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THEME: Problem-Solving Instruction

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EDITOR'S PAGE

No More Vo-Ag?

The future of vocational-technical education in agriculture appears to be more uncertain now than at other times in the past several decades. Vo-ag may become extinct in the next few years. Why could this be written? Is it true?

Any educational or other program of the government is always subject to attack, whether justified or not. Since the Vocational Education Act of 1963, vocational-technical education has greatly expanded. Many new programs in specialized areas have been developed. Why the concern about the future?

The Federal Government

Vocational-technical education in agriculture has its roots at the federal level. The Smith-Hughes Act, The FFA Charter (Public Law 81-740), and other laws which have given life to vo-ag are federal statutes. Now the federal government plans to end support for all of vocational education. The FFA, as it is set up, will go out of existence. (The Charter says that the FFA will operate in those public schools qualifying for federal reimbursement under the vocational education acts.)

Plans also include the elimination of all vocational education personnel at the federal level by 1984. This means that there would be no individuals in vocational-technical education in agriculture in the federal government. Further, it means that there would no longer be a National FFA Advisor.

The plan to "eliminate" vocational agriculture is a part of the "New Federalism" movement. It basically involves the shifting of federal programs to the states. The federal government would still provide some general funds to the states through 1991, at which time the states could continue or end vocational education programs.

The State Level

"Economic development" is a popular term in many states today. Governors and other state-level leaders want to use vocational-technical education as a vehicle through which they can hopefully stimulate employment, industry growth, and the expansion of tax base. Much of the effort centers on the establishment of high technology programs in postsecondary institutions. When this occurs there is likely to be less emphasis on vocational education in the high schools. This means less emphasis on vocational agriculture.

The Professional Level

Are vocational-technical agricultural educators contributing to their own demise? Are they providing the needed leadership to remain a strong component in American education? There are several indicators of atrophy within. The internal disintegration of vocational-technical education in agriculture is a product of the following:

JASPER S. LEE, EDITOR
(The Editor also serves as Professor and Head, Department of Agricultural and Extension Education, Mississippi State University.)

A decline in professionalism — Fewer vo-ag teachers are joining professional organizations and subscribing to professional magazines. (Does this indicate that we have lost faith in ourselves?)

An increase in vocational education generalists — These individuals fill many administrative, supervisory, and teacher education positions. The "generalist" movement has weakened program-specific leadership. The only way to have strong programs is to have well prepared professionals who are highly competent in the specific program areas.

The use of non-degreed teachers — This is a very serious problem. There is no way individuals without professional teacher preparation can be members of the profession. A professional vocational-technical agricultural educator must be well prepared and hold at least a baccalaureate degree. (General vocational teacher education won't do either! Program-specific teacher education is just as important as program-specific administration and supervision.)

The standards in local programs — The real measure of vo-ag is at the local level. High quality local programs speak well for all of the profession.

Whose Hands Hold Our Fate?

The future of vocational-technical agricultural education is up to everyone involved with it. We especially need strong professional organizations. Leaders of our professional organizations need to speak out, take action, and rally members of the profession. Political action may be needed. Such action involves individual risk, and our professional leaders must be willing to take it.

The future need not be all gloom and doom. We must be enthusiastic. We must develop programs of high quality which teach the technology of today's agricultural industry.

Note: Information supplied by Robert W. Cox, Executive Director of the National FFA Alumni Association, on activities at the federal level was helpful in preparing this article. Individuals who wish to have a voice in shaping the future of vocational education should contact their representative or senator or call the White House opinion number at 202/456-7639. The address to use in contacting Mr. Cox is: FFA Alumni Association, P.O. Box 15058, Alexandria, Virginia 22309.

THEME

Dissolving Some Myths About Problem Solving

By John R. Crunkilton, Theme Editor

(Editor's Note: Dr. Crunkilton is Professor and Program Area Leader, Agricultural Education, Division of Vocational and Technical Education, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. He is also co-author of a book soon to be released on using problem solving.)

Agricultural Educators must return to using problem solving as the way to teach or we as a profession must be willing to accept that our program is well on its way to becoming a non-vocational program. This is a bold statement with which to start an article, but a true statement. If we as a profession do not teach to solve problems confronting the students, then something is seriously wrong with our educational program. Perhaps one approach to a discussion on the use of problem solving is to dispel some myths about problem solving as a method of teaching.

Problem solving reduces the opportunity to use different teaching techniques. A person who holds this belief does not fully understand the mechanics of using problem solving. Used correctly, problem solving is an overall approach to guide the teaching/learning process by identifying problems or questions that need to be solved related to the topic under discussion. The teacher then assists students in identifying alternative solutions to each of the problems or questions. The next step is to work with the students in selecting the one best solution, given a situation, for the problem at hand. All through the process of identifying problems or questions; searching out information either through student work, teacher input, or a combination of each; decision-making situations; application; and evaluation, ample opportunities exist for teachers to use different teaching techniques and instructional aids.

Students do not know enough about the subject to use the problem solving approach. This myth is likely to be used by an individual who has not planned the lesson well or does not know enough about the students' backgrounds to relate to their situations. This myth could also come about from a teacher who was teaching a topic totally irrelevant to the students' or community needs. The point is that if the topic should be taught, students will have a sufficient level of knowledge that will permit the teacher to start the problem solving process.

Instructional materials in the department are inadequate or out of date for use in problem solving. Two observations are pertinent if this is the case. First, if this situation exists, then the department is in trouble no matter what or how the teacher attempts to teach. All departments should have as a high priority the maintenance of an up-to-date library. And second, the use of problem solving can be very effective if a large number of resources are not available. For example, not all students need to be seeking information for the same problem and/or using the same material. Prior planning by the teacher can avoid the situation where every student would need the same material when the quantity of that resource is limited.

Students must be able to read if problem solving is to be used. This statement implies the teacher is misusing problem solving. Again, problem solving is an overall approach to teaching, not a specific technique. If a teacher has a group of students who possess reading problems or other unique learning characteristics, then teaching techniques should be planned that minimize the use of the students' limitations and that maximize their strong learning behaviors.

Problem solving is too difficult to use or I tried it and it won't work. How many things in life are done well the first time? Were you able to ride a bicycle the first time you climbed on it? How many times did it take before you were able to strike an arc? Or, let's identify several examples closer to us as professionals. Does a surgeon perform without flaws on the first operation as an intern? Did you as a professional educator say the right things or ask the right questions on your first supervised occupational visit? The point to be made is that all educators must learn to perfect the problem solving approach according to his/her unique teaching style, and this perfection only comes about through practice and experience. Problem solving can easily be implemented by asking two simple questions. The skeleton lesson outline for a unit on "Selecting Engine Lubricants" serves to illustrate how a teacher can start the process.

Once you have the list of problems or concerns on the chalkboard, the teacher then directs the learning process to answer or provide alternative solutions to each question. How the teacher chooses to do this depends upon the creativity employed and knowledge of different teaching techniques and instructional aids.

In summary, just remember the first time you use this approach, neither you nor your students may feel comfortable. But, constant and continual use of problem solving will lead to a natural flow of the teaching/learning process, both for the teacher and student.

SELECTING ENGINE LUBRICANTS

Basic Outline	Example	Basic Outline	Example
INTEREST APPROACH Motivate	**INTEREST APPROACH** Where are lubricants found in or on a tractor? Using samples of oil, what is different about them?	**PROBLEMS OR CONCERNS** Given the student responses above, ASK "What must you know about oil to achieve these operating conditions?"	**PROBLEMS OR CONCERNS** Sample responses might be: 1. What does SAE mean? 2. What brand should I buy? 3. How does oil lubricate? 4. When should I change oil? 5. And so forth. (Note: State in question form on the chalkboard.)
CLASS OBJECTIVES Question to ask — "Why is it important for you to be knowledgable about engine oil?"	**CLASS OBJECTIVES** Sample responses placed on the chalkboard might be: 1. To increase engine life 2. To reduce engine repairs 3. To reach economical engine operation 4. To achieve maximum operating power		

The Cover

Students enrolled in horticulture learn to solve problems in the laboratory using plant specimens and other realia. This photograph shows a teacher assisting a student in solving a problem. (Photograph courtesy of the National FFA Center, Alexandria, Virginia)

THEME

Critical Points in Problem Solving

By Alfred H. Krebs

(Editor's Note: Dr. Krebs is Professor Emeritus of Agricultural Education at Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061. He has held various administrative positions in higher education. He is author of For More Effective Teaching, *a prominent book on using problem solving.)*

As with many other aspects of life, the development of an understanding of the problem solving process as a method of teaching is a never ending effort. For purposes of this writing, the focus is on those critical points in the problem solving process which are most frequently associated with a lack of teaching success. For ease of discussion, the critical points are grouped under the headings of philosophy, planning, technique, and time.

Philosophy

Unless one believes in problem solving as a method of teaching, the result of using it will usually be a failing effort of some magnitude. A lack of confidence or faith in a method or technique tends to cause one to perform in a way which could guarantee that the use of the method or technique will result in failure. In education, the shaping of a faith in or a lack of faith in problem solving can be found in one's philosophy of education.

Teaching methodology and teaching techniques used are a reflection of what the teacher believes the purposes of education, in part, to be. And unless the teacher views the educational values of the use of problem solving to be important and to be attainable, success with problem solving teaching will not occur. Thus, the first and most significant of the critical points in the use of problem solving as a teaching method is the determination of one's own faith in it through an examination of one's philosophy of education.

Some examples of philosophical considerations may help clarify this point. The first factor that comes to mind regarding one's philosophy of education is whether one believes learning should include development of the ability to analyze or whether learning consists mainly of the memorization of material. If the teacher believes learning is memorization, the student need only be presented material to be memorized; working out solutions to problems would not be essential. Another factor is whether the teacher believes a student should locate (discover) information or whether the information should be assigned or presented. In the latter situation, the teacher can use the lecture method and avoid the more challenging tasks of preparing for and of directing learning through problem solving.

Yet another factor is whether one believes information is learned to be used or whether the student's mind is simply a place for learning to be stored. If information is learned to be used, opportunities for application under supervision of that which has been learned are essential and require the use of some aspects of problem solving as a method of teaching.

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Critical Points in Problem Solving

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To prevent the development of a philosophy based on difficulty in the use of problem solving, future and present teachers should engage in a continuing debate on what education is all about. While the study of education and engaging in educational activity contribute to the shaping of one's educational philosophy, it is also necessary that educational philosophy be discussed as a topic to develop a conscious and firm philosophy to serve as the basis for future decision making in matters of educational concern.

Finally, for effective use of program solving in teaching, a teacher must believe that students have the right to direct their own educational development and that the schools have an obligation to teach them how to do so. Developing students' abilities to make their own educational choices means keeping firm control of the process by which the students make decisions on direction rather than controlling the actual decisions.

Planning

Sound planning is a critical element in any teaching method. Many of the teaching difficulties associated with problem solving are built into the plans developed by the teacher. Planning for the use of problem solving does require more effort than does preparing for a lecture. In addition to subject matter content, problem solving requires plans for how the teacher will interact with the students and plans for student activity. When the teacher fails to prepare a plan complete in every detail, the stage is set for possible failure.

Planning, can, of course, be based on the wrong thing. If the subject matter content has not been properly divided into teachable segments (units and problem areas), the teacher will have a very difficult time both in planning and in teaching. In fact, improper content segment development leads to confusion in all other aspects of the teaching process.

Another kind of confusion in planning is that of not properly defining teaching/learning objectives and anticipated student objectives. Teaching/learning objectives are ability/competency based while student objectives are based on achievements possible through the use of learnings. An incomplete analysis of the teaching situation also may lead to teaching problems. It is not enough to prepare the subject matter only. The teacher needs also to take into consideration grade level, individual differences, cultural background resources, time relationship of content to prior instruction and to instruction to follow, local community factors, state and national factors, and opportunity for application. Other kinds of planning failures include not planning for teaching resources and poor selection of teaching techniques.

The elimination of the kinds of problems related to planning obviously requires the development of complete, sound teaching plans. And while it is a good practice to keep teaching plans on file, it is absolutely necessary to prepare or revise teaching plans for each class to be met. One need only recognize that each student is a unique individual to appreciate the necessity of replanning for each class. Of course, the experienced teacher can accomplish the needed replanning in much less time and with less detail than can the beginning teacher.

Technique

Not only must the teacher build the proper teaching techniques into the teaching plan, the teacher must also be able to use well each technique. In addition, there are techniques which, while used, are not identified in the teaching plan.

Techniques recorded in a complete teaching plan include the steps in the plan outline, the use of notebooks, demonstrations, field trips, movies, resource persons, supervised study, and many others. But skill is required in the use of each technique. For example, field trips must be planned and a "dry run" made by the teacher. The students must be informed regarding the objectives for the field trip and what to see and do in order that the objectives may be achieved. Movies should be previewed and discussed with students before viewing to acquaint them with the objectives for viewing and with content. A second discussion is required after the film has been seen.

Examples of techniques and learning activities not recorded in teaching plans include discussion leading, teacher involvement with setting student objectives and with identifying problems, pace of classroom activity, listening, and adjusting teaching to student responses. These kinds of techniques, combined, are at the core of a teacher's ability to interact with students, the ability to conduct the class session. The teacher must be able to make use of student contributions, using the words the students used in making them, whether such contributions are excellent or relatively meaningless to class progress. A contribution is always important to the student making it and, by using it in some way, the teacher helps the student develop.

The teacher must be an active participant, a partner in the development of student (group) objectives and problems. The teacher must set the pace for the class at a rate which accommodates, to the extent possible, the strongest and the weakest of the students. As the teacher learns more and more about the knowledge the students have concerning the content under study, he/she must make adjustments to go into either more or less detail. Failure on any of these kinds of techniques is difficult to diagnose and correct because it requires careful observation by someone else, or expert self-evaluation, and because these techniques reflect what the teacher is as a person.

Avoiding or correcting errors in the use of techniques involves learning how to select the proper techniques at the time of making the teaching plan and an extensive "student teaching" experience under the guidance of a capable teacher. The student teaching experience is especially critical because the student teacher must develop the ability to sense what students are thinking, whether the pace of the class is right, whether adjustments are needed, and whether the teacher and the class are truly working as a team in the teaching/learning process. In the process of developing master teachers, there is no substitute for actual teaching experience to develop this "sense" of how well a particular class is going. If the teacher does not have the ability to react in an almost automatic and reflexive manner to the flow of classroom activity, the teacher is not fully ready for assuming responsibility for the teaching task.

Timing

Even after complete preparation by a master teacher, the teaching process can go "sour" simply because of poor timing for the teaching activity. The timing can relate to length of class period, seasonality, pace, or size of content segment. The problems with pace and content segment have already been noted. A few additional comments are needed on class period length and on seasonality.

While the teacher cannot control the length of the class period, the teacher does control how the time within the period is to be used. Problem solving provides complete flexibility for starting and stopping instruction at almost any point in the teaching/learning process. Thus, it is up to the teacher to assure proper timing within the period for including the necessary articulation, at the start of each class, with what was done the previous day and to provide whatever time is needed at the end of the period for summarizing and setting the stage for the next day. Timely scheduling of content within the school year is also critical to success in teaching. Scheduling a content segment just ahead of the time when students can make use of the learning adds a priceless dimension to the teacher's task of motivating learning. Seasonality is important whether scheduling for crop production, for planning for further education, or for finding a job.

As with other aspects of the teaching/learning process, avoiding difficulties stemming from "timing" starts with having a sound program of teacher preparation, including student teaching. The rest is a matter of the ability and willingness of the teacher to work continuously on self-improvement using all of the opportunities made available by the local school, the universities, and the state education departments.

Summary

The teaching/learning process is too complex to permit more than a brief overview, within the space permitted here, of the critical points in using problem solving as a teaching method. Even a lifetime of excellence in teaching leaves the teacher with room for improvement. Of the potential kinds of difficulties noted — planning, technique, timing, and philosophical — it is the philosophical which can have the greatest impact. With a belief in the values of a problem solving approach, the teacher will be self-motivated to take the necessary corrective actions for the teaching difficulties associated with planning, technique, and timing.

THEME

The Versatility of Problem Solving

By Martin K. Auville

(Editor's Note: Mr. Auville is vocational agriculture teacher at Fort Defiance High School in Fort Defiance, Virginia 24437.)

The problem solving approach to teaching has been a traditional method of teaching vocational agriculture. In past years, problem solving was nearly the exclusive teaching approach to most units. A unit identified with accompanying enterprise, problem areas, and specific jobs. Originally problem solving was more than a teaching technique, *it was the way to teach.* This approach to teaching was strongly aimed at the supervised occupational experience programs of students, and rightfully so with many students coming from the farm.

As the industry of agriculture changed, so did the methods of teaching vocational agriculture. Many traditional methods of teaching were revised or discarded. This was largely due to the fact that the type of student taking vocational agriculture was also changing. The percentage of students in vocational agriculture with farm backgrounds began to decline as fewer farm families lived in the communities, and more urban students were being attracted to the vast opportunities of vocational agriculture and the FFA.

The whole philosophy of teaching vocational agriculture shifted away from using the problem solving approach and farm project application. Consequently, many teachers associated problem solving with "old ag" and have placed it on the bottom of the list of a possible teaching method. By shunning this method of teaching, we may be less effective teachers. What is more important? Teaching technical information and filling students' minds with facts and data, or teaching students how to think and reason. If you prefer the latter choice, then the problem solving must have a place in your teaching strategy.

Stimulate Creativity

The problem solving approach stimulates creative thinking, student interest, and the decision making process. It also makes instruction more personal to students and helps to build confidence in themselves. Through the use of this method of teaching, students discover problems and answers to these problems. The role of the teacher is also different. Rather than actively stuffing the students with technical information which they may or may not be interested in knowing, the teacher passively guides the learning process that allows students to learn for themselves.

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The Versatility of Problem Solving

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If problem solving is so effective and does develop the students' thinking abilities, why isn't it used more by teachers? There are two primary objections, as I see it. First, many teachers still believe that it has little value in the modern classroom since students don't have the farm background. Teachers feel that students lack project experience and/or the ability to identify and to conduct good projects. Other teachers contend that the problem solving approach is too limiting and restricts the use of other techniques.

In response to the first objection to using problem solving, it should be kept in mind that problem solving can be used to teach topics which are not related to student project work. To the latter comment, the problem solving approach may well be the most versatile method of teaching and a variety of teaching techniques is needed more than ever before in the classroom. Problem solving establishes a framework of instruction that promotes the use of a variety of techniques.

Versatility

Let's examine the versatility of the problem solving approach and how it encourages the use of other teaching techniques. Assume that a unit on choosing proper welding electrodes is to be taught. After defining the problem of choosing electrodes, the class can identify factors which need to be considered when choosing electrodes. This could lead to the use of brainstorming to identify these factors. Once the factors are identified class discussion can be used to find out how much students know about choosing electrodes. At this point students will realize that more information is needed to understand fully how to choose electrodes properly. Through the use of supervised study, technical information can be presented to supply important information needed to solve those problems in choosing electrodes.

Following a complete discussion of the problem, an excellent follow-up would involve a demonstration on the practical application of the information learned. Experiments could be used to show the results of proper or improper electrode selection. Resource persons from local welding shops could be used with, or in place of, the supervised study. In this example, six different teaching techniques were used to complement the problem solving approach to this unit.

Problem solving would be an excellent approach to teach small engine troubleshooting. Many students have practical experience with contrary engines and are keenly interested in learning how to solve the problems they have encountered. Students can readily identify possible causes for engines not starting or not running properly. Once possible problems are identified by students, the stage is set for the instructor to choose from a variety of techniques to provide essential information to solve these problems. Again, supervised study, experiments, demonstrations, or field trips can be used. Additionally, the teacher can choose from many aids such as films, filmstrips, repair manuals, charts, and reference books to supplement the learning activity. As part of the instruction, practical application of troubleshooting would be planned for in the laboratory in order to allow students to apply troubleshooting concepts to bugged engines.

Another idea would be to reverse the approach and let students first work on bugged engines which will not start. Students could identify possible causes why their engines would not start and then through independent study, students could gather information to help solve their particular problems.

This approach allows problem solving to be a form of individualized instruction. The same procedure could be followed if a unit was being taught on increasing weight gain of cattle. Students with cattle projects may have this problem, however, the cause for low weight gains may be different for each student. Again, each student may research the same problem yet find a different answer for solving his or her particular problem. Thus problem solving can make instruction personal and can address the particular needs of each student.

Problem solving is not limited to just laboratory units. For example, it can be used to teach farm management and farm economic concepts. I taught a unit on making the farm more efficient by increasing labor efficiency and planning for farm expansion. The class spent two days identifying problems related to increasing labor efficiency and problems in planning for farm expansion. The class then made a field trip to a local young farmer who was experiencing some difficulty in maximizing the use of farm labor, and who also was experiencing expansion problems. While on the field trip students were concerned with analyzing his labor needs, feeding systems, and other problems.

Following the field trip, students used two days to gather information to help solve his problems. Alternatives were established and the class formulated final recommendations for the problems which they had identified. The final step involved a return field trip to the farm to discuss the recommendations prepared by the class. The class had proposed some suggestions which he had not yet considered. The class, on the other hand, was pleased that they had made sound and reasonable suggestions and felt a sense of accomplishment after studying these units.

Leadership development topics can be taught using problem solving and a specific unit on parliamentary law is a prime example. After students identify problems in performing different parliamentary skills after an FFA meeting, the teacher can use role playing to illustrate how different procedures are performed. Students can think through other procedures and solve similar parliamentary problems. Parliamentary procedure is a thought stimulating unit by nature, thus problem solving proves to be a good approach to the unit.

The key to the versatility of the problem solving approach is that it is totally unlimited in the types of techniques that can be used to provide technical information needed to solve problems identified by students. Problem solving sets the stage for effective teaching and effective learning and allows for instruction on a group or individual basis.

Another uniqueness of problem solving is that it fits well with competency based instruction. The problems identified by students are actually the competencies which need to be learned. Guidance by the instructor helps to assure that appropriate problems and objectives are identified. Problem solving is a natural disguise for competency-based instruction.

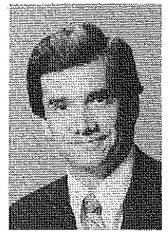
Use is Almost Unlimited

The examples of how to use the problem solving approach are nearly unlimited. It has practical application to units of instruction and is a thought provoking method of teaching. There are special considerations to problem solving just as there are with other teaching methods. Although problem solving is effective, it may not be particularly efficient if time is a limiting factor. Problem solving must also be directed by the teacher so that appropriate problems are identified, that class discussions remain on track, and that the technical information learned helps to solve problems. It is also important that solutions to problems work. Students need to feel achievement and success when using problem solving. Student frustration and failure dampens the students desire to learn, and lessens their confidence in learning.

Problem solving achieves one of the primary goals of education, which is to teach young people how to think. With its versatility, it is adaptable and flexible in nature. It proves to be an effective approach to teaching by stimulating interest, decision making, self confidence, and achievement. Problem solving needs to be a part of the instructional program of all vocational agriculture instructional programs.

THEME

Using Problem Solving Teaching in Non-Production Agriculture Classes



By L.H. Newcomb

(Editor's Note: Dr. Newcomb is Professor of Agricultural Education at The Ohio State University, Columbus, Ohio 43210. He has previously served as a Theme Editor for The Magazine.*)*

The words, problem solving teaching, are almost as sacred in agricultural education circles as the three letters, FFA. What is it about problem solving teaching that has so thoroughly captured the attention of educators and claimed their continuing loyalty? The reason that agricultural educators are enamored with problem solving teaching is because it works so well!

Problem solving teaching is a way of thinking. It is a process by which one is able to learn. It is a systematic way of bringing logical organization and structure to a learning situation. When students learn via problem solving teaching, they discover new knowledge the same way a scientist discovers new knowledge by using the scientific method. Both the scientific method and problem solving teaching follow the same essential steps. There is a provocative situation; the problem is defined; information is gathered and studied; possible solutions are formulated; proposed solutions are tested; and the results are evaluated.

While problem solving teaching has been used by production agriculture teachers for years, is it a worthwhile way of teaching in non-production agriculture programs? Under what conditions does it best work?

Problem Solving Works Best When Teachers Have Students Studying Real Problems

While the basic components of problem solving teaching can be used with almost any unit of instruction, it is most robust when used in real problem situations. It can be used to lead students to learn basic factual information. For example, if you wanted to teach students a unit entitled "Breeds of Beef Cattle," problem solving teaching could be used.

Examples of problems and concerns include: What are the breeds of beef cattle? What are the advantages and disadvantages of each breed? These could be drawn from the class. Answers to these questions could then be developed.

However, problem solving teaching enjoys its finest hour when it is used to direct learners toward resolving meaningful felt needs (problems). Such is the case when teaching a unit like "Renovating a Lawn" and the students each have the opportunity to actually renovate a lawn. They are confronted with a problem lawn, and that gains their interest. The teacher can then draw from them problems, such as these questions: When should you renovate a lawn?, What procedures need to be followed when renovating a lawn? In such situations, learners are then able to try out their new knowledge (answers, solutions) in a functional setting in order to see if these solutions really work.

Problems versus Questions

In the case of the breeds of beef cattle, the problems and concerns were questions to be answered. In the example of renovating the lawn, the problems and concerns were real problems. A question is aimed mainly at gaining information. This can be information for information's sake or it can be information that is needed to solve a problem. On

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Using Problem Solving Teaching in Non-Production Agriculture Classes

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the other hand, a problem personally affects one and usually calls for personal action (often in the form of decision making). The chief distinction between a problem and a question is the level of personal involvement. Questions may be nice to know about, but problems which personally affect one demand attention. Good problems deal with actual situations and demand answers in terms of conclusions. They do not have ready-made answers in a textbook. Rather the information from the textbook must be applied to each specific situation if the problem is to be solved.

Conditions Which Provide Real Problems

In order for a teacher to have a higher proportion of units of instruction falling in the category of problems, the students must have situations at school, at home, or in some other location that are the bases for the instruction. It is out of such occupational experiences that problem solving instruction grows. It is these same situations that students are able to apply their new knowledge in a functional setting.

In non-production agriculture programs with extended labs (two or more hours in length per day) such conditions can readily exist. If a lab has been well developed it provides a wide array of excellent occupational experiences. These experiences are closely interrelated with the curriculum. The lab provides students with a situation which contains a real setting where they can apply their new knowledge and judge its effectiveness for themselves. Furthermore, it provides a common frame of reference and provides sufficient scope to allow the involvement of students to be meaningful.

With such an ideal setting, it is only natural for teachers in non-production agriculture programs to use problem solving teaching.

My Experience Using Problem Solving Teaching in a Non-Production Setting

In March of 1980, I returned to the high school classroom for one month. I felt that as a teacher educator I ought to get back out on the firing line so as to stay in touch with the day-to-day challenges agriculture teachers encounter. I wanted to teach a more urban group of students than my previous high school teaching experience. I also wanted to teach a non-production agriculture subject. My choice was horticulture. In addition, I wanted to see if the methods of teaching which I teach at The Ohio State University worked in a contemporary vocational agriculture program.

During my four week stay, I taught a full schedule of horticulture classes in a large suburban high school. I was involved with classroom and laboratory instruction, as well as visiting my students at their homes.

How Did Problem Solving Teaching Work in a Non-Production Agriculture Program?

To illustrate how problem solving teaching worked in the horticulture department of this suburban high school, a unit on producing bedding plants was taught. The unit was preplanned precisely as students in my methods course are instructed to do their planning. The following outline was followed:

I. Title: Producing Bedding Plants
II. Situation
III. Teacher Objectives
IV. Interest Approach
V. Identification of Students' Reasons for Needing to Study the Unit
VI. Identification of Problems and Concerns to be Solved
VII. A Plan for Teaching the Solution to Each of the Problems and Concerns
VIII. List of Approved Practices
IX. References and Teaching Aids
X. Special Activities and Events
XI. Quiz or Plan of Evaluation

The situation for the unit was the laboratory greenhouse where the class would grow a crop of bedding plants for sale to finance other lab activities and generate some revenue for the FFA. Thus the students had a situation of which they were a part and they had had a common frame of reference.

After becoming familiar with the students' situations (scope, detail, deadlines, facilities, money available), a set of teacher objectives was developed for the unit. This allowed me to provide a framework within which to develop the remainder of the unit. It outlined the scope and targeted the essential behavioral outcomes I expected.

The students' situations were used as the bases for creating interest and, more importantly, a personal felt need on their part for studying the unit. They were given the task of measuring the space available, deciding on the plants which would sell in the community, deciding how much greenhouse space to allocate to each plant, deciding how many seeds or seedlings to order and determining the supplies needed. While they could experience some success with the task, such as measuring the greenhouse, they had a problem for which they lacked sufficient information to solve without further study.

Hence, when they were asked if they felt they needed to learn how to produce bedding plants, their response was yes. When asked to list some reasons why they needed to study this unit they were readily able to identify their reasons why they wanted to study this unit. Likewise, they had enough understanding of the problem area to be able to think of a set of questions which they needed to answer before they could produce a crop of bedding plants. These questions constituted the list of problems and concerns which served as the organizer for the unit of study.

The class then studied each problem in turn. A number of teaching techniques were used to guide them in solving the problems of producing bedding plants. Class discussion, supervised study, demonstration, role playing, experiments, slides and other visuals, information sheets, and the skill sheets were used in order to solve the various problems. Short periods of highly structured supervised study were frequently used in order to determine if today's students (with their attendant reading problems) could successfully use this technique. When provided with the reference materials which are readily available today, they were able to make good use of well planned, supervised study periods which were then followed up by using the class to develop group conclusions.

Careful attention was paid to developing specific conclusions and/or arriving at definite decisions for each problem. In some cases a list of approved practices was developed for a given problem as a way of summarizing.

At the conclusion of the unit a complete set of approved practices and general principles was developed with the class. Students then developed plans of practice for lab activities as appropriate.

Problem solving teaching worked very smoothly in this non-production agriculture program. Students had more of a real problem to solve than is true for many production agriculture students these days. The opportunity for application was constant. Real problems were solved and the horticulture students grew a fine crop of bedding plants.

The same approach to teaching should work equally well in other non-production agriculture areas of instruction. Students in natural resources could use problem solving when studying areas such as "Raising Game Birds," "Improving a Timberstand," or "Building a Pond." Animal care students could use problem solving when studying areas such as "Setting up Salt Water Fish Aquaria" and "Grooming Dogs." Agricultural equipment and mechanics students could learn how to tune tractors, service combines, or repair brakes using problem solving. In all these cases, there could be real problems demanding unique solutions.

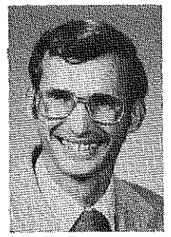
A Logical Way

Problem solving teaching is a very logical and successful way to teach non-production agriculture students. It is a way of teaching that is able to unify related matter by having students gain an overview of a group of related problems and then solve each related problem, in turn, such that at the conclusion of their study of the unit they have mastered a new area of agriculture knowledge and/or skill.

Problem solving teaching grows out of and makes use of sound learning theory. Hence, why not use it?

THEME

Five Approaches to Problem Solving . . . Using the Possibilities-Factors Approach



By Lee Cole

(Editor's Note: Dr. Cole is Assistant Professor of Agricultural Education, Oregon State University, Corvallis, Oregon 97331.

The problem solving approach to teaching tends to focus classroom work on real problems; the kinds of problems students will face in careers in the agricultural industry.

In order to effectively utilize the problem solving approach, the problem must be concisely identified, the various kinds of facts and detailed information appropriate to the solution of the problem must be identified and gathered, and the facts and details must be put into a problem solving format appropriate to the type of problem under consideration. The students should then make a decision based on the information gathered and be able to justify their decision. Problems and decisions should be discussed openly in class.

Problem solving will both promote and test the thinking of students. Its emphasis on real life problems, and the solution of those problems will bring application to teaching.

Use Versus Memorization

Problem solving puts an emphasis on the use of material rather than the memorization of it. Problem solving forces the learner to identify important facts and organize them in such a way that a solution can be derived based on logic rather than emotion or impulse. Problem solving lends itself to students participation and individual student evaluation of all facts gathered.

Process Versus Product

Problem solving is more process oriented than product oriented. Don't be mislead, there will be a final solution to a real life problem confronting an individual in the class, the school's land lab, or a member of the local agricultural community. The exact solution to a given problem may be be the same for similar problems with differing circumstances. For example, time, capital outlay, production potential, and acreage may change from one farm to another causing a potential change in the final solution. It is imperative that students learn the process of solving problems so that the process may be applied to the many problems which people encounter during their lives.

It could be said that we use the problem solving technique in class in order to solve a pressing problem confronting us at the time. The solution to that problem may not be the greatest asset to the student. Having been through the problem solving format, rather working

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Five Approaches to Problem Solving... Using the Possibilities-Factors Approach

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through the problem solving format, will be the long lasting advantage to the student. There are five accepted problem solving formats which are used. These should be used frequently so that students know them and are comfortable using them.

Many teachers use problem solving quite frequently in their teaching, some without even labeling what they are doing as problem solving. Problem solving does require that vocational agriculture teachers be in tune with the agricultural communities they serve.

It also requires that teachers be actively involved with the SOE programs of their students. Many problems suitable for classroom work will arise out of the SOE program. Further, the agricultural library must be complete and up to date. Time is required to frame problems correctly so solutions may be derived, but good teaching in any form requires preparation. The teacher must solve the problem before the students in order to guide the students and provide appropriate input upon request. A final consideration as to why problem solving may not be used as extensively as it could be is that people fear that with which they are unfamiliar. If a teacher has never been exposed to problem solving instruction, either while they were in high school or while they were involved in a teacher preparation program at a university, it may take great courage to try the problem solving approach. This writer would advise, "try it, you'll like it."

Five Approaches

Many educators accept five problem solving approaches, as follows:

1. **The "possibilities-factors" method** — This is used in making selections. Whenever the problem deals with selecting something, this method is appropriate. The key words to use in writing the problem statement are "what source of," "what breed of beef cattle should," or "when should we breed our gilts?" This method provides for having several factors and alternatives to consider.

2. **The "steps and key points" method** — This method is most appropriate when leading students through a process or procedure. The key words to use are "what procedure should we follow" or "how should we." The steps constitute the conclusion in this method.

3. **The "present situation with accepted standards or an ideal situation" method** — This is most appropriate when determining if changes should be made in an existing situation. The key words for the problem statement are "should we consider?"

4. **The "advantages or disadvantages" method** — This is most appropriate when making a decision between two courses of action. The key words for the problem statement are "should we consider?" A concluding statement is essential.

5. **The "question-answer-discussion" method** — This is appropriate for presenting factual information and problems which do not fit the other categories. The key words are "what are the essential parts?" A verbal conclusion of the main points may be used to summarize the discussion.

Sample
POSSIBLITIES-FACTORS PROBLEM SOLVING FORMAT

TRACTOR 500 hrs use per year	Rated HP	Rated @RPM	Cubic Inch Displacement	Turbo or Natural	PTO HP Neb. @Max	DB HP/Fuel 100%	DB HP/Fuel 75%	DB HP/Fuel 50%	Dealer Service	Regional Parts Warehouse	Cost	Resale Value	TOTAL
John Deere 4640													
*rating													
Case 2390													
*rating													
International Harvestor 1586													
*rating													
Massey Ferguson 2775													
*rating													

*NOTE: Assign a rating of one to five for each column with 1 being best and 5 being worst. Derive a total for each tractor model to assist in making a final decision.

Which tractor would you recommend for purchase? _____

Why? _____

_____

The Format

The remainder of this article is devoted to the possibilities and factors problem format. It is one of the least used problem solving approaches. It holds great potential for use in vocational agriculture classrooms.

A problem set in the format of possibilities and factors problem solving is presented. Some educators would disagree with the use of problems, such as tractor selection, saying that there is too much room for arbitrary, emotional input. While there is the potential that personal preferrence would over-rule all logic in the selection of a tractor, it is an area that many vocational agriculture students may be involved with and/or could be excited about. This particular problem allows the vocational agriculture teacher to follow the lesson with such topics as machinery management (especially tractor size requirements) and/or energy considerations in modern agriculture. It also allows the teacher to introduce materials like the Nebraska Tractor tests, as well as manufacturer's tests to the classroom environment for consideration and study.

Study the chart provided. Gather the data necessary to solve this problem. Introduce the problem to your students from the perspective of one of your students or a farmer in the area wanting to make such a decision. (To make it real to your community, identify a local farmer planning a tractor purchase. Change the models and/or various factors to make the problem format fit your real problem.)

Allow the students to gather the data. (The teacher should have already gathered the needed information so you will know if it can be obtained. You should also get the implement dealers to cooperate with the students in gathering data directly for themselves). Put all of the data collected by students together in the format (chart) you developed for your problem. Before you allow any discussion of the facts on the completed data sheet, have each student write his or her selection and, most importantly, why they selected the tractor they did. Have the students hand in their answers (problem sheet). Then discuss the information and allow students to give oral arguments for their selections.

Excitement

Routine studies can be made exciting by using problem solving. Further, the problems often lead into other important areas of agricultural instruction. Give problem solving a try!

ARTICLE

Solving Problems in the Real World

By
Robert A. Martin
(Editor's Note: Dr. Martin is Assistant Professor of Agricultural Education at The Pennsylvania State University, University Park, Pennsylvania 16802.)

"Because their knowledge has been achieved in connection with needs of specific situations, men of little book learning are often able to put to effective use every ounce of knowledge they possess; whereas, men of vast erudition are often swamped by the mere bulk of their learning, because memory, rather than thinking has been operative in obtaining it" (Dewey, 1933, p.53).

As this quote emphasizes, learning is of little value without thinking and systematically using the knowledge learned. Vocational agriculture has long been one part of the school curriculum which helps students think and learn by doing. Thinking is not, however, accomplished in a vaccuum. Dewey (1933) emphasized that memorization of facts does not lead to action. Problem solving leads to action. Action creates further problems which require further thought and knowledge.

There is a growing concern among vocational agriculture teachers that we are getting away from problem solving as emphasis is placed on competency-based education. This need not be the case. In fact, these concepts should compliment each other. But there are lingering questions.

What is problem solving? What makes problem solving good? Why do problem solving and vocational agriculture fit together? Why don't more vocational agriculture teachers use problem solving? How can problem solving be implemented?

Not Negative

It is a safe assumption that most people automatically associate the word "problem" with something negative. Teachers have often said that they and their students don't have any problems to solve. These teachers say they just want to teach agriculture. Unfortunately these teachers overlook the positive aspects of problem solving as a teaching technique and, or course, they miss the point entirely. Phipps (1980) defines a "problem" as a life situation which creates a state of suspense, doubt, confusion, or difficulty. In essence, a problem is an opportunity for action.

Phipps (1980, p. 49) emphasizes that problem solving has the following advantages:

1. It is active — not passive.
2. It uses real experiences.
3. It employs creative thought.
4. It adjusts to change.
5. It provides incentives to learning.
6. It emphasizes that learning of knowledge is a tool, not an end in itself.
7. It develops democratic abilities.

Doing to Learn

Put quite simply, we learn what we do. If we merely talk about agricultural

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Solving Problems in the Real World

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problems, we learn only to talk about agricultural problems. "The assumption that information which has been accumulated apart from use in the recognition and solution of a problem may later be freely employed at will by thought is quite false. The only information otherwise than by accident, that can be put to logical use is that acquired in the course of thinking while carrying out a task" (Dewey, 1933).

This "doing," however, must be systematically approached in a disciplined way. Teachers and students should be concerned with knowledge and skills which may be used now or in the very near future as it relates to present problems or ones that will be encountered in any given enterprise. Too many teachers teach for the distant future, thus making problem solving difficult. Teachers may try to teach students how to raise cowpeas, for example, even though the farmers in the community do not raise cowpeas, because of a pious belief that some day they might raise cowpeas.

It is very difficult to teach for future use. We forget fast what we do not use. We lose interest and do not learn what is being taught. Instead, we learn to dislike what is being taught. Record keeping taught without analysis and interpretation probably teaches students not to keep records instead of teaching them to keep them. It is a question of readiness. Learning must begin where the students are; effective learning cannot begin anywhere else. So it is with problem solving. We are not learning mere skills, but we are learning to solve real problems as we develop skills. The techniques of solving problems will be transferable to many situations. Basic skills may change rapidly over time.

Not Used

Unfortunately, problem solving is not used by a vast number of teachers of vocational agriculture because of several factors. Not least among them is that some teachers have never operated a tractor and the related equipment, owned an animal or crop, grown a garden, kept financial records, or made management decisions. Many teachers are not involved in any of these activities currently nor have many experienced teachers recently returned to the work place for updating of occupational skills. To these teachers, problem solving is a threatening approach. But more importantly, problem solving is not being used because it is not fully understood by many teachers.

There is an assumption made that problem solving is just learning by doing and that it means that students should be set free to do whatever they want wherever they want. Of course, this interpretation of problem solving and learning by doing is haphazard and it is learning by trial and error in an unorganized way. Problem solving, however, is learning by doing in a systematic scheme of events leading to a productive goal. It is thinking, gathering information, testing ideas and procedures, making decisions, and acting upon these decisions by developing further the technical skills needed to solve the problem.

Implementation

The following outline of a problem solving procedure is given as an example of how it might be utilized. As this example is used it should be evident how this approach stimulates interest, develops thinking ability, gets students involved, helps students evaluate, helps students draw inferences, and helps students make decisions.

Situation

You are teaching a lesson on corn rootworm as a part of a unit on corn production (pick your own topic) and plan to use the problem solving approach. List briefly the steps/activities that you might use to teach this lesson. Justify each.

Answer

1. Identify the significance of the corn rootworm for corn production in the United States, a given state, and locally.
   a. Have students look through farm magazines for ads selling corn rootworm control insecticides.
   b. Talk with local farmers, farm supply and seed salesmen, county agents, etc., about the extent of the problem locally. (Students might do this as a class project.)
   c. Conduct a survey of incidence of rootworm on local farms.
2. Identify the insect.
   a. Show slides showing rootworm damage.
   b. Have a sample (pickled) or pictures of the rootworm or both.
3. Develop a list of practices/recommendations for controlling rootworm.
4. Compare the cost of control with cost of infestation.
5. Have students decide whether to attempt control.

In this problem solving situation, an attempt has been made to have the students (1) identify the problem, (2) collect data, (3) consider and evaluate alternative solutions, and (4) make a decision. These steps are similar to those outlined by Dewey although the sequencing is not as precise within the context of the problem. As a teacher one could use supervised study, student surveys, a guest speaker to identify extent of the problem, field trip, slides, realia, class discussion to arrive at a decision, supervised study to identify costs and returns, and class discussion to arrive at a decision. Hence, a number of teaching methods would be incorporated into solving the problem.

Summary

Problem solving is regarded by many to be among the most effective approaches to teaching, particularly in agriculture. Using the above exercise, students would be required to do what the practitioner (farmer) would do to make a decision. Students are decision makers concerning a management problem as a part of a real life situation. If we want to make learning exciting and effective, we would be wise to use problem solving.

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ARTICLE

Helping Students Become Better Decision Makers

By
Charles W. Smith
(Editor's Note: Dr. Smith is currently Dean of Education, Louisiana State University, Baton Rouge, Louisiana 70803. He was previously an agricultural teacher educator at LSU.)

The question is asked often why some people seem to get ahead and progress while others struggle along? Why are some individuals leaders in adapting farming operations to the latest technological changes in agriculture? Why do some plan for change while others are ultimately pushed into it in order to just hang on to the farm mortgage?

Apparently each person perceives the environment differently and reacts to it according to these individual perceptions. People tend to manage their personal and economic lives in unique ways with varying degrees of success. According to Socrates, "Competent individuals are those who manage the circumstances which they encounter daily, and who possess a judgment which is accurate in meeting occasions as the need arises and rarely miss the expedient course of action."

The Art of Deciding

Today's social and work patterns require that an individual be adaptable to change and be a good manager of information in order to cope with an evolving environment. The ability to make meaningful decisions is a prerequisite to effective working and living. One's ability to choose from among competing alternatives can be, and often is, a difficult task even for the person who has considerable knowledge of the decision making process.

Teachers of vocational agriculture/agribusiness have many opportunities to work with students who are in the process of making decisions concerning their supervised occupational experience programs, future educational and employment plans, and other aspects of their personal and social life.

Traditionally, teachers have been a major source of information both in and out of the classroom and have provided advice and counsel to students as it was needed. This approach often helped the students to solve the immediate problem but did little towards assisting them in becoming more independent and capable decision makers, which is an essential characteristic of successful citizens.

What Is Decision Making?

Decision making is basically a process of selecting from the available alternatives and then committing oneself to those courses of action that will lead to the desired outcomes. This implies that if one has access to the information concerning the available alternative courses of action, if would then be a simple matter of selecting the most logical alternative that would lead to the solution that is desired.

Although the quantity and quality of available information determines to some extent the effectiveness of the decision, more importantly, it is the way in which the information is processed that is the key to the quality of the outcome. As one improves this ability to process information, the chances of making decisions that bring about the desired outcome are enhanced.

Who Needs Decision Making Skills?

Everyone needs effective decision making skills. Most rational individuals utilize some form of strategy when making decisions, whether it be an appropriate or inappropriate strategy. In too many cases, however, students decide without really understanding why they have selected a particular course of action since they have not had the opportunity to learn an appropriate decision making strategy. Because of the countless alternatives available to them, many will select inappropriate courses of action or will opt not to decide, which results in inaction. Thinking is a demanding task.

When Are Decison Making Skills Used?

Decision making skills are used throughout every waking day of one's life. On a daily basis, individuals make very simple decisions concerning the route to take to their place of work and often must formulate more complex decisions about how to resolve a personal conflict with a friend or loved one. Although students do not always make the same kinds of decisions that adults make, they make just as many decisions at their present developmental stage which are equally as important to them as are those of adults.

Basically students lack information and experience and are unsure of their values, interests, abilities, and goals in life. Many of the conflicts that students have with parents, their peers, and others are a reflection of their inability to pursue appropriate courses of action that are meaningful to them. They receive conflicting feedback from peers, parents, teachers, and others when they fail to make decisions that are considered to be acceptable. This often results in confusion, frustration, and rebellion on the part of the decision maker.

Decision making can be taught and should be an integral part of the vocational agriculture/agribusiness curriculum. Without the ability to process and internalize the technical information that is taught, students cannot receive maximum benefit from their instruction. Teachers, in their instructional, supervisory, and advisory capacity, should constantly strive to assist students to become more self-directing in terms of their school, social, and work lives.

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Helping Students Become Better Decision Makers

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Requirements for Decision Making

If students are to become skillful decision makers, three major requirements must be mastered. Each individual must develop an awareness of and the ability to:

1. Examine and recognize their personal values
2. Identify and use adequate and relevant information
3. Use an effective strategy to convert this information into an appropriate action

Values. The way one reacts under certain circumstances is determined to a great extent by values. Values are an expression of what is prized, cherished, or held in high esteem and ultimately determine what is satisfying and in turn helps one to set objectives.

Values are learned and become an appropriate topic for classroom discussion. Students will become more competent decision makers if they are aware of their personal values, the sources of their values and if they develop a respect for differing sets of values.

The time has since passed whereby teachers can indoctrinate students with one set of values that are their own and have students accept them. It is one thing to encourage general parameters of acceptable behavior and conduct and yet another to moralize to the extent that students have no latitude in terms of choice. There are no right or wrong values since values can only be judged by the individual.

An awareness of one's values is essential in setting personal goals and objectives. Otherwise, individuals tend to react not really knowing why they are behaving as they do. If students are thoroughly attuned to their values they are more likely to set clear cut goals and objectives that are attainable.

Information. Without adequate and relevant information, the decision maker does not have at hand all of the possible alternative courses of action. Knowing where to go and what to ask and then evaluating the information obtained are important skills to be learned.

An impending decision requires information concerning the following:

1. Alternative courses of action
2. Consequences of each alternative
3. Probability of the consequence occurring
4. Desirability of the possible outcomes

As students seek out information and process it, they are able to increase the number of options or alternatives available to them which in turn provides for more freedom or latitude in their choices. Students need to know the sources of information and how to generate new alternatives from the available information. The evaluation of information on the basis of its objectivity and relevance is an important step in establishing an unbiased basis for decision making.

From information, one can not only determine the possible courses of action but the consequences or possible outcomes for each altenative. It is not enough to know the possible courses of action, it is necessary that one anticipates what the possible outcomes will be for each of the alternatives. There is no guarantee that the alternative selected will produced the desired outcome, therefore, it is likely that there will be some risk associated with each alternative that is considered.

Strategy. The ability to calculate the amount of risk associated with each possible alternative and then apply this information requires the use of a decision making strategy. This involves the uniting of ones values with the information concerning the alternatives and the possible consequences of each. Values determine the personal importance of the outcomes of the decision and, ultimately, the amount of risk that one is willing to take to achieve the desired outcome.

Since each choice frequently leads to several possible outcomes involving some degree of uncertainty or risk, a decision making strategy should be utilized. A strategy is a plan for making decisions on the basis of values, objectives, information, and risk. With a well thought out strategy, the student is more likely to make more realistic and meaningful decisions.

In applying a decision making strategy, it is generally recommended that one choose the most likely and the most desirable plan. This involves selecting a course of action that has both a high probability of success and a high desirability as viewed by the decision-maker. Although it may appear to be a simple process, it is not since it requires:

1. Knowing personal values
2. Knowing the alternatives and having the ability to predict the possible consequences of each,
3. Having the ability to estimate the probability of something happening
4. Having the ability to rank the desirabilities of something

Students need opportunities to explore personal values, consider alternatives, estimate their chances for success, and determine their priorities. The classroom is an excellent place to begin. The process can be taught and the skills that are learned can be utilized in every aspect of their lives. With sufficient practice, students can learn to systematically apply a decision making strategy.

The most difficult task in teaching decision making skills is finding time in what may already be an overextended curriculum. Perhaps you are presently teaching one or more instructional units that could be adapted to include a lesson on decision making or you might consider substituting it for some lesson that you have considered omitting from your curriculum. The topic of decision making is relevant for all students, regardless of the vocational agriculture class in which they are enrolled.

As the teacher of vocational agriculture you must ultimately decide what is to be taught to your students. If you feel that a unit on decision making skills would be beneficial to your students, have each of them identify a decision that they need to make concerning some aspect of their life and then use the following steps in the process:

1. State the decision to be made
2. List the alternatives that are presently being considered
3. Seek additional information that can be used in generating other alternatives
4. List the possible consequences of each alternative
5. List in rank order the desired outcomes from most important toleast important so that one may establish priorities
6. Assign a weight to each desired outcome beginning with the least important and then consider the next outcome in importance in relation to the one previously ranked and and assigned a relative weight
7. Estimate the probability of each outcome occurring and rank in order from certain to uncertain
8. Select the course of action that has a high probability of occurrence and that will produce the most desirable outcome based on the students prediction system
9. Implement the decision
10. Evaluate the outcome

Practice does not necessarily make for perfection, but it will surely help. If one provides opportunities for students to apply a decision making strategy they will become better decision makers and will benefit in every aspect of their life because of it.

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ARTICLE

Serving Rural Youth in Vocational Agriculture

BY ROSCO VAUGHN

(Editor's Note: Mr. Vaughn is Supervisor of Vocational Agriculture, State of New Mexico, Box 3501, Las Cruces, New Mexico 88003.)

Today approximately nine percent of the rural labor force is engaged in farming. Many people still consider vocational agriculture as a program which trains young people for farming and they cannot understand why vocational agriculture programs, with the integral Future Farmers of America, continue to remain as dominant skills training and leadership development programs in small rural high schools.

A Reassessment of the Past

While those of us involved in the agricultural education profession contend that our program has expanded to include the agribusiness and natural resource areas of the agricultural sector of the economy, perhaps we should take time to assess our position as we move through the 1980's. The real strength of vocational agriculture results from the "hands-on" activities which allow students to step into the world of agriculture and experience the successes, failures, joys, and disappointments associated with the industry.

Supervised occupational experience programs and Future Farmers of America activities have provided the opportunities for students to indulge in these experiences. Prior to the 1960's when vocational agriculture was preparing boys for the farm, the goals and direction of the program were clear and easily understood by teacher educators, supervisors, vocational agriculture teachers, and students. With the advent of new legislation for vocational education in the 1960's, which authorized a rapid expansion of agricultural education to serve all areas of the vast agricultural industry, many educators lost the ability to focus clearly on the program goals and objectives. Agricultural educators tried instead to provide an all encompassing curriculum. Providing agricultural education to all interested parties has been the major thrust of the program for the past few years. Now may be the time to reexamine the goals and objectives of vocational agriculture in terms of the student population served by the program.

Rural Youth as a Target Population for Vocational Agricultural Education

Vocational agriculture programs are currently provided in many metropolitan areas of the United States. Many of these programs are extremely successful and have proven that all youth with an interest in agriculture can benefit from participation in vocational agriculture and the FFA.

While recognizing the importance of these programs, we must not forget that the traditional strength of vocational agriculture lies in rural America. An important function of vocational agriculture for the future will be to continue to replace the production agriculture work force. This function clearly indicates a continued need for entrepreneurial training in production agriculture. The curriculum in rural schools located in farming communities should continue to reflect this emphasis on production agriculture.

Providing Entrepreneurial Experiences in Agribusiness for Rural Youth

Rural areas of the United States have a high incidence of self-employment and a high proportion of workers with more than one source of income. Over half of the agricultural work force is self-employed and other sectors of the rural economy also tend to have higher rates of self-employment than urban areas. Most businesses in rural communities are small and more diverse than large businesses. These characteristics of rural communities have implications for agricultural educators serving these areas. Most small businesses tend to hire generalists rather than individuals with a high degree of specialization. Many self-

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employed individuals rely on their own time schedule rather than that of the clock.

Many rural students prefer to remain in rural communities rather than seek employment in urban areas. While these self-employment opportunities exist in many rural communities, they are often overlooked as potential placement areas for vocational agriculture graduates.

Student Involvement in Planning Entrepreneurial Training: A Plan of Action

The students enrolled in a local vocational agriculture program could assist in conducting a community manpower needs assessment that emphasizes opportunities for self employment. Since employment statistics for rural areas are almost non-existent at the state and national level, a logical solution to determining local needs is a local needs assessment.

Dividing a vocational agriculture class into two groups and allowing one group to list all self-employed individuals in the community and the other group to list other job opportunities, provides student incentive through competition. Asking questions about needed, but lacking, community services would add to the list of employment opportunities.

When the teacher and students complete this project, they can then begin to plan their local program to meet their community manpower needs for the 1980's. If a number of self-employment opportunities exist in agribusiness and production agriculture, the vocational agriculture curriculum should reflect this emphasis through supervised occupational experiences and other classroom, laboratory, and leadership activities which provide for experiences designed to increase the students' independence, self-reliance, and decision making regarding the risks of entrepreneurship.

Will Vocational Agriculture Meet the Challenges of the 80's?

The primary reason vocational agriculture has continued to prosper since its inception lies in the ability of agricultural educators to meet the needs of the local community and to adapt to changes as the community changes. As we look to the future, we must continue to emphasize the local vocational agriculture department that serves the needs, wants and desires of the local community. In the rural areas of the United States, agricultural educators should carefully analyze their local community needs before they make curriculum changes. It may well be that the entrepreneurial training traditionally provided through vocational agriculture education may only need to be refocused in some communities and not eliminated to provide specialized training in one phase of agribusiness.

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BOOK REVIEW

Western Fertilizer Handbook, by Soil Improvement Committee, California Fertilizer Association, Danville, Illinois: The Interstate, 1980, 6th ed., 280 pages, $5.50.

The Western Fertilizer Handbook presents information on soil, water, plant growth, fertilizer products and their properties, and correct usage of fertilizer products. Since western soils are distinctly different from soils east of the Rocky Mountains, the main emphasis of this book is on the usage of fertilizer products on western soils.

The first three chapters deal with soil, water, and principles of plant growth. Soil texture, profile, structure, microorganisms, and management are explained briefly. Water and its importance to plant growth are discussed. Irrigation water and methods of irrigation are discussed due to the importance of irrigation in western soils. Plant growth is another subject that is covered. The book stresses that it is important to understand the plant growth process in order to understand what plants consist of and how they function.

The remaining chapters include coverage on the sixteen plant nutrients that are essential for plant growth. Each nutrient is covered in depth and its importance explained. Fertilizers and their sources are covered in depth, as well as fertilizer formulation, storage, application, and handling methods. Color plates are included which show common nutrient deficiencies. The plates are helpful for anyone who has had little experience in identifying deficiency symptoms.

The Western Fertilizer Handbook is directed toward the high school or junior college audience. This book provides a good introduction to basic soil properties and the importance of the use of fertilizers for anyone who has little knowledge or practical experience. It is and excellent text for high school horticulture classes and junior college basic soils classes.

Richard Hylton
Angie Hylton
California State Polytechnic University
Pomona, California

Next Month in the Magazine . . .

Just for Teachers and The First National Vocational-Technical Agriculture Opinion Poll

ARTICLE

Horse Riding Therapy for the Handicapped

What constitutes agricultural education programs? Are they only in the formal setting of the high school, vocational-technical schools, and colleges? Are they also in other areas?

Do you want to see agricultural education at its best outside the formal school setting? Put handicapped students up on horses and don't bother to tell them they can't handle the situation. Watch their faces at the realization that these gentle animals they sit astride are reacting to their commands.

Physical, mental, and emotional handicaps don't magically go away. Yet, the sense of accomplishment and learning, the sense of being in charge has the effect of making handicaps seem far less disabling.

Helping make handicaps less disabling is what The Winslow Riding for the Handicapped Foundation, Inc., is all about. Located in Warwick, New York, the foundation is a non-profit organization that functions under the premise that riding horses should be available to all types of handicapped people. Rider handicaps include cerebral palsy, deafness, emotional disturbances, learning disabilities, multiple sclerosis, muscular dystrophy, mental retardation, and a multiple of others. In fact, the only problem that seems to stop students from getting involved in the program is allergy to horses.

Depending primarily on private and corporate donations as its major funding source, the foundation provides over 2500 riding sessions a year at Borderland Farms in Warwick.

By John J. Buckley

(Editor's Note: Mr. Buckley is vocational agriculture teacher at Warwick Valley High School, Warwick, New York 10990.)

As with many in-school programs, volunteers are critical to the success of the riding programs. They work alongside students as safety rules, horsemanship, and procedures are discussed. They are again alongside as riders take the first trip around the indoor riding arena.

The Foundation, administered by Virginia Martin, has worked with various groups since incorporation in 1974. Student riders range in age from adults to the very young. Schools from both New York and New Jersey have included riding at Borderland Farms as part of their pre-school programs for the handicapped.

If you want to experience real excitement and share a feeling of fulfillment, watch the five and six year olds, riding helmets in place, mounted on quiet, easy-gaited horses. Watch faces that show only glee and pride as students ride out and horses react to hands, legs, and voices telling them what to do.

Some youngsters are timid to begin with, but the horses soon take on personalities and come to be known on a first-name basis.

One dark-haired, enthusiastic little girl lost all apprehensions as "Joe" and "Brownie" became her good friends. Friday riding sessions became something to look forward to with new information learned each time.

The Foundation is a member of the North American Riding for the Handicapped Association (N.A.R.H.A.). As such, the Foundation has sent riders to events such as the International Special Olympics, National Games of the National Association of Sports for Cerebral Palsy, and the Metropolitan Regional Therapeutic Equestrian Games. Three riders also took part in international competition in Canada as part of the U.S Therapeutic Equestrian Team.

Two films have been produced about the Winslow Foundation's work. "Saddle Pals," seen on National TV, chronicles the progress of the program from its inception. "Exceptional Equestrians" is geared to showing techniques and reasons why riding works in therapy for the handicapped. Both films are available for rent. They, along with additional information, may be obtained by writing to Administrator, Winslow Riding for the Handicapped Foundation, Inc., RD #1, Box 245, Warwick, New York 10990.

Virginia Martin, Administrator of the Winslow Riding for the Handicapped Foundation, is shown instructing youngsters and adults about horses.

The pre-school youngster is given her first horse ride. Volunteers assist with the program. Safety is stressed to the fullest extent, as shown here by the helmet.

ARTICLE

Small Engine Trouble Shooting Contest

By Jordan Hudson

(Editor's Note: Mr. Hudson is Assistant Professor of Agricultural Education at Virginia State University, Petersburg, Virginia 23803.

The Virginia Association of Future Farmers of America has an annual engine trouble shooting contest held at the Virginia Fair each year. An FFA member representing each supervisory area of the State competes to determine a State winner. Each contestant has to win one or more local/federation small engine events prior to competing in the State contest.

During the 1979 Spring State Agricultural Education Staff Meeting, it was determined that there was enough need and interest to conduct a State FFA Small Engine Trouble Shooting Contest. The need was based on the following:

1. The Agricultural Education Instructional Guide included 25 hours of instruction on maintaining small gasoline during the second year of Agricultural Science and Mechanics classes.
2. Being able to trouble shoot small engines would provide a basic understanding of engines needed in the ever-increasing mechanization of agriculture.
3. More students would be interested in learning about small engines if they had an opportunity to compete in a State contest.
4. A contest similar to the Tractor Trouble Shooting Contest would give exposure and recognition to additional students.
5. Students, teachers, and representatives from the State Fair had expressed an interest in such a contest.

After a thorough investigation of several similar contests, it was decided to pattern the event after the already established Tractor Trouble Shooting Contest. (A copy of the State Guide for the Small Engine Contest is included at the end of this article.) Since both contests are held in the same building, 30 minutes is allowed between the start of the two contests. This interval provides time for introduction of the contestants. Having the two events occur almost simultaneously gives the spectators more than one type of activity to observe.

Objectives

The objectives of the Small Engine Contest are for the student to be able to:

1. Exercise safety.
2. Demonstrate the proper use of tools.
3. Locate the problem(s) and correctly adjust, repair, and/or replace the item causing the problem(s).
4. Identify parts needed from the parts department.
5. Return the engines to normal operating condition within the minimum time possible.
6. Demonstrate a general knowledge of small engines through completing a true-false/multiple choice test.

The Contest

The contest begins with an explanation of the purposes, rules, and information concerning any ususual conditions of the engine or contest. Students are not told how many malfunctions to find. However, they are instructed that the check-off sheet will be used in scoring to eliminate the possibility of luck in correcting a malfunction.

The preliminary portion of the contest involves a short test of the student's general knowledge of small engines. It is timed and recorded on the score sheet to become a part of their total score.

The main portion of the contest, which has a two-hour limit, is performance-based. The student selects an engine that has been "bugged" by a contest judge, and corrects the malfunction(s). It is a good practice to circulate among the participants and engage in conversation with them individually. This practice establishes good rapport, and tends to lower their anxiety level. The competition is conducted by a contest committee composed of a manager, timer, parts manager, and judges.

As each student restores the engine to normal operating condition, the judge should observe its operation. The contestant should be present to observe and verify mistakes as the judge checks the ignition system and carburetor. Having the contestant present allows the judge to not only score the trouble-shooting performance, but to show the student any adjustments that may be required. This practice marks the contest as a learning experience, and more than mere competition. It also reinforces the objectives for the student.

Problem Areas

Even the best planned contest can have problems. The following are some problem areas and possible solutions:

1. Engines — It is sometimes difficult to secure engines of the same make and model for all contestants. The best solution would be to have a small engine company donate engines to be used only for the State contest. This would assure sufficient engines to trouble shoot, but precludes having a variety of brands and/or models.
2. Tear-down vs. Trouble Shooting — If there are too many malfunctions, the student who is competent in trouble shooting will not have an advantage over one who takes the engine apart and puts it back together. Therefore, it is better to have only a few good malfunctions.
3. Prizes — Just as you do in the classroom, a good response should be reinforced. Prizes can be obtained from local merchants. The Virginia contestants receive a ribbon and money award from the State Fair Association, as well as prizes from local merchants.
4. Parts — Students may accidentally break parts for which you must have replacements. Replacement parts can be obtained through donations from local small engine dealers. Some dealers will agree to loan parts to be used in emergencies. Contestants should be warned to be careful, particularly about overtightening the small screws. (The proper sheet metal screw can be substituted when the threads strip.)
5. Safety Glasses — Spectacles develop less annoying fog problems than goggles. If the goggle type has to be worn, use the perforated type and treat them with an anti-fog compound.
6. Unanticipated Mechanical Failure — When you least expect it, a problem will develop. The timer will have to be notified to deduct the time from the score of the contestant when an unanticipated mechanical failure occurs. This type of action should be covered in the rules, in case it prevents the student from completing the contest.
7. Motor Mounts or Braces — The engines can be attached to motor mounts or tables. Bolts or C-clamps can be used to hold the engines in place while they are operating. If heavy tables are used, there will be fewer problems with vibration.
8. Correct Tools — Some students will not bring all the tools they need. This problem can be remedied by having a set of tools in the parts department to be loaned to contestants. Students should also be warned and penalized if they use incorrect tools.
9. Large Spaces — To avoid close observation of one another, the contestants should be positioned at separate tables throughout the area being used.

SCORE SHEET

for

SMALL ENGINE TROUBLE SHOOTING CONTEST

Name of Contestant _____ Number _____

School _____ Points

1.	Failure to get engine started x 200	_____
2.	Failure to correct a present defect. _____ Number of defects not corrected x 50	_____
3.	Carburetor main load mixture improperly adjusted x 50	_____
4.	Carburetor idle mixture improperly adjusted x 20	_____
5.	Parts requested but not needed. _____ Number of parts not needed x 20	_____
6.	Safety violations (safety goggles, smoking, carelessness, etc.) _____ Number of violations x 20	_____
7.	Improper use and care of tools _____ Number of cases x 20	_____
8.	Written examination _____ Number wrong x 20	_____
9.	Each minute or major fraction thereof trouble shooting time will be counted 2 points. _____ Minutes x 2	_____
	TOTAL POINTS DEDUCTED	_____

MALFUNCTION CHECK-OFF SHEET

SMALL ENGINE TROUBLE SHOOTING CONTEST

Contestant Name _____ Number _____

Motor Serial Number _____ Model _____

		Good	Needs Work	Describe Work Done
1.	Ignition System:			
	a. Spark plug			
	b. Breaker points			
	c. Condenser			
	d. Armature air gap			
	e. Coil			
	f. Plunger			
	g. Ignition wires			
	h. Other:			
2.	Fuel System:			
	a. Air cleaner			
	b. Carburetor (not bugged internally)			
	c. Fuel, fuel line			
	d. Idle adjustment			
	e. Main load			
	f. Choke			
	g. Stop switch			
	h. Governor			
	i. Other:			
3.	Cranking System:			
	a. Compression			
	b. Tappet			
	c. Rings			
	d. Timing			
	e. Gaskets			
	f. Valves			
	g. Other:			
4.	Lubrication:			
	a. Oil level			
	b. Drain plug			
	c. Breather			
	d. Other:			

Notify timekeeper when you have completed the contest.

Virginia FFA State Guide Small Engine Trouble Shooting Contest

Purpose

The Small Engine Trouble Shooting Contest is designed to give FFA members an opportunity to demonstrate their knowledge and skill in trouble shooting small engines. Total engine tear-down is not encouraged.

Participation

Any bona-fide FFA member is eligible to compete. One contestant competes in the State Contest from each supervisory area. Participants must be certified prior to the date of the State contest.

Scoring

The point deduction system will be used to score the contest. The contestant with lowest total score will be the winner. Each contestant will be scored on safety throughout the contest by the judges. The malfunction check-off sheet used by each contestant will be utilized in scoring to eliminate the possibility of luck in correcting a malfunction.

Time Allotted

Twenty minutes will be allowed for the written examination. The written exam will consist of 25 true-false and/or multiple choice questions. Two hours will be allowed to adjust the engine and get it operating properly. In those cases where a malfunction occurs which was not anticipated, time needed to correct the malfunction will be deducted from the participant's total time.

Rules

The general rules and regulations are as follows:

(Continued on Page 22)

Small Engine Trouble Shooting Contest

(Continued from Page 21)

1. Bona-fide FFA members, including those who have competed but who have not won in a State Small Engine Trouble Shooting Contest, will be eligible to compete.

2. Engines will be identical, and have the same malfunctions.

3. Contestants are to bring their own tools in a tool box.

4. References and manuals may be used.

5. Oil, fuel, rags, fire extinguishers, and parts containers will be provided.

6. Only members of the contest committee and contestants will be allowed in the immediate trouble shooting area. Spectators may observe from a distance, but may not converse with contestants.

7. No work will be done outside the designated trouble shooting area.

8. Contestants are requested to consult with the judges when in doubt.

9. Adjustments must be within the specified tolerance or within .002 inches when no tolerance is specified.

10. Participants will not be penalized when requesting extra parts if they can justify the need to the judge.

11. Contestants are responsible for notifying the timekeeper when completing the contest. After that time, no further adjustments to the engine will be allowed.

12. Contestants and/or tools may be used by the judge in determining if malfunctions have been corrected.

13. Contestants may be disqualified for the following reasons:

- *a. Failure to follow rules and regulations or instructions of judges.*
- *b. Conduct on the part of the instructor or contestant unbecoming a gentleman or lady, or to the spirit of the contest and the school they represent.*
- *c. Smoking in the contest area.*
- *d. Conversing with anyone except the judges.*
- *e. Using a starting fluid or unapproved practice.*

14. If a mechanical failure over which no one would have any control should occur, it will be considered as an act of nature, and participants will be expected to accept this without claim or recourse.

15. Should a condition occur which is not covered by the rules, the decision by the contest committee will be final.

Contest Committee

A contest committee comprised of a contest manager, timekeeper, parts manager, and two judges shall be established. The judges will be assisted by student teachers from selected schools. The responsibilities of the contest committee members are as follows:

Contest Manager

1. Secure identical engines for each contestant.

2. Secure spare parts, oil, fuel, rags, fire extinguisher, and two containers per participant. One container will be used to exchange old parts for new, and the other will be for storing parts while trouble shooting.

3. Designate a spare parts area and appoint a parts manager.

4. Determine and supervise the installation of the malfunctions.

5. Review the malfunctions with the judges prior to the beginning of the contest.

6. Be responsible for the overall operation of the contest.

Contest Timekeeper:
(selected by contest manager)

1. Conduct a drawing among contestants to determine who gets which engine.

2. Furnish a malfunction check-off sheet to each contestant.

3. Record the starting time for the contest.

4. Record the finishing time of each member.

5. Assist the contest manager in maintaining order in the contest area.

6. The timer may also serve as a judge or as a parts manager.

Parts Manager:
(selected by contest manager)

1. Secure replacement parts as requested.

- *a. Have participants write their name, number, and parts wanted on a piece of paper. (Paper to be supplied by parts manager)*
- *b. More than one part may be obtained at one time.*
- *c. Have contestant turn in old part for new part.*
- *d. Allow only one participant in parts department at one time.*
- *e. Evaluate the students' justification for extra parts.*

2. Keep a record of the parts requested by each participant.

3. Be familiar with all parts, and have each replacement part readily available upon request. (Every precaution is to be taken not to reveal to the contestants which parts are available.)

Judges:
(two selected by contest manager)

1. Assure that contestants do not inspect the engines prior to contest time.

2. Circulate among contestants.

3. Have a list of the malfunctions, a copy of the malfunction check-off sheet, and a score sheet for each contestant. Use these to determine if malfunctions are corrected properly.

4. Observe the progress of repairs, but not interferring with the contestants unless such repairs are damaging to the engine or to the safely of the contestants.

5. Will not assist the contestants in any manner in locating or correcting the malfunctions.

6. Signal the timekeeper when a contestant has finished.

ARTICLE

Simple Adjustments Solve Most Mower, Rake Problems

By Paul Castner
(Editor's Note: Mr. Castner is with Sperry New Holland, New Holland, Pennsylvania 17557.)

Conventional mowers or disc mowers and rakes are very popular in a lot of haying operations across North America. Preventive maintenance on equipment can help reduce costly machine downtime.

Many nuisance problems on conventional mowers can be eliminated if the operator takes the time to service the mower before the season and for different crops while in season. It is important to replace all worn guards and broken knife sections. In many cases, the complete knife assembly should be replaced.

Take time and evenly adjust the guards the full length of the cutterbar. These serve as supports for the knife back when material pushes against the knife. Also, adjust the hold-down clips to hold the knife against the ledger surface of the guards.

Always lubricate the mower and oil all pivot points, and be sure to replace the drive belt if it is worn or cracked.

Before attempting to use the mower in the field, attach it properly to your tractor. The mounted mower must be adjusted for the different tractors you may use. To position the mower for correct frame height, run your tractor at 540 R.P.M. for a sickle speed of 800-825 strokes a minute.

Make sure the cutterbar has lead at the outer end and that the break-away latch is functioning properly. Adjust the cutterbar tilt for short or lodged crops. Make sure the proper knife head bolt is used and torque the knife bolt properly. In all cases, refer to your operator's manual for the best maintenance procedures on equipment.

Disc Mowers

Disc mowers are relatively new in many areas of North America but are fast gaining popularity in tough mowing conditions. Disc mowers are very popular in the South where hills are infested with fire ant hills.

For the best operation of a disc mower, make sure the cutting blades are in good condition. Blades are reversible but they must be replaed when badly worn or broken. Uneven blades cause vibrating.

Never operate the mower unless the end crop divider caps are in place. After you lower the cutterbar, wait just a few minutes before operating and allow the oil to spread out in the cutterbar gear case. Drain oil in the cutterbar to flush out any buildup of dirt and foreign materials. This is especially important with a new mower after the first ten hours of use.

Always check the pressure relief valve for the cutterbar to relieve any excess pressure. Set tension on drive belts properly. Loose belts may burn up quickly. Regulate ground speed according to crop and field conditions. Remember, a slower ground speed may have to be used in heavy crops.

Do not attempt to operate the mower without the plastic cover over the discs. Adjust the cutting height by tilting the cutterbar with the top link. And don't cut so low that the blades cut into the ground.

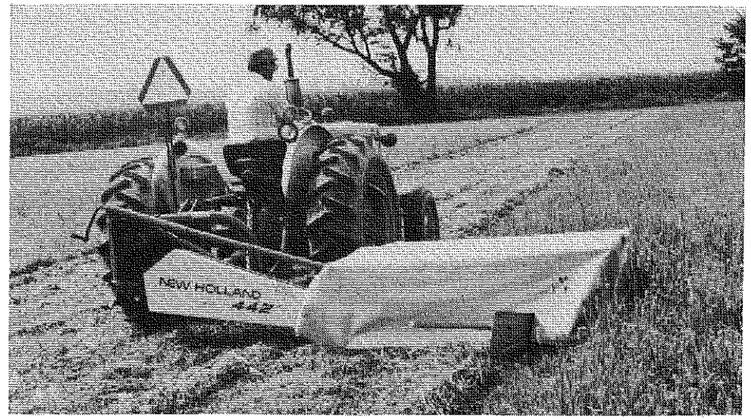
Rakes

Rakes don't require a lot of maintenance. But a few minutes of making adjustments is all it takes to prevent a lot of downtime or hay spoilage at a critical time.

Before operating a rake in the field, replace any bent or broken tines and straighten bent stripper bars to make sure the tines clear the bars. This can be done by turning the rakes with your hands. It is important to keep an eye on the lubricant level in the gearbox — refilling as required.

It helps to lubricate the tine bar bearings on rakes that have grease fittings. A couple of pumps on each fitting is just enough. Never grease until the old grease is forced out of the seal areas, and don't operate your rake so low to the ground that the teeth dig into the ground.

The teeth should be at least ½" or more above ground. It is important to always have your operator's manual close by for quick reference to helpful maintenance tips.

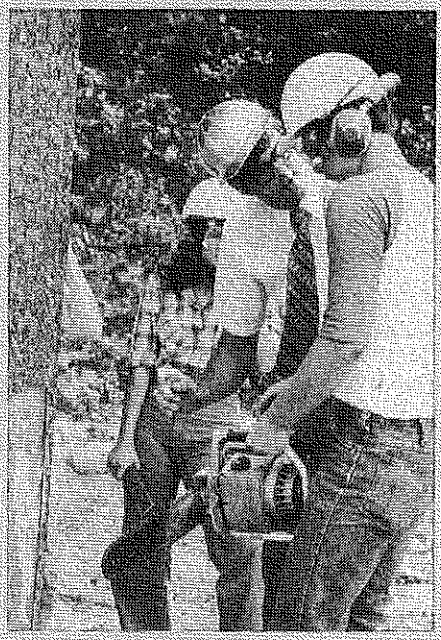


Disc mowers are relatively new in many parts of North America, and when properly maintained cut much faster than conventional sicklebar mowers. The cutting discs spin at 3,000 rpm. Cut crops are left in a wide, lightly fluffed swath for quick drying. There's virtually no plugging in down, tangled crops; dense, wet undergrowth; or in fire-ant hills.

Stories in Pictures

Problem Solving Leads to Success

What tools do we need?



What safety practices do we observe?

How high do I cut?

How do I get the tree to fall in the right direction?

Success comes from solving the problems. (all photographs courtesy of Photo Lab, Learning Resources Center, Virginia Tech, Blacksburg, Virginia).