



Extension FactSheet

Food, Agricultural and Biological Engineering, 590 Woody Hayes Dr., Columbus, OH 43210

Points of Peril

Farmers and operators use various pieces of equipment to increase the ease and efficiency of production agriculture. Common machinery includes tractors, mowers, combines, grinders, augers, balers, and the list goes on and on. Although each piece of equipment is unique and designed with a specific purpose in mind, all farm machinery shares one commonality—risk points. Risk points are specific places on machinery where the risk of injury runs high. They include places with gears, chains, cutting edges, and revolving shafts. Each piece of machinery usually has more than one risk point. By becoming familiar with the risks associated with operating farm machinery, you can protect yourself from serious injuries or an untimely death.

Shear and Cutting Points

Imagine you are mowing a field of hay. You have been mowing for several hours, when you notice a problem. Grass and weeds have collected along the cutter bar of the mower/conditioner you are using. You climb down from the tractor to remove the grass tangled between the knife and guards. What hazards should you avoid?

Shear points. These form where the edges of two objects move together closely enough to cut as with the knife and guards on a commonly associated with hand-held grass sickles and rotary mowers.

Cutting points. These occur where a single object moves rapidly enough to cut. They are commonly associated with hand-held grass sickles and rotary mowers.

Shear and cutting points can be located on both machinery designed to cut and on those that are not. For instance, grain augers are not designed to cut anything, yet they have shear points. These points occur where the rotating shaft meets the sides of the metal casing. As a result, augers have been identified as the most dangerous piece of farm machinery on a per hour used basis.

In order for many shear and cutting points to function properly, they cannot be fully guarded. For this reason, they are extremely hazardous mower/conditioner.

To prevent accidents involving shear and cutting points, follow these simple rules.

- Be extra alert when using equipment with shear and cutting points.
- Place warning labels near all possible shear and cutting points.
- Warn others working with you of the dangers associated with shear and cutting points.
- Keep shields and screens in place over the ends of augers and other risk points.
- Avoid close contact situations with shear and cutting points.



As teens mature into contributing farm workers, they are given larger workloads with less supervision. These two factors, however, create hazardous situations when youth are not properly trained. To ensure their safety, warn youth of the hazard points located on farm equipment, train them to use safe operating methods, and most importantly, teach them that farm equipment demands their full attention and respect.

Pinch Points

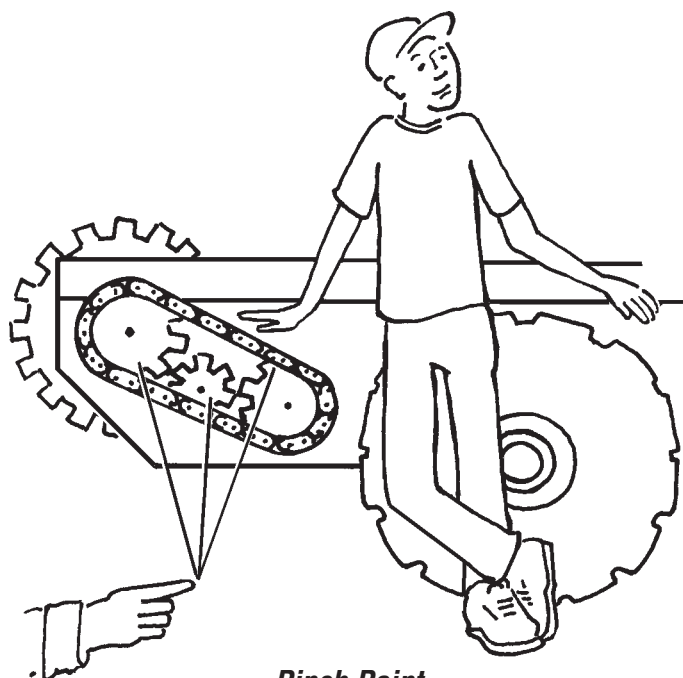
Imagine that you are lubricating your combine in preparation for tomorrow's harvest. You remove a few of the combine's shields in order to grease and adjust the chains. To locate the grease fittings, you must turn the machine by hand. What hazards should you avoid?

Pinch points. These are found where two rotating objects move together and at least one of them moves in a circle. Common examples include the points where drive belts contact pulley wheels, drive chains meet gear sprockets, feed rolls mesh, or where gathering chains on harvesting machines draw crops into the equipment.

Pinch points are considered a risk since fingers, hands, and feet are often directly caught by them. Loose clothing can also become entangled and eventually lead to pinched appendages. Falling into or brushing against pinch points should also be avoided. The bottom line—once you're caught, you're caught. Today's equipment moves too quickly for you to free yourself.

To prevent mishaps with pinch points, follow these guidelines.

- Be aware of the places where pinch points occur and avoid them.
- Place warning labels near all possible pinch points.



- Wear well-fit clothing when operating machinery equipped with pinch points.
- Never reach around or work near rotating parts.
- Turn off machinery before performing any maintenance or repairs including lubrication.
- Wait for machinery to completely stop moving before attempting to make repairs or perform maintenance. Even at very low speeds, machines have enough momentum to cause serious injury.
- After completing maintenance and adjustments, always replace shields that were removed.

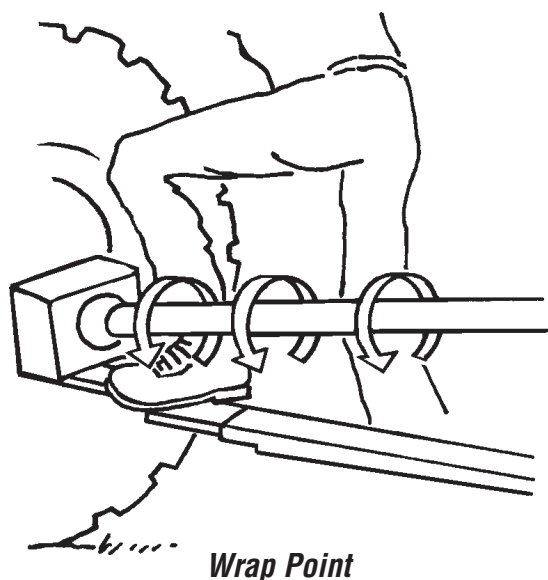
Wrap Points

Picture yourself grinding cattle feed for your commercial cow/calf operation. You have been grinding feed for a while and need to check the amount of feed you have already ground. The grinder/mixer you are using is equipped with windows on the sides to check the feed level. You see that one side is full, but realize that the other side may not be and decide to check it. You step over the rotating power take-off shaft on your way around the grinder to make the check. What's wrong with this picture?

Wrap points include any exposed machine parts that rotate. The most common examples are power take-off shafts or PTOs, but there are several others. A few not commonly recognized include beater bars on self-unloading ensilage wagons and blades on manure spreaders.

Loose or frayed clothing, drawstrings, shoestrings, or hair can become entangled in a wrap point and result in serious injury or death. If caught in a wrap point, several injuries can occur. An individual can be suffocated, have limbs ripped from his or her body, suffer severe lacerations, or even be beaten to death by the strength and force of a PTO slamming his or her body to the ground.

Engineers have developed numerous guards to prevent accidents with wrap points. Master shields enclose the area where PTO drivelines connect to the tractor. Stub shaft shields cap exposed PTO stub shafts when not in use. Shaft shields enclose PTO drivelines. Implement shields are similar to master shields; however, they are attached to the implement and cover the rear PTO connection point.



Shielding devices alone cannot fully protect you from the hazards associated with wrap points. A little common sense and planning is also needed.

- Shield all potential wrap points when possible.
- Replace damaged or bent shields immediately. Mangled shields are as dangerous as no shields at all.
- Never step over or crawl under rotating shafts.
- Never reach over, under, or around potential wrap points.
- Shut down all equipment and wait for all moving parts to stop before performing any maintenance or repairs.
- Place warning labels on all possible wrap points.
- Never wear loose or frayed clothing when working with or around equipment.
- Remove drawstrings from jackets and sweat shirts before working around equipment with wrap points.
- Never wear jewelry when working with or around farm machinery.
- Keep long hair pulled back when working with all equipment and especially when working around equipment with wrap points.

Crush Points

Imagine you are helping your father hitch a tractor to a grain-filled wagon. Your father is driving the tractor, and you are positioned near the wagon. He slowly edges the tractor toward you. In response, you

fling one leg over the wagon tongue. Holding the hitch, you straddle the wagon tongue and wait for your father to ease the tractor into the hitching position. What hazard should you avoid?

Crush points. These are created when two objects move toward each other or when one object moves toward a stationary object. A common crush point occurs when hitching tractors to implements.

Injuries from hitching accidents usually occur to the fingers, but crush points have the potential to cause very serious injuries. Jacks slipping, overhead supports breaking, skid steer loader buckets falling, and equipment rolling are examples of crush points that often result in fatalities.

Crush points can also occur during general equipment operation. An operator's head or chest can be crushed between equipment and low beams in buildings. Low tree limbs serve as another possible hazard when operating equipment outdoors.

To prevent accidents involving crush points, practice these safety tips.

- Recognize and avoid potentially dangerous situations involving crush points.
- Warn others of the presence and dangers of crush points.
- If you must work under machinery, make sure the jacks you are using are secure.
- Block wheels on equipment to prevent unwanted movement.
- Use caution when operating equipment in buildings with low beams or when working outdoors around low tree limbs.
- When operating skid steer loaders, always wear your seat belt.
- Never modify a skid steer loaders' ROPS. Leave the entire cage in place.
- Always lower a skid steer loader lift arms and bucket before dismounting. If the lift arms must remain raised, restraining devices or hydraulic locks must be engaged to prevent crushing due to hydraulic failure.
- Never straddle implement hitches when hitching equipment. Stand to the side of the equipment.
- Wait until the tractor has completely stopped moving before attempting to hitch equipment.

Freewheeling Parts

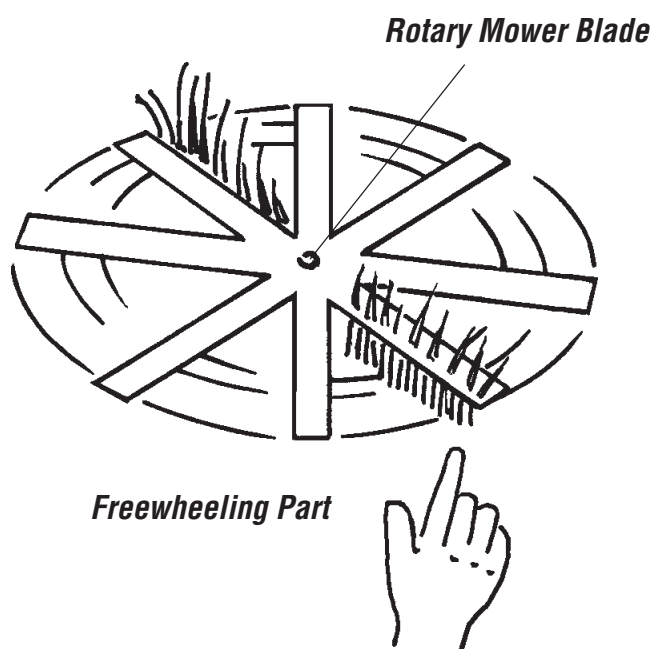
You are mowing along an overgrown fence row. The weeds are tall and the grass is damp. Due to the moisture content and size of the weeds, you are forced to move along at an extremely slow speed. However, even at that speed, you notice the mower is still not working as well as it should. Finally, you decide to stop and clean some of the grass out from around the mower blades. You shut down the tractor and disengage the power take-off. What hazards should you avoid while removing grass from the mower?

Freewheeling parts. Machine parts will continue to move even after power to the parts have stopped. This usually involves the continued rotation of mower blades or knives. Inertia causes these parts to keep moving. Whenever inertia is at work, remember: the heavier a point is and the faster it moves, the longer it will freewheel. In some instances freewheeling parts can continue to rotate up to three minutes after power to the implement has been shut down.

Freewheeling parts are found on a variety of farm equipment. Some of the most common include rotary mower blades, flywheels on balers, hammer mills on feed grinders, and cutter heads on forage harvesters.

Protecting yourself from freewheeling parts is relatively simple. Just follow these rules.

- Know where freewheeling parts hazards are located and avoid direct contact with them.



- Warn others of the presence of freewheeling parts hazards.
- Take the time to listen for whirring or humming sounds after disengaging equipment. These noises are excellent indicators of freewheeling.
- Watch for motion. Never just assume machine components have stopped.
- Never attempt to touch a freewheeling part no matter how slow it is moving. Slow moving freewheeling parts can still cause serious injury.

Pull-in Points

Imagine that you are shelling corn with a modern self-propelled combine. Suddenly, you notice a problem—the corn head is clogged. You climb out of the cab, walk to the front of the combine, and position yourself between two snouts. Immediately, you start jerking and pulling on the material clogging the corn head. What hazard are you exposed to?

Pull-in points. This refers to those places where an individual may be pulled into the moving parts of a machine. Pull-in hazards are commonly found on feed grinders, forage harvesters, corn pickers, combines, and hay balers.

Most accidents involving pull-in points occur when the operator attempts to unplug machinery while the equipment is running. Feeding materials by hand into feed rolls or grinders frequently results in severe injuries as well.

Injuries acquired in the previous situations usually result from a sudden jerk made by the equipment being used. That simple jerk can be enough to pull an individual's hand or other appendage into a machine. In a matter of seconds, the hand or appendage can be mangled and chewed. An individual has no time to react and lacks the strength to pull free.

PTO shafts are another dangerous pull-in point. Pulling on an object that has been wrapped around a rotating shaft can prove to be a fatal effort. Instead of loosening, the wrapped object will most likely continue to wrap more tightly. This puts that individual in the dangerous situation of being pulled into the machine as well.

Pushing objects through machinery also involves great risks. For example, attempting to push or kick forage through a hay baler is not a very intelligent

***Pull-In Point***

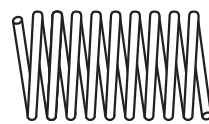
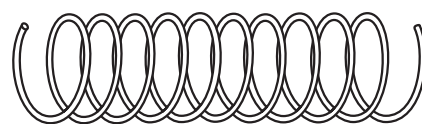
thing to do. Think about it—once the hay goes through, your foot or hand will follow.

Working safely around pull-in points involves adhering to these rules.

- Recognize and avoid potential pull-in points.
- Warn others of the dangers of pull-in points.
- Shut off all equipment before attempting to unclog or unplug equipment.
- Never hand feed any material into a machine while it is running.
- Wait for all parts to completely stop moving before attempting to unplug equipment or perform maintenance of any kind.
- Never attempt to push or kick oversized objects into machines.
- Never attempt to free objects wrapped around PTO shafts while PTOs are engaged.

Stored Energy

Imagine you are replacing a spring on a round baler. Sounds easy enough, but several hazards actually make that task rather difficult. What hazards should you watch out for when working with springs?

***Stored Energy
Spring Compressed******No Energy
Spring Relaxed***

Stored energy hazards. Stored energy is perfectly safe as long as it is confined. However, when stored energy is unexpectedly released, severe injuries can result. Compressed springs expand with great force when released, and stretched springs contract violently when released. Even small springs can store a great deal of energy. Springs can be found on various farm machinery and are basically used to keep belts tight, absorb shock, and lift implements.

Most injuries from springs occur when an individual removes a device connected to a spring without taking into consideration what direction the spring will move. Either the spring can fly off and hit the person, or the spring can propel another machinery component toward them.

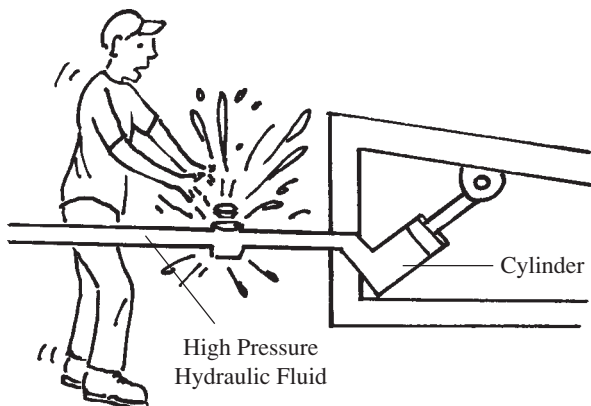
The hazards of springs can be avoided by following these simple rules.

- Always release the tension on springs before performing maintenance on spring-loaded items.
- Always know what direction a spring will move when performing maintenance on equipment with springs.
- Always know how a spring will affect other components when performing maintenance on equipment.
- Always stay out of a spring's path when performing or observing maintenance.
- Warn others of the dangers associated with springs and keep them out of a spring's potential path.
- Use the proper tools when removing or replacing spring-loaded devices.

Pressurized Systems

You have been disking a field all afternoon when you notice your hydraulic system is not working properly. You shut down the tractor and begin checking for problems with the system. Checking for leaks in the hoses seems to be a good place to start, so you

High Pressure Fluid Can Injure You



begin by running your hand over the hoses. What hazard are you exposed to?

Pressurized systems hazards. Like springs, hydraulic systems store tremendous amounts of energy. They accomplish this by confining fluid under extreme pressure—often at levels higher than 2,000 pounds per square inch. Equipment operators rarely see the dangers in hydraulic systems because there is no visible motion. However, carelessness in servicing and adjusting hydraulic systems can result in serious injury. Most injuries are caused by escaping fluid. Escaping fluid under pressure is capable of penetrating human skin. Even leaks from tiny pinholes can damage flesh. To make matters worse, hydraulic liquid can be extremely hot. Once this fluid enters the skin, it must be surgically removed. If the fluid is not removed within a few hours, gangrene will develop.

To prevent accidents with hydraulic systems, follow these guidelines.

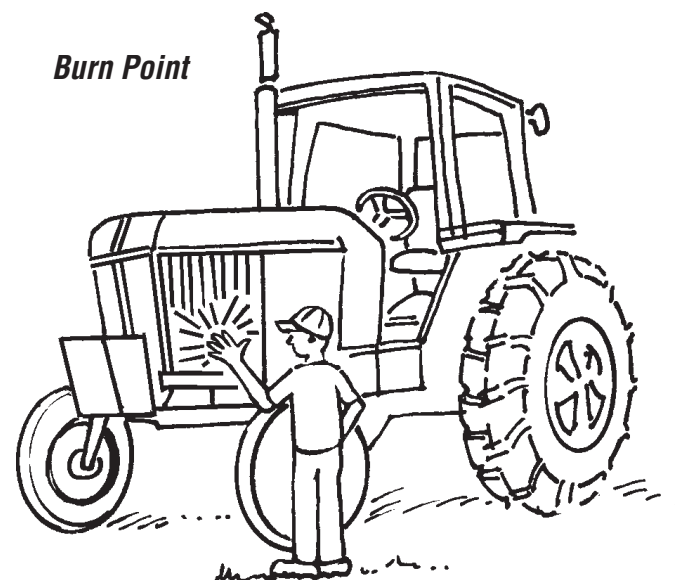
- Shut off the engine which powers the hydraulic system before performing maintenance of any kind.
- Lower implements to the ground before performing maintenance on equipment.
- Move the hydraulic control lever to relieve the pressure before engaging in maintenance.
- Follow the operator's manual to determine the exact procedures for servicing specific hydraulic systems safely.
- Keep all hydraulic fittings tight to prevent leaks.
- Do not tighten fittings without relieving hydraulic pressure first.

- Do not over-tighten fittings causing them to crack and leak.
- Relieve pressure before disconnecting hydraulic lines.
- Tighten all connections before applying hydraulic pressure.
- Keep hands and all body parts away from holes and nozzles which eject fluids under high pressure.
- Always use a piece of cardboard or paper to check for hydraulic system leaks. Never use your hands, even if they are protected with gloves.
- Wear safety glasses when checking for hydraulic system leaks.

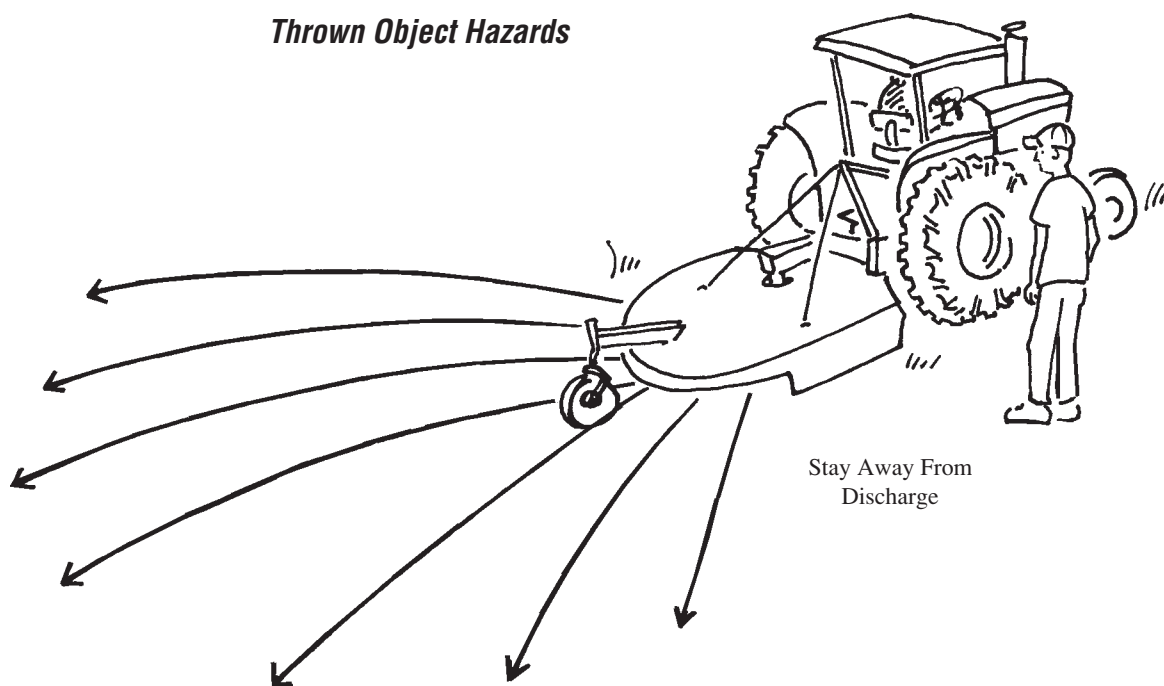
Burn Points

You are planting soybeans and midway through the day you need to refuel. You climb up on the tractor and remove the gas cap. What hazards should you be aware of while refueling the tractor?

Burn points. There are many machinery components which cause burns when brought into contact with human skin. Common burn points include such hazards as hot mufflers, pipes, and engine blocks. Burns can also result from hot fuel, hot oil, and numerous chemicals. Most injuries involving burn points result from equipment inspection or maintenance. The real danger of burn points, however, does not rest with the actual burn itself. On the contrary, the sudden shock of coming in contact with a hot



Thrown Object Hazards



object can prove fatal. The shock can cause an individual to jump, in which case he or she may bump or fall into other dangerous machinery components.

Follow these guidelines to prevent injuries from burn points.

- Know where potential burn points exist.
- Warn others of the presence of burn points and the dangers associated with this hazard.
- Avoid performing maintenance on equipment that has been running for a lengthy period of time. Always allow equipment to cool.
- Wear the recommended protective clothing when working with chemicals.

Thrown Objects

You are spreading manure in a field behind your house. Your 5-year-old cousin is playing in the backyard near the fence row. What hazards should you be aware of while spreading manure near bystanders?

Thrown object hazards. These commonly occur on machines that grind, chop, cut, or fling. Examples of such equipment include rotary mowers, feed grinders, and manure spreaders. These machines are capable of propelling objects great distances and can transform relatively harmless objects, like sticks, rocks, and corn cobs into deadly devices.

To avoid thrown object hazards, take these simple precautions.

- Learn to recognize equipment capable of throwing objects.
- To reduce the possibility of thrown objects, keep all equipment properly shielded.
- Be aware of the distance and direction in which objects may be thrown.
- Stay out of the likely path of thrown objects.
- Warn others concerning the dangers of thrown objects and prevent them from entering an objects' likely path.

Things to do: HAZARD HUNT

Locate the following hazard points on equipment you routinely use on the farm. Note the locations of these points and ways in which you can protect yourself from them. Use the chart below to help you keep track of your findings.

<i>Hazard Point</i>	<i>Location</i>	<i>Protection</i>
Ex. Shear Point	Grain auger	Keep shield in place, stay alert, and avoid close contact when possible.
Shear Point		
Cutting Point		
Pinch Point		
Wrap Point		
Crush Point		
Freewheeling Parts		
Pull-in Point		
Stored Energy Hazard		
Pressurized System		
Burn Point		
Thrown Objects		

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Sources:

- 1) Bean, Thomas L. *Preventing Farm Machine Hazards*. AEX-593. Agricultural Engineering Department Fact Sheet. The Ohio State University, Columbus, OH.
- 2) Hathaway, Louis R. ed. et al. (1987). *Fundamentals of Machine Operation—Agricultural Safety*. Deere & Company, Moline, IL.
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