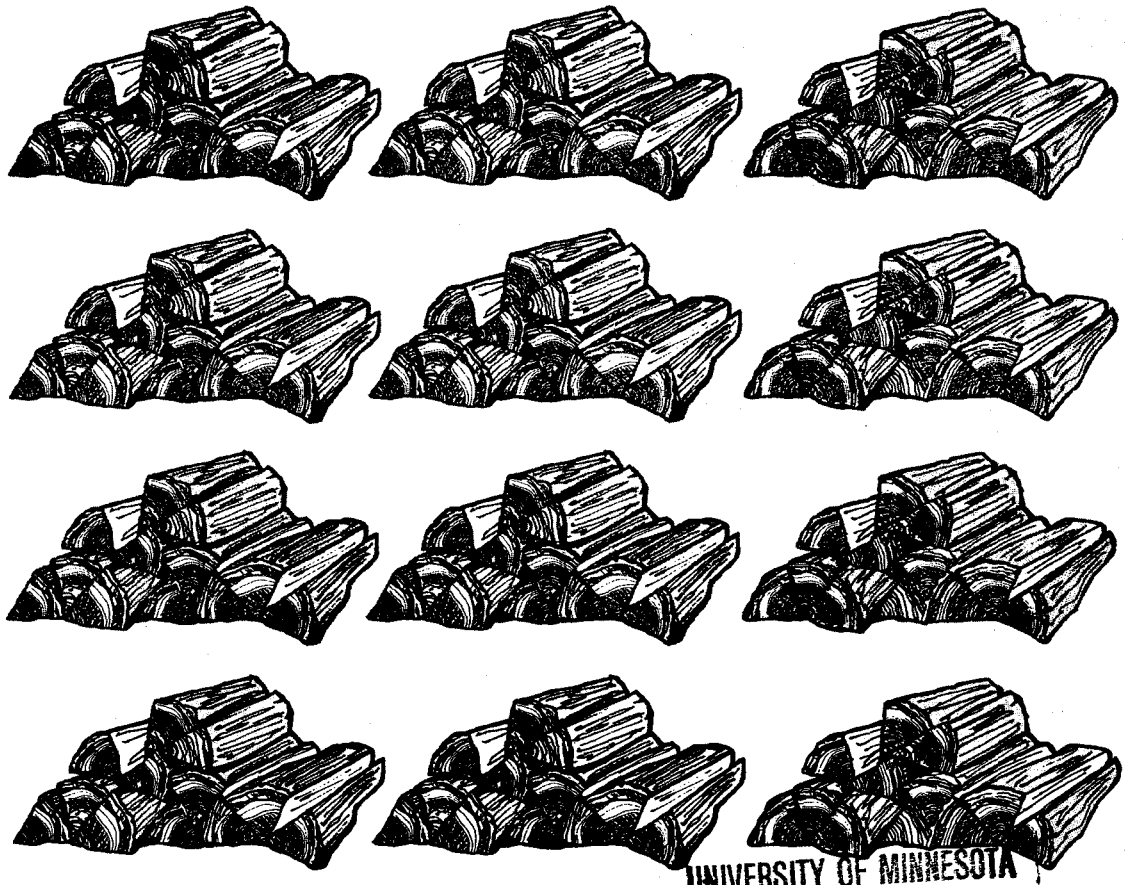
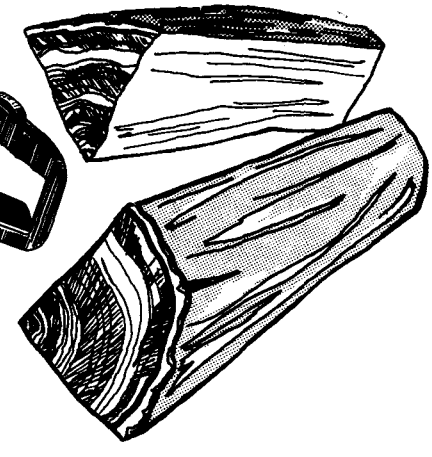
AG-FO-2487
Educational Package AG-EP-2657





SAFE CHAINSAW OPERATION

A. Scott Reed
Lee Schultz
Robert A. Aherin

Agricultural Extension Service
University of Minnesota

INTRODUCTION

Chainsaws are a powerful and valuable tool. They can be found on most farms and in homes where wood is cut for fireplaces or heating systems. They are also the principal cutting tool for nearly half of the commercial timber produced in Minnesota.

However, despite the benefits of chainsaw use, the potential for accidents while using a chainsaw is high, and injuries sustained are usually severe.

The Consumer Product Safety Commission found that the number of chainsaw accidents requiring medical attention increased from 70,000 to 135,000 annually over a five-year period. These accidents appear to be increasing at the alarming rate of 10 percent per year.

In Minnesota, fatality reports show that during a five-year period 19 people died. Seventeen, or nearly 90 percent, of the chainsaw **deaths** resulted from trees or branches falling on workers as they used a chainsaw.

Contact with a moving chain accounts for 85 percent of **injuries** to chainsaw operators. The most serious accidents involving the moving chain result from kickback. The incidence of kickback can be reduced by paying attention to the major components of an accident (figure 1).

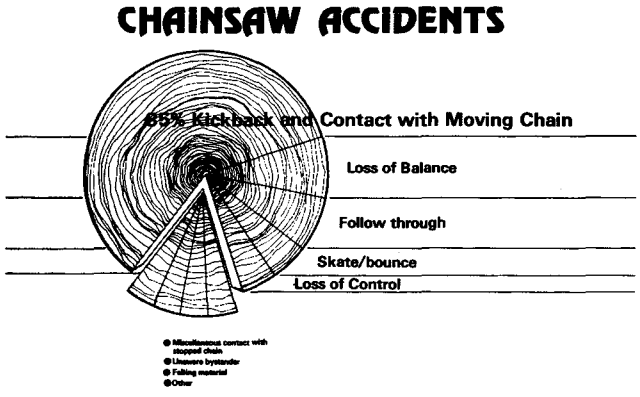


Figure 1. The majority of chainsaw accidents are caused by contact with a moving chain, although most deaths occur when operators are struck by a falling tree or limb.

ACCIDENT COMPONENTS — HUMAN, AGENT, ENVIRONMENT

The **human** component refers to both the physical and mental condition of the operator. Operating a chainsaw calls for recognizing any personal limitations, including fatigue and boredom, which can reduce reaction time and increase the odds of an accident occurring.

Although the chainsaw itself is the **agent** that inflicts most common injuries, accidents also result from falling trees or dead limbs and from loss of balance, which can lead to serious falls.

Environment is the third accident component. Changing and often severe weather conditions can also increase the likelihood of an accident.

BASIC FIELD MAINTENANCE

Safety maintenance consists of field attention to the essential parts of a saw to keep it in efficient and safe operating condition. The operator's manual should always be consulted for items specific to an individual saw.

A broad trigger guard and chain catchpin help protect the operator if the chain breaks or becomes otherwise disengaged. If the chain breaks or jumps the bar, the catchpin will cause the chain to bunch up, keeping it from striking the operator's right arm.

Heat from the muffler sometimes ignites gasoline or dry forest tinder near the saw. Be sure that the muffler is in sound operating condition.

When the moving chain on the tip of a bar strikes something, the bar is sometimes forced upward toward the operator (figure 2). This occurs because the teeth take an oversized bite and temporarily stall, transferring the power from the chain to the saw, which then rotates toward the operator. The saw can kick back 90 degrees in one-tenth of a second . . . faster than the human brain can respond.

Most saws are equipped with a chain brake designed to stop the moving chain when the brake is engaged by the operator's hand, wrist, or arm. If a kickback occurs, a stopped chain will do far less damage.

Some saws are equipped with safety-tipped bars, which attempt to keep the tip from contacting anything. Although chainsaws with safety tips are not as versatile, this safety feature can be useful for an inexperienced chainsaw user.

Older model saws frequently generate severe vibrations that can, over time, contribute to blood vessel deficiencies in operators. Handles of newer saws are mounted in rubber and vibrate much less.

Figure 2. A kickback can occur in less than one-tenth of a second, faster than the human brain can respond.

DAILY OPERATION CHECK

Daily examination to ensure that the saw is operating efficiently helps reduce the prospect of an accident.

Taking care of the chain is the most important, most often neglected, and most difficult feature of a daily operation check. *Sharpening* techniques can be varied with good results. However, it is important to use the proper technique for specific types of chain. Consult your owner's manual to determine the proper size file and tooth angles.

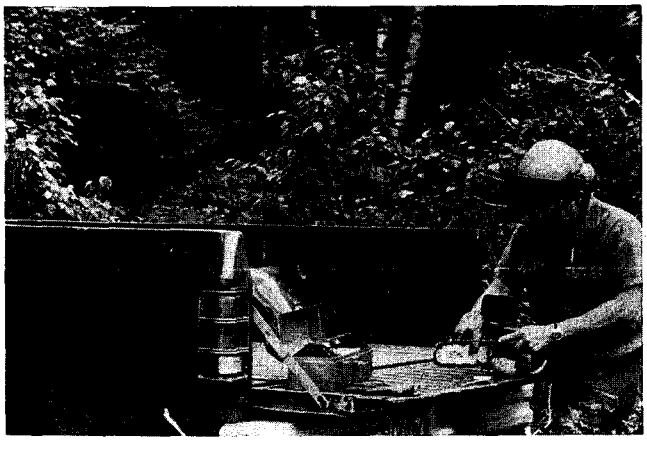
Proper *chain tension* contributes to efficient cutting and longer chain life and lessens the chance of the chain jumping the bar. For a hard-nosed bar, the proper tension should result in 1/16" to 1/8" of space between the bottom of the bar and the tie straps between the teeth. Tension for a bar with a roller or sprocket nose should be slightly tighter without binding when the chain is pulled around the bar with a gloved hand.

Chain lubrication is provided by a mechanism in the saw housing. Whenever the chain is off the bar, examine the oil port and clean it if necessary to keep the chain running coolly and efficiently. A well-lubricated chain is also less likely to jump from the bar and injure the operator.

Access to the *air cleaner* is usually provided by a thumbnut on the top of the housing. The element should be cleaned by brushing or tapping it to clear out small collected debris. Never use gasoline or other solvent because flammable residue could explode if ignited by the muffler or electrical system.

The *idle and/or clutch adjustment* must be set in such a way that the chain does not turn when the engine idles.

Figure 3. A field examination of basic safety features and saw components will reduce the odds of an accident occurring.



SAFETY FEATURES:
- **CHAIN CATCHER**
- **MUFFLER**
- **CHAIN BRAKE**
- **SAFETY TIP (IF PRESENT)**
- **RUBBER MOUNTED HANDLEBAR**
- **CHAIN SHARPNESS**
- **CHAIN TENSION**
- **CHAIN OILER**
- **AIR CLEANER ELEMENT**
- **IDLE ADJUSTMENT**

PERSONAL PROTECTIVE EQUIPMENT

Before going into the field to operate a chainsaw, the operator should be protected with clothing and other gear designed to reduce the severity of any accident.

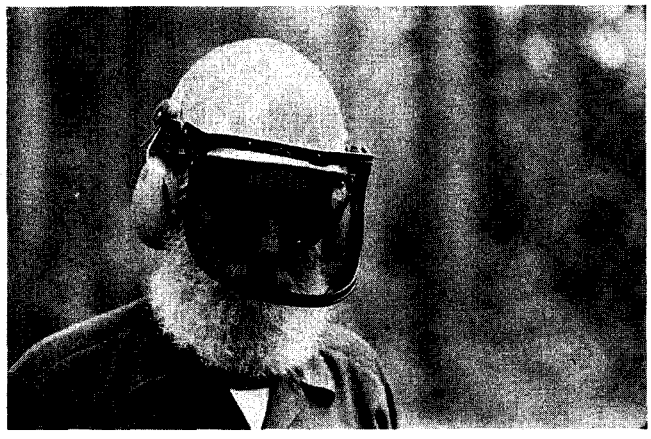


Figure 4. Hardhats specially designed for wood cutting are now widely available. Many have devices for both hearing and eye protection attached directly to the hat.

The basic piece of personal protective gear is an approved *hardhat*. There are many hardhats available with attached *ear muffs,* necessary to cut the noise, and a screen-shield, which gives *eye protection* from flying debris (figure 4).

Inexpensive ear plugs are also effective for protection from high noise levels. It's important to fit them tightly into the ear canal. Safety-glass eyewear can also substitute for a screen-shield, although lack of air circulation behind the lenses frequently causes fogging during exertion.

Other protective gear should include sturdy *work boots*, leather *gloves*, and leg *chaps*. Be sure that the chaps are constructed of material designed for protection from chainsaws. Two materials commonly used, ballistic nylon and Kevlar, are designed to slow or stop the chain if it strikes your leg, allowing you slightly more reaction time.

GETTING STARTED — FELLING

Fueling and starting the saw is best done after the engine has had some time to cool after prior use. Before you fuel the saw, clear the area around and under it of woody debris and other flammable material.

After the saw is fueled, move it at least ten feet from the fueling area and be sure that the saw is firmly supported before you try to start it. Don't attempt to start the saw while you are standing and holding it unsupported because it could pivot, striking you or another object, causing a kickback as it starts.

Before making the first cut to fell a standing tree, consider various factors that can influence how, and even if, you should fell it.

First, check diameter of the tree. If it is more than twice the length of the saw bar, it requires special cutting techniques best left to specialists.

Check every tree for lean before choosing a felling direction. Trees with a slight lean are best, as the lean helps place the tree. Trees with severe lean can be dangerous to fell because the tree moves in the leaning direction too quickly, splitting at the base and becoming what is known as a "barber chair." Barber chairs can fly upwards, striking the operator with terrific force.

The soundness of a tree can be evaluated by looking for signs of rot, including loose bark, fine "sawdust" particles at base of tree, or large holes in the trunk at any height. Trees usually rot from the center out, sometimes leaving only a shell of sound wood.

Distribution of the tree's crown can affect felling direction. Check for large limbs, snow or ice accumulations or uneven distribution of the crown. All of these factors can pull the tree in one direction.

Consider environmental factors also before choosing a felling direction. Wind is the most important environmental concern. The effect of wind is more pronounced on trees with large crowns. Avoid felling on very windy days.

The general terrain in the working area should be evaluated both to gauge its effect on the felling direction and to predetermine a safe escape route to use as the tree begins to fall.

Brush should always be cleared from around the base of the tree before beginning cutting. This allows greater freedom of movement and makes it easier to move away once the tree begins to fall.

BASIC FELLING CUTS

All felling techniques consist of two basic cuts with the chainsaw: the undercut and the backcut. The undercut removes a wedge-shaped piece of the trunk from the side to which the tree will fall. Only one-fourth to one-third of the tree's diameter should be removed with the undercut. The backcut, made on the opposite side, lets the tree fall.

The conventional undercut is made by first sawing the lower horizontal face and then sawing the upper face down at an angle to meet it. A newer style of undercut uses angled top and bottom faces, which together form a 90-degree angle. Use the new style of undercut whenever possible because the faces of the cut do not close until the tree is on the ground, giving a longer period of control over the tree's fall. Be sure that both cuts meet precisely. If one cut travels into the trunk too far, cut the other just deep enough to meet it.

The horizontal backcut is made from the opposite side of the tree, about two inches above the "V" of the undercut. Be sure to stop before reaching the undercut. About two inches of uncut wood should remain. This uncut portion, called the "hinge," helps guide the direction of fall. It also helps keep the butt of the tree from leaving the ground and striking the operator (figure 5).

Larger trees can sometimes be felled more easily by using wedges, made of wood or plastic. The wedges are driven into the backcut behind the saw to force the tree in the desired direction.

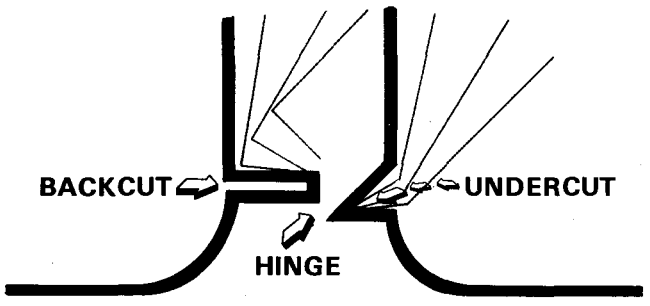


Figure 5. Each tree felled requires first an undercut, done on the side to which the tree will fall, and then a backcut. Be careful to leave a "hinge" of uncut wood.

After the tree has begun to fall, the operator should retreat in a diagonal direction from the tree, away from the direction of fall. Use a predetermined escape route and keep your eye on the falling tree for any developing problems.

One type of special felling situation consists of leaving a hinge of so-called "holding wood" that is thicker on one side and is used to pull a tree slightly away from its direction of lean. Although other, more elaborate cutting techniques are sometimes used on special cases, it is best to leave them to professionals (figure 6).

Figure 6. Use of "holding wood" can help fell a tree slightly away from its natural direction of lean.

REMOVING LIMBS AND BUCKING

Once the tree is on the ground, the limbs are normally removed, then the tree is "bucked," or cut into smaller pieces. Fallen trees are frequently under tension depending on the way they are supported by the ground or their limbs.

Normally, a trunk will be under both tension and compression on opposite sides; the sides change based on support points. Compression wood is being squeezed and if the saw cuts too far into the compression area it will begin to close, binding the saw. Usually the compression wood is cut part way first, then bucking is completed on the tension side, which will open away from the saw as the cut deepens, because the wood fibers are being stretched.

If a trunk is supported only at one end, compression wood occurs on the lower side. In this situation, the final cut should be made from above, allowing the pieces to separate (figure 7).

Removing large limbs also requires identifying tension and compression sides. Limbs on the underside of a fallen tree may be under severe stress and should be evaluated carefully.

When working on steep hillsides, always cut from the upper side of a fallen tree, because the pieces can easily roll after bucking.

Figure 7. Identifying the location of tension and compression wood in a trunk will make it easier to buck without binding the saw bar.

GENERAL OPERATING RULES

Several general guidelines help make chainsaw use more efficient and less dangerous.

First, learn to look *up* as you approach a tree before cutting. Overhead hazards can include dangerous wires, other trees, and dead and loose branches.

Saws are designed to be run at full throttle. Always accelerate the engine before beginning a cut.

Operator balance is important in controlling the saw. Shift your position instead of overextending your reach, and avoid reaching above shoulder height.

Kickback hazards can be reduced by staying conscious of the factors that make it possible. A correct position of the left hand, with the thumb wrapped *around* the handlebar, provides the operator with a more secure grasp of the saw.

While sawing, keep your eye on the tip, or"kickback zone" of the bar. This is where the cutting teeth can take an oversized bite and transfer the saw's power upward toward the operator. Kickback can also occur if the tip strikes another object such as a rock or debris. Keep your saw operating at peak efficiency by sharpening the chain often and, if it has a chain brake, testing and adjusting it regularly. Your owner's manual will point out any special attention your saw needs.

Before you make your first felling cut, there are at least twelve things to consider: Lean, branch distribution, clear work area, spot to fell the tree, escape route, location of buddy, location of vehicle, presence of power lines, appropriate cutting technique, presence of rot, wind speed and direction, and any overhead hazards, which, if they fall, are known as "widowmakers."

If you are not very experienced, start on smaller trees to learn and practice the basic felling cuts. Avoid going out when you are physically or mentally fatigued and don't go out alone. Take along a responsible adult to assist you and to provide emergency help if necessary. Remember to avoid felling a tree if it is a difficult case. Secure an experienced helper or hire a professional for dangerous work. Finally, make accident prevention a personal goal. The most important piece of safety equipment goes *under* your skin . . . your attitude.

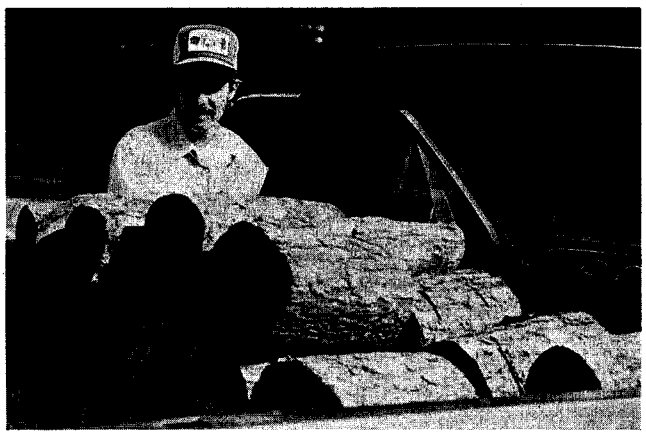
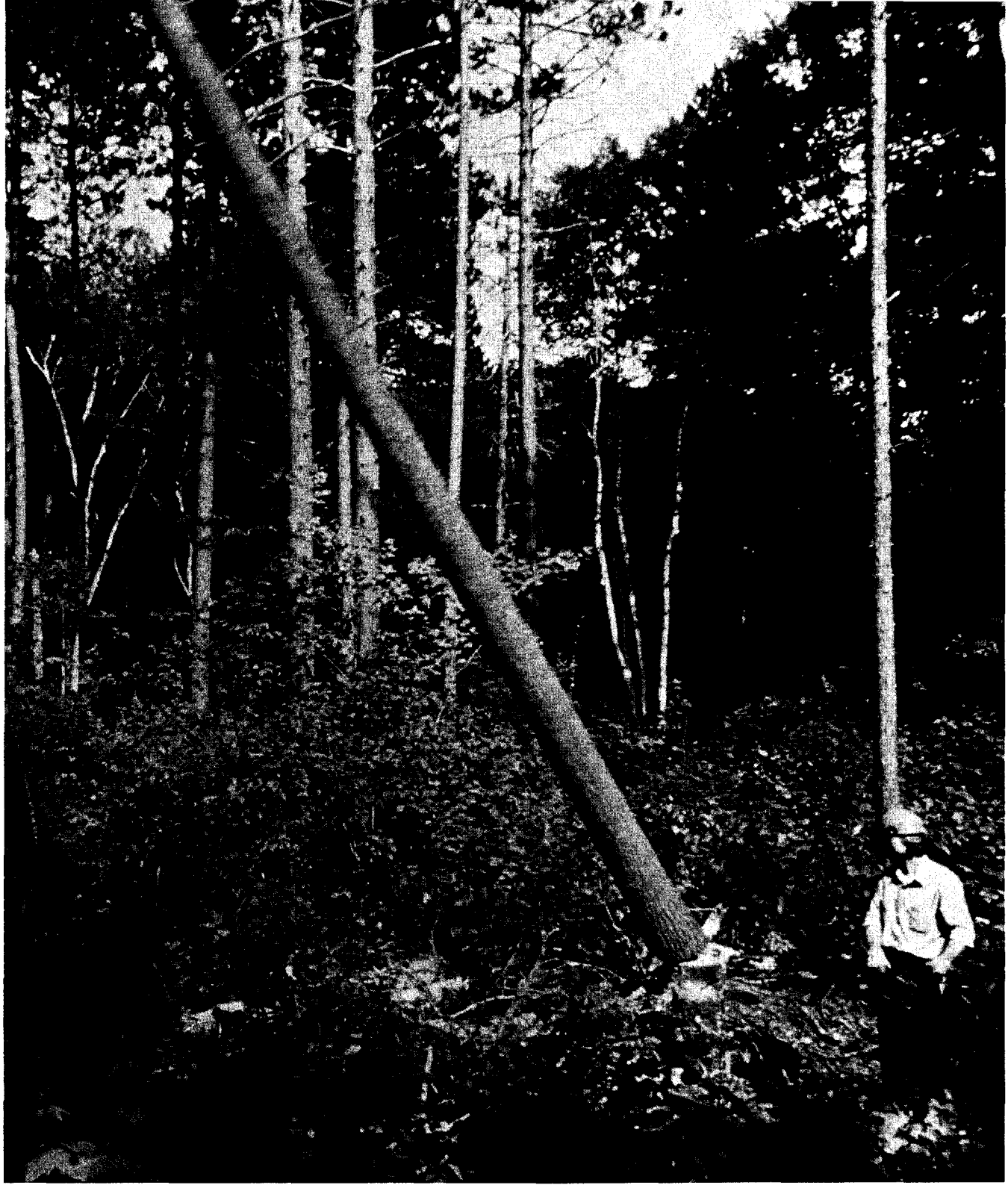


Figure 8.The reward for a productive and safe day in the field operating a chainsaw.



Authors: A. Scott Reed is extension forestry specialist and Lee Schultz is assistant extension safety specialist, University of Minnesota. Robert A. Aherin is extension safety specialist, University of Illinois.

Project Coordinator: David Hansen Editor: Anne Gillespie Lewis Photographer: David Hansen Graphic design: Sue LeMay

Issued in furtherance of cooperative extension work in agriculture and home economics, acts of May 8 and June 30, 1914, in coperation with the U.S. Department of Agriculture. Patrick Borich, Director of Agricultural Extension Service, University of Minnesota, St. Paul, Minnesota 55108. The University of Minnesota, including the Agricultural Extension Service, is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, religion, color, sex, national origin, handicap, age, or veteran status.

This Material has been funded in whole or in part with Federal funds from the U.S. Department of Labor under grant number DOL/9P305017. Individuals undertaking such projects under government sponsorship are encouraged to express freely their professional judgement. Therefore, these materials do not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.