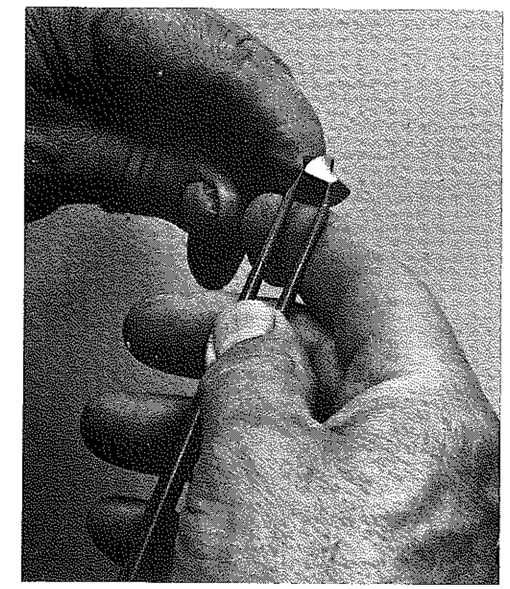


**Figure 8**

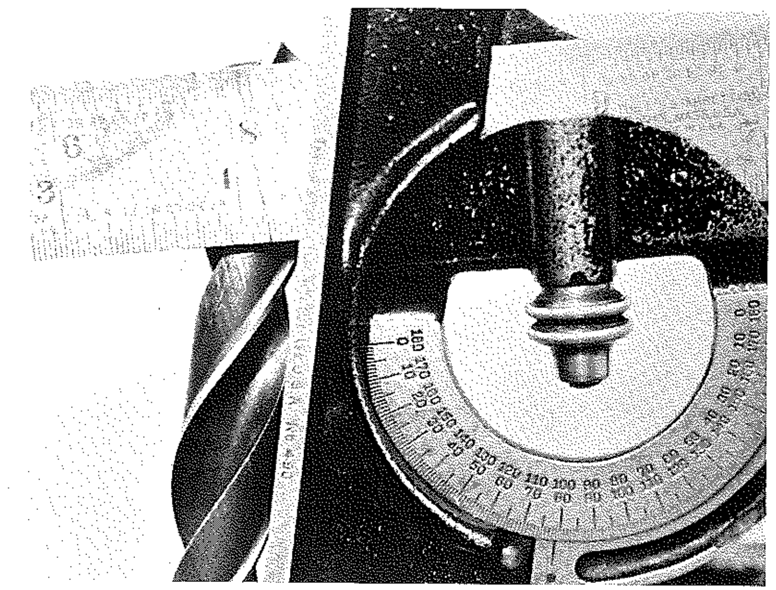


**Figure 9**

edges is too close to a 90° angle. This indicates a lack of lip clearance at the chisel point. Even though lip clearance may be correct at the margin, this drill would require excess pressure to make it cut. Fig. 11 shows the correct angle of the chisel point to cutting edge.

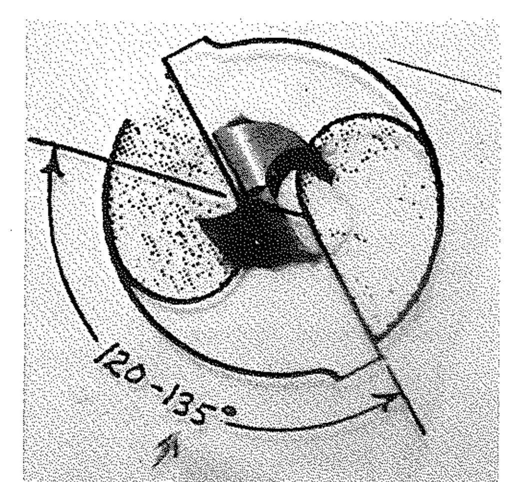



**Figure 10**

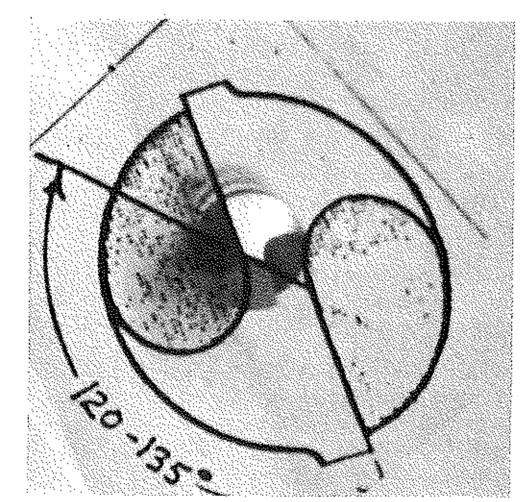



**Figure 11**

## Correcting Faults of Twist Drill Sharpening

| Faults: | To Correct |
|---|---|
| • Unequal length of cutting edges. | • Grind short edge more. |
| • Not enough lip clearance. | • Move shank toward DOWN (Fig. 2) at start of grind. |
| • Too much lip clearance. | • Move shank toward UP (Fig. 2) at start of grind. |
| • S-shaped chisel point. | • Do not rotate drill as much. |
| • No lip clearance at chisel point. | • Not enough movement to left (Fig. 3). |

## Other Hints

Use a bar of Ivory soap as a substitute for metal. Cutting the soap with a drill bit held in the hand will effectively demonstrate the proper cutting of a drill bit. It is difficult to remove even soft soap with a drill bit that lacks lip clearance.

Make sure grinder guards are in place while grinding. Guards were removed for clarification purposes only for this paper.

**Editor's Note:** Please feel free to remove this centerfold and make as many copies as needed.

### Reference

Use and Care of Twist Drills, 1978 Cleveland Twist Drill, P.O. Box 91839, Cleveland, OH 44101.



### *Keeping Agriculture in Agriscience*

*(Continued from page 10)*

understanding of science comes through associating science concepts and principles with relevant applications to life. Agriculture happens to provide the food and fiber for everyday living.

To maintain a balance of science and agriculture, I recommend using real agriculture problems as an approach for introducing science content. Problem-solving has been used in agricultural education for a long time. Be aware, however, that to be effective the problems must be meaningful to the students. You will have to look beyond the familiar production-oriented problems we solved in the past when teaching agriscience for the future. It can be done with perseverance and patience according to Mindy Elvidge, a first year agriculture teacher at Monticello, Illinois. "I just keep hitting them with problems until something is relevant to their life and grabs their interest."

Keeping the proper balance of agriculture in agriscience also requires teachers to keep current with new agricultural technology. New developments are reported monthly in agricultural magazines, journals, and newspapers. *Agricultural Research*, a publication of the U.S. Department of Agriculture, is an excellent resource available free to all members of the National Vocational Agricultural Teachers Association. Multiple copies of *Agricultural Research* can also be requested for classroom use. Keeping current in agriculture requires investing time in learning about the new developments. You may also keep subject matter current by inviting resource speakers and scheduling field trips to agricultural businesses, allowing students to see first-hand how science is helping to solve important agricultural problems.

FFA has recognized a change in its customers, the students, and is responding by developing new programs and activities for members. Agriscience student competition, agricultural science fairs, and an overhaul of career development events are examples of making programs relevant to the agriscience student. As a teacher, if you have changed your curriculum to agriscience but still participate in exactly the same events (FFA contests) of five years ago, maybe it's time to shift priorities and try some new activities. It requires some extra effort and won't be easy, especially if you've won the section poultry contest the past five consecutive years. If we want agriscience students to benefit from the FFA experience, we need to provide those opportunities which match their interests. FFA should be as intracurricular to agriscience as it has been to vocational agriculture for the past 68 years.

A fresh look at Supervised Agricultural Experience may also be required for agriscience. Agriscience students may show little interest in crop and livestock projects for an SAE. Consequently, they may not need to learn the finer details of keeping a production record book. However, in agricultural research, record keeping or documenting the research protocol is as important as the results of the experiment itself. There's definitely a place for SAE and record keeping for all students in agriscience. The idea of providing planned, practical activities conducted outside of scheduled class time in which students develop and apply agricultural knowledge and skills is as appropriate for agriscience as it was for traditional vocational agriculture. I recommend you obtain a copy of *Experiencing Agriculture: A Handbook on Supervised Agriculture Experience,* and review the nature of supervised agricultural experience and your responsibility for planning, conducting and supervising SAE's in light of the changing times and interests of students in agriscience programs. Done well, supervised agricultural experience provides a powerful learning experience for agriscience students.

Student achievement in agriscience is commonly measured in two ways, performance on quizzes or tests and student laboratory reports. In both situations it's important to assess what students have learned about science and about agriculture. Test questions covering how an agricultural practice is impacted by a science concept or principle is as important as defining the principle. As an example, students should be able to explain common planting practices for local crops in addition to listing the environmental factors affecting seed germination. Similarly, when students write conclusions in their laboratory reports they should be able to relate information learned in the experiment to management practices followed by producers. Once more, it's a matter of balancing agriculture and science in the evaluation of student performance.

A good method of evaluating teacher performance is through self-assessment. If you teach an agriscience class, rate yourself on the following statements about how agriculture is treated in your agriscience courses.

*(Continued on page 24)*

THEME ARTICLE

# Safety In The Agriscience Laboratory

*By: Larry Pfeiffer*

*Mr. Pfeiffer is a district representative for the Facilitating Coordination in Agricultural Education program in Carlinville, Illinois.*

Is the agriscience laboratory at your school a pleasant and safe environment in which to work and learn? If you can answer yes to this question without hesitation or reservation, chances are your school district has an effective laboratory safety policy. If you aren't quite sure if your agriscience laboratory is pleasant and safe, it may be time to review your safety policy.

Safety is a very important concern in agriscience courses because students are attempting to learn new skills, working with unfamiliar equipment and using materials that can pose some degree of hazard. The very nature of hands-on activities makes laboratories more vulnerable to accidents and mishaps than seat work.

It is beyond the scope of this article to provide a comprehensive safety policy for all agriscience programs, but it will offer a framework for reviewing agriscience laboratory policies that are conducive to a pleasant and safe environment.

**Sample Safety Inspections**

Safety checks of the physical layout and condition of the agriscience laboratory are an effective way to document a safety inspection. It is recommended that a safety inspection be repeated every three months.

School:______________________ Room:______________________

Inspector:______________________ Date:______________________

| Check for proper operation of: | Satisfactory | Unsatisfactory | Date Remedied |
|---|---|---|---|
| Gas cylinders | | | |
| Electrical outlets | | | |
| Fume hood | | | |
| Auxiliary ventilation | | | |
| **Condition of:** | **Satisfactory** | **Unsatisfactory** | **Date Remedied** |
| Fire extinguishers | | | |
| Fire blanket | | | |
| First-aid kit | | | |
| *Spill clean-up kits | | | |
| **Hazards** | **Satisfactory** | **Unsatisfactory** | **Date Remedied** |
| Exits are not blocked. | | | |
| Aisles are not cluttered. | | | |
| Chemicals are not stored in room. | | | |
| Chemicals are properly labeled and stored. | | | |
| **Housekeeping** | **Satisfactory** | **Unsatisfactory** | **Date Remedied** |
| Sinks and sink traps | | | |
| Fume hood | | | |
| Work counter tops | | | |
| Table tops | | | |
| Floors | | | |
| No food or drink | | | |
| Broken/damaged equipment | | | |
| Waste containers for chemicals | | | |

*Spill clean-up kits can be made from two five gallon plastic buckets. Fill one bucket with kitty litter and the second with baking soda. Cover each bucket with plastic food storage wrap and write on the plastic wrap the contents and "spill clean-up kit".

**Responsibilities**

Safety in the agriscience lab is a shared responsibility. A safe laboratory program requires participation by teachers, students, administrators, and the community.

Administrators' Responsibilities

1. Provide a safe and effective laboratory area for agriscience activities.
2. Provide regular inspections of the laboratory and document inspection and maintenance of safety equipment.
3. Comply with state and federal regulations for disposal of chemicals.
4. Establish a school safety committee and ensure that it meets regularly.
5. Attempt to provide a class size appropriate to the laboratory and in keeping with recommendations of professional societies.

*Food Science and food processing laboratories are popular physical science activities. (Photo courtesy of Larry Pfeiffer).*

Teacher's Responsibilities

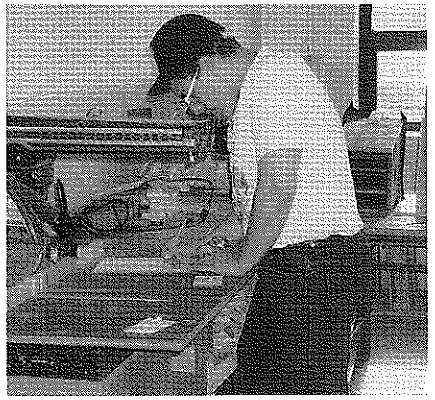
1. Set a good example by observing all safety rules, wearing proper protective equipment, and being enthusiastic about safety.
2. Know the properties and hazards associated with each material used in a laboratory activity before the students carry out the procedure.
3. Ensure that all safety equipment is present in the laboratory and is in good working condition.
4. Provide eye protection and other necessary personal protective equipment for students and instruct students in their use.
5. Before each laboratory experiment, instruct students about the hazards associated with each activity. Reemphasize the use of eye protection and other necessary personal protection equipment.
6. Ensure that all containers are properly labeled with their contents and hazards.
7. Make sure that all safety rules are obeyed.
8. Promptly clean up or direct the clean-up of spills.
9. Dispose of chemical wastes properly.
10. Return chemicals and hazardous materials to locked storage after use.
11. Report any accidents or unsafe conditions in writing to your department chairperson, principal, or other appropriate administrator.

Students' Responsibilities

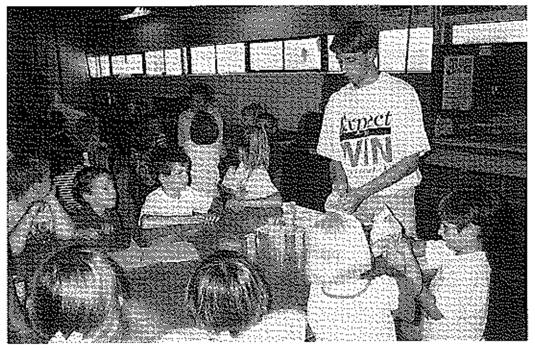
1. Understand the experimental procedure before starting to work in the agriscience laboratory.
2. Be familiar with the properties and hazards of the chemicals you are working with.
3. Obey all safety rules and regulations and sign a safety contract.
4. Know the location and use of all safety equipment in the laboratory.
5. Clean your work area immediately after use. Obey good housekeeping practices.

Parents' Responsibilities

1. Read the laboratory safety rules. Discuss these rules with your child. Sign the safety contract indicating that you have read and understood the safety rules.
2. Work with the teachers and administrators at your school to develop a strong safety program. →



*Student safety tests are an essential component of the local school district's safety policy. Many schools document safety skills in student portfolios. (Photo courtesy of Larry Pfeiffer).*



*Literacy activities are often conducted in the agriscience laboratory. This photo illustrates that students have a pleasant and safe environment in which to work and learn. (Photo courtesy of Jonathan Morris).*

# Safety In The Agriscience Laboratory

## Agriscience Safety Contract

Dear Student:

An agriscience class is different from some of the other classes in which you are enrolled. It is a lab class and therefore involves activities that are *potentially* hazardous if proper procedures are not followed.

In an effort to make you more aware of safety considerations, the following contract is to be signed by you and one of your parents. It is my hope that you will give some thought to the items listed below and the reasons why they are included in this contract. Also, by having your parent sign, it is my hope that they, he or she will reinforce to you the need for safety in a lab class.

This contract does not absolve either me or the school district of liability if in fact we are found to be negligent. A student's failure to follow the following rules may result in his or her removal from the class.

Sincerely,

Teachers Name
Agriscience Teacher

- ☐ **I will follow all written and oral instructions given by the teacher.**
- ☐ **I will only do the lab work approved by the teacher. No independent work is allowed without explicit approval of the teacher.**
- ☐ **I will not remove any chemicals, tools or equipment from the lab.**
- ☐ **I will not misbehave or engage in any "horseplay" while in the lab.**
- ☐ **I am aware of the locations of the eyewash, safety blanket, and fire extinguisher and know how each is to be used.**

Signature of student______________________________Date________

Signature of parent/guardian__________________________Date________

If you have any questions or comments, please feel free to call me at (school phone #)





# A View from the Agricultural Mechanics Laboratory Egress Opening (Shop Door)

There seems to have been an obvious increase in business at the teachers R&R center lately. Well maybe school hasn't been as smooth as it could have been, or maybe folks have just been dazed by what's coming out of Alexandria, Virginia. As I understand it, the FFA will no longer hold *CONTESTS*. It will, however, sponsor *CAREER DEVELOPMENT EVENTS*. This new development may have been too much for older and wiser advisors. It may have been the straw that drove Tess into retirement.

I sometimes wish I could join him. Why, I can read the headlines in the *Meridian Times*—local chapter of the FFA places first in the Dairy Career Development Event (CDE) held at the South Hills Institute of Technology. I can see the look on readers as they think to themselves, what the hell is a CDE? Where did the South Hills Institute of Technology come from?

Now I think a little history lesson is in order here. Or should I say Past Historical Education Activity (PHEA)? First, the powers somewhere decided that students should no longer conduct ag projects, but should instead have SOEP (Supervised Occupational Experience Programs). Then when most everyone was becoming comfortable with that term, it was changed to SOE. I guess that this made the acronym easier to remember.

Then it was changed to SAEP (Supervised Agricultural Experience Programs) and shortened to SAE, which I always thought was a fraternity. But again, I was wrong. What I think will be necessary to clean up this mess is a new program called the Supervised Occupational Agricultural Program, also known as SOAP. I don't know, however, if we will be able to afford enough of it, on our limited budgets, to clean up this mess.

To continue with the PHEA, we must now remember that FFA no longer is an acronym for Futures Farmers of America. It stands for FFA. But in some circumstances, it still can stand for Future Farmers of America. Confused? So am I. In addition to removing Farmers from the organizational name, it was removed from the FFA Creed. We (?) changed it to agriculturists.

Now I dare anyone to walk up to a farmer and tell him or her that he or she is no longer a farmer and should now call themselves agriculturists. I guess that if you are a cattle rancher, you should no longer be known as a cattle rancher, but rather, as a Bovine Specialist. This even has an appropriate acronym for this whole column.

What about the change from Vocational Agriculture to Agriculture Science and Technology Education, sometimes known as Agricultural Education. But instead of being called ASTE, it is still most commonly referred to Vo-Ag. Oh well.

Now for the latest issue at hand: the *CAREER DEVELOPMENT EVENTS*. Again allow me to refer to the South Hills Institute of Technology. ***A contest is a contest and a bovine specialist is a bovine specialist, no matter what the politically correct terminology may be!*** And you may quote me on that—but be sure to use the appropriate acronyms.

To put this in perspective, let me go to the sacred high school athletic events also known as *sports*. Now let's change a football game from a football game to the more appropriate terminology: Physical Enhancement Activity. But now that can't be correct because football involves more than just physical enhancement. It also involves mental development as well as building self-esteem and social skills.

Perhaps Social Activity Involving Mental and Physical Development Activities (SAIMP-DA) would be more appropriate. While this does not describe a football game, it may be a much more appropriate term than sports. But then, how will we distinguish between a football game and a volleyball game?

I don't know, but even I am getting confused. I believe I will go back to the South Hills Institute of Technology and try to get a Higher Education Academic Degree. Now if

*(Continued on page 22)*

# Interpersonal Skills: A Need in Agricultural Careers

*By: Gary Waters and Vernon D. Luft*

*Mr. Waters is the coordinator of occupational education services in the Clark County school district, Las Vegas, NV. Dr. Luft is an occupational teacher educator at the University of Nevada, Reno.*

It is clear that educational reform, especially in vocational education, has embraced the concepts of accountability of programs and measurability of outcomes (American Vocational Association, 1994). In a time when government expenditures at all levels are carefully scrutinized for their impact, education is cited for having fallen short on how expenditures affect students and learning (Council of Chief State School Officers, 1994). In fact, the entire educational reform effort appears to swing on that singular concept, and most recommendations does policy changes at national, state, and local levels increasingly discuss the importance and relevance of standards, outcomes, and measures (American Vocational Association, 1994). Government, business, industry, parents, students, and progressive educators are demanding that program improvement and student progress be validated and outcomes measured (Hudelson, 1993). It is evident that if any program, service, or activity expects to be included in future educational legislation or initiatives, the language and concepts of clear and definable standards must be a central focus (Secretary's Commission on Achieving Necessary Skills - SCANS, 1991).

Like other vocational education programs, agricultural careers must embrace skill standards. These skills must be diverse in nature, comprehensive enough to be valuable and used by the occupation where they will be applied, and most importantly, be taught in a practical manner by educators (Smith, 1993; Williams-Coyle & Maddy-Bernstein, 1992).

As vocational education has grown in its support for the concepts of standards and measures, the building of these standards has focused almost exclusively on specific occupational competencies. "Employability skills" were often incorporated into the skills and competencies in general categories of interpersonal skills, communication, or other similar skills and titles. It is refreshing to note that the recently distributed National Voluntary Occupational Skill Standards for Agricultural Biotechnology Technician (National FFA Foundation, 1994) contains a section of standards addressing employability skills. The "employability skills" section contains skills in the categories of resources, interpersonal skills, information, and systems.

The SCANS Report lists five broad "Personal Qualities" as a component to a three-part foundation for education. These personal qualities include: responsibility, self-esteem, sociability, self-management, and integrity/honesty. Additionally, the report lists five competencies, one of which is "Interpersonal: Works With Others". The interpersonal category is further broken down to include: participates as a member of a team, teaches others new skills, serves clients/customers, exercises leadership, negotiates, and works with diversity (SCANS, 1991).

**Interpersonal Competency as an Employability Skill**

One can quickly recognize that the foundations and competencies outlines in the SCANS Report and discussed in other professional publications are a component of employability. Fundamentally, interpersonal competencies are the skills needed to obtain a job, get along in a job, and keep a job. In fact, it is well known that the major reason employees are terminated from employment is not because they cannot competently perform occupational tasks, but rather, they cannot get along with the people with whom they work.

Concepts taught and promoted in interpersonal skill development are fundamental to working with others and getting along on the job. Inappropriate attitudes, language, and behavior should not be tolerated in the workplace. Workers are protected by law and through the courts from being exposed to it and suffering from its effects. Employers are warned that, in addition to offending workers, they themselves will be held accountable and liable for the damages for allowing such inequities to exist. Consequently, employers and schools are at a great risk for the incompetencies of an interpersonally inadequate worker than a technologically inadequate one. A technically incompetent worker can simply be fired. If interpersonal incompetence is found to be rooted in discrimination, monetary liability can result in substantial damage or →



possibly destroy a business and its owner. For further proof of the impact on business of interpersonal incompetencies of workers, we need to look no further that recent court awards for sexual harassment.

As a result, interpersonal education is important as a basic skill and competency for employability. Logically, students in agriculture need to know this fundamental workplace expectation. This interpersonal workforce competency should be considered equal to any technical competency which students or seasoned workers are expected to possess.

The employability skills section of the Agricultural Biotechnology Technical Skill Standards can serve as an excellent basis for developing the necessary competencies. They appear to be relevant to all careers in agriculture, and not just biotechnology. In fact, employability skills should become an essential part of every agricultural skill standards document developed.

If employability skills are important in developing agricultural workers, should texts include a section on the topic? We believe they should. Interviewing some of the recently published agricultural texts, we found that some make a passing reference about the importance of interpersonal skills, while others address the topic with some depth. The text, The Earth and AgriScience, by Crunkilton, Osborne, Newman, Osborne, and Lee (1995) contains an entire chapter on "Developing Personal Skills". This is an excellent chapter which could be used to teach interpersonal skill development.

Students can learn the employability skills through classroom and laboratory activities and management, their supervised agricultural experience program, and FFA activities and programs. Emphasis should be placed on desired workplace behaviors when participating in these various learning situations. The transfer of employability skills to the workplace will occur with fewer problems.

**Interpersonal Skill Development as Program Improvement**

While it is clear that a central element of the Carl Perkins Act is to provide access of special populations to improved vocational education, many argue that the primary purpose of the Act is program improvement and that the needs of special or unique populations (and the services that accompany these groups) have been overemphasized (Fornero, 1994). Others counter with the concept that until access and equal opportunity is extended to all students who seek to participate in vocational education, especially those who are members of special student populations, that substantial and significant efforts should be directed to resolve the inequity (Cassity, 1994). The need for interpersonal competencies is not solely confined to special student groups who are clearly in need of them, but by all students who are participating in vocational education, including agricultural education, and will be employed directly following. Agricultural careers are no less "interpersonal" in nature than any other. In fact, as the agricultural workforce becomes more diverse, interpersonal skills become more important.

Some have strongly claimed that interpersonal education serves primarily the students who are less functional and less "social". This belief further aligns interpersonal education and skill development as supplementary or unique to a specific target group or special population, and thus not a serious component of the main educational reform event and educational initiative of program improvement. Because of the strong belief in interpersonal skill development, agricultural education integrated interpersonal education within the activities of the FFA. These activities are intended for all students, and not only special populations.

It would be inappropriate to think of agriculture and agribusiness employment as focused only on the development of products. Agriculture deals equally with business and services which are largely interpersonal in nature. Interpersonal skills in agriculture are global in value and should be universal expectations of agriculture students. Agriculture products are needed globally, and the interpersonal skills and cultural sensitivities necessary to market them worldwide dictate that the skills must be present in agriculture professionals. As a basic and fundamental principle, the teaching of interpersonal competencies should be included in every secondary and post-secondary agricultural education program.

**Conclusion**

Generally, agricultural educators have embraced and adopted the concept that interpersonal skills should be developed in our students in the agricultural education program. We must continue to promote the development of interpersonal skills as part of "being employable" if we want to help our students become successful in the workforce. Agricultural education can continue doing so by deliberately including activities in classroom instruction, through supervised agricultural experiences, and though participation in FFA activities.

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## Oooh-Ahh: So That's How It Works!!

*(Continued from page 9)*

average of test, quiz, and homework scores, as they are in many subjects. They now earn a grade based upon a whole new set of assessment tools. I am constantly on the lookout for new methods of assessing my BSAA or PSAA labs. Students prepare laboratory reports for many of the labs performed. These lab reports are a splendid opportunity for the students to practice those writing skills, which we are told need development in our young people. At Tri-Point High School, a lab report has ten parts; ranging from a cover page to a statement of purpose and ending with written conclusions, analysis, and interpretations of what happened and why. The students are also asked to include possible extensions and improvements for the lab. This is a good opportunity to gain ideas for the future. We also utilize group work, individual presentations, and computerized and hand constructed graphing of data, just to name a few. The students welcome the change of pace from paper and pencil tests. I do utilize brief quizzes periodically to further check knowledge of the basic concepts. What I am more interested in, however, is that the student comprehends and can use the knowledge gained through the performance of the laboratory experiment.

I could enumerate on many of the labs included in the Physical Science Applications in Agriculture curriculum which may be obtained through the University of Illinois, but instead I would encourage you, as agricultural educators, to get a copy of the PSAA curriculum and try one or two labs with your own students. Another way to get ideas for interesting labs involving physical science principles is to network with your fellow teachers. There are literally tons of innovative ideas for experiments and labs out there which have been developed by teachers just like you and me. There is no need to reinvent the wheel. Take some time to share the ideas and labs which work best for you. No matter where you get the ideas for the labs to teach physical science applications in your agriculture education class, take the time to try it. I think you will be pleased with the results! May you be hearing ooohs and ahhs in your classroom and laboratory soon!

*Editor's note: The PSAA and BSAA curricula were developed by agricultural education faculty at the University of Illinois. Teacher's guides and student texts are available from Interstate Publishers, Inc. (Danville, Illinois) and Vocational Agriculture Service (University of Illinois).* ■

*Student working the agriculture mechanics laboratory to build an apparatus for a PSAA lab. (Photo courtesy of Diana Loschen).*

## Letter To The Editor

*(Continued from page 19)*

you figure out the acronym for that, then give me a call and we'll have a little chuckle—it's the only thing humorous about this whole mess.

Till later, Jim Barnack Sorensen
Kimberly High School
Kimberly, ID 83341 ■



## Preparing Teachers to Teach Agriscience

*(Continued from page 4)*

would require teacher educators to model effective agriscience instruction. In essence, they would return to the "front line" to teach technical content, as opposed to the usual challenge of teaching students how to teach technical topics. In this case, they would teach both the methods and the content. Teaching such a course would no doubt boost the confidence and expertise of teacher educators as they continue their work of preparing high quality agriculture teachers.

### Summary

As secondary agriculture curricula have continued to become more science-based, the need to prepare and update teachers in the technical and pedagogical dimensions of teaching agriscience have also become greater. These needs are primarily due to the inadequate and/or inappropriate preparation of teachers for teaching agriscience. The study of science in university programs has generally not enabled students to develop a working knowledge of science. Teacher educators cannot assume that completing a collection of traditionally crafted agriculture and science courses will result in a teacher candidate who is well prepared to teach agriscience.

In pre-service programs, teacher educators need to do more than place students into a series of traditional content area courses. Even when these courses are well taught, they still miss the mark in terms of explicitly teaching agricultural practices as applications of science. In addition, the teaching of science concepts is seldom extended to studying these concepts and principles as they are applied in technological fields such as agriculture. Thus, teacher educators need to step forward to ensure that specially designed courses are offered that directly focus on enabling students to effectively teach agriscience. These courses must address both the technical (What should I teach in agriscience?) and the pedagogical (How should I teach agriscience?) aspects of teaching agriscience.

A number of options can be considered for improving the readiness of teachers for teaching agriscience. At one extreme, teacher educators can rely solely on cooperating teachers to prepare teacher candidates for teaching agriscience. However, this option is unlikely to result in well prepared teacher candidates across the board. Team teaching a specially designed course with content area specialists could clearly boost the preparation of undergraduates for teaching agriscience. But the logistics and related problems associated with this option will limit its implementation in most universities. The best options require teacher educators to develop and teach instructional modules and/or one or more special courses in "Teaching Agriscience." Modules could be infused into the existing sequence of Agricultural Education courses, whereas a new course could be added to this course sequence. In the latter scenario, students should take such a course after they have completed their basic study in the sciences and agriculture but before they student teach.

The design of the "Teaching Agriscience" course is all important. Its content should be oriented around major agricultural systems and the agricultural practices inherent within each of those systems. Then, the biological and physical science concepts and principles that serve as the foundation for these agricultural management practices must be identified and taught. Instruction in this "Teaching Agriscience" course should be laboratory based and predominantly taught via experimentation. Problem solving and student inquiry approaches to teaching should be used. Teacher educators teaching this course must model effective methods for teaching agriscience. A similar version of the course, as well as an advanced course, could be taught to practicing teachers in the field.

University agricultural education faculty must take the initiative to design and teach one or more courses that address the content and methods of teaching agriscience. Until teacher educators directly address the needs of pre-service and in-service teachers for teaching agriscience in a substantive and systematic way, the quality of agriscience instruction in secondary programs will vary greatly and continue to be unclear.

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## Keeping Agriculture in Agriscience

(Continued from page 15)

**Is Agriculture Making the Grade in Your Agriscience Program?**

Directions: Grade your performance for keeping agriculture in agriscience. Circle the letter of the grade you deserve.

| | Never True | Seldom True | Sometimes True | Mostly True | Always True |
|---|---|---|---|---|---|
| 1. Agricultural applications are discussed in classroom instruction prior to student experiments/activities. | A | B | C | D | F |
| 2. The percentage of students with SAE's is as great in agriscience classes as other agriculture classes. | A | B | C | D | F |
| 3. The percentage of students in agriscience classes who join FFA equals that of other agriculture classes. | A | B | C | D | F |
| 4. Students in agriscience classes are given equal opportunities for participation and achievement in the FFA. | A | B | C | D | F |
| 5. I keep current with new agricultural technology by reading agricultural magazines, journals, and newspapers. | A | B | C | D | F |
| 6. I include resource speakers and/or field trips to agricultural businesses in agriscience classes. | A | B | C | D | F |
| 7. I include information on agricultural careers in the curriculum for my agriscience classes. | A | B | C | D | F |
| 8. Students are required to write about agricultural applications of science concepts in lab reports. | A | B | C | D | F |
| 9. A problem-solving approach is used in agriscience classes with real problems encountered by producers. | A | B | C | D | F |
| 10. Quizzes/tests include questions on agricultural applications of science concepts. | A | B | C | D | F |

How did you do? If you earned an A-B average, congratulations. You've successfully developed an agriscience program with the proper perspective on the importance of agriculture in agriscience. I encourage you to share how you teach with others in the profession. If your average for the ten statements is barely passing, I encourage you to pick one or two of the statements and go for the A next year. By keeping agriculture in agriscience, we will all be keeping a bright future for agricultural education.