



UNIVERSITY OF
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IFAS EXTENSION

Harvesting Silage Safely¹

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Mowers, conditioners, windrowers, forage harvesters, wagons and blowers, tractors and trucks may all be part of the silage harvesting process. They are all dangerous and have the potential for causing serious accidents.

The first silage harvesting hazard is the hurried attitude of the operators. The maturity of the crop, the desired moisture level for storage or threatening weather may cause the operator to become more hurried, less cautious and prone to having an accident. Additionally, if the operator is inexperienced, the equipment poorly maintained or improperly adjusted and field conditions unfavorable, the chances of accidents are greatly increased.

GENERAL SAFETY RULES

The following safety rules apply for all silage harvesting equipment and operations:

1. Properly maintain the equipment. Equipment not properly maintained and adjusted will not function properly, will frustrate the operator and increase the risk of an accident.
2. Study the operator's manual before each harvesting season, especially the safety instructions.
3. Make certain that all guards and shields are in place.
4. Never attempt to adjust or unclog a machine while its parts are in motion.
5. Space tractor and equipment wheels as far apart as possible to increase stability.
6. Make certain the RPM of the tractor's PTO (540 or 1,000 RPM) match the design RPM of the equipment.
7. Inspect the field for stumps, stones, wash-outs, ditches and other obstacles which might damage the equipment or cause an overturn.
8. Never permit riders, and keep children, pets and uninformed adults away from the machinery.
9. Wear close-fitting clothes and sturdy slip-resistant work shoes.
10. Never operate equipment if you are ill, tired or have alcohol or medications in your system. You must stay alert.

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FORAGE HARVESTER SAFETY RULES

1. Never get in the path of the discharge spout while it is operating.
2. Stop the forage harvester before hooking or unhooking wagons.
3. Never clean, oil or adjust the harvester while any parts are moving.
4. Keep doors, shields and guards in place.
5. Be aware that operating the built-in knife sharpener is an extremely hazardous activity. Read and accurately follow the instructions in the operator's manual.
 - Make certain you have good footing. This is no time to slip or trip.
 - Wear goggles and a hard hat if the sharpening is done with the door open.
 - Keep others clear to prevent distraction.
 - Securely block the cutter head before servicing, adjusting, or making repairs.
 - Use care that no tools or parts fall into the cutting mechanism.
 - Make certain that the cutter head is properly adjusted and balanced and that all bolts are properly torqued (tightened).

HARVESTER FORAGE SAFETY RULES

1. Set up the blower following the instructions in the operator's manual. A level setting is nearly always required, with the blower pipe absolutely vertical.
2. All shields and guards should be in place; stay clear of all moving parts, even the shielded PTO.
3. Assemble the blower pipe on the ground, and raise with rope and tackles. Attach the rope end to a tractor's drawbar. The rope should be secured to the middle of the assembled blower

pipe and then with a half-hitch at the top to prevent it from swinging free.

4. Securely tie the in-place blower pipe at the mid-point and top after it is secured to the blower and before untying the rope from the tractor's drawbar. Secure this rope to the blower or silo.
5. If a telescoping pipe is used, always attach the smallest diameter section to the blower to reduce the chances of plugging.
6. If a blower deflector is used, raise this from inside the silo.
7. Use sufficient power and controlled feeding of the blower to prevent plugging of the blower pipe.
8. Never climb into the blower hopper or use your hands or feet to force forage into the blower.
9. Should a blower pipe plug, stop the blower and remove the pipe from the blower. Make certain the pipe is firmly secured to the silo. Tap the pipe lightly, starting at bottom and working upward, with a rubber mallet or short piece of rubber hose. Do not dent the pipe. If the pipe cannot be cleared in this manner, the pipe must be lowered and disassembled.
10. Do not enter a silo after filling - deadly silo gases may be present. Study the entry in this section on silo gases.

FORAGE WAGON SAFETY RULES

1. Don't place a 10-ton box on a 5-ton wagon gear. Match the box with the wagon gear.
2. Remember that conveyors, augers and beaters on self-unloading wagons are extremely hazardous. Make certain shields and guards are in place, then still stay back.
3. Make certain all quick shut-off levers, trip bars, etc. are functioning properly.
4. Never crawl onto or into a self-unloading forage wagon when it is operating. The only way to insure yourself is to disconnect the PTO shaft or have the tractor's ignition key in your pocket.

5. With dump wagons, side or rear, never crawl under, or place an arm or head under, the box when it is in a raised position unless you have securely blocked the lift mechanism so that it cannot drop.

TRANSPORT OF FORAGE HARVEST EQUIPMENT

The size, width, length, weight and lack of visibility all make the transport of forage harvesting equipment hazardous on both farm and public roadways. Specific safety precautions should be followed.

1. Transport the equipment in a transport position. This might call for relocating the hitch point, removing the cutter heads, and using hydraulic hoists. Follow all instructions in the operator's manuals. Make certain all transport safety pins are securely positioned.
2. Use the correct size hitch pin, secured with a clip. The use of a safety chain might be recommended, or even required, in certain instances.
3. Lock the brake pedals on the tractor together.
4. Use extended rear-view mirrors to see traffic behind you.
5. Do not allow extra riders on the tractor or towed load or equipment; they are prohibited.
6. Maximum width of a load on public roads is 102 inches. Special permits are needed for wider loads.
7. Equip vehicles with a Slow Moving Vehicle (SMV) emblem clearly visible from the rear.
8. Provide tractors and self-propelled equipment with vehicle hazard-warning lights, two headlights, at least one red tail light (mounted to the far left), and/or two red reflectors.
9. Provide towed equipment, wider than the tractor, with an amber reflector to the front, and a red reflector to the rear, both located at the far left edge of the equipment.
10. Permit only licensed drivers to operate farm tractors and equipment on public roads; this, however, is not a state requirement.

SILO DANGERS

Tower silos add other health and safety hazards to a cattle feeding operation. Falls from great heights can be dangerous, but silo gases and silo fires can also be deadly.

Falls

Falls from outside ladders and inside chutes can be reduced by following a few safety precautions.

1. Wear slip-resistant shoes; crepe or rubber soles are much safer than leather or synthetic material soles.
2. Always have one firm hand and foot hold.
3. Wear a safety belt secured to a rung of the ladder if you must do some work high up on a silo.
4. Keep others away from below the ladder, should a tool or part slip and fall.
5. Do not climb silo if heights cause fear.

Silo ladders are perpendicular and the rungs do not provide the same foot hold as a regular ladder set at an angle. Climb slowly with secure holds. Practice descending from low levels. Many individuals find the descent from a silo more difficult than the climbing.

Silo Gases

A number of silo gases are formed as the materials ensiled begin to ferment. The two most frequent life-threatening silo gases are nitrogen dioxide (NO₂) and carbon dioxide (CO₂). A number of plant chemistry and environmental factors contribute to the kinds and amounts of gases formed. However, it is always best to assume that life-threatening quantities of silo gases are present.

Nitrogen dioxide (NO₂) gas may be visible as a reddish-to-yellowish brown haze and have a

bleach-like odor. It is very toxic. It is 58% heavier than air, so it settles and accumulates in low spots. It is most prevalent during the first three weeks after silo filling.

The presence of nitrogen dioxide may be recognized by a burning sensation in the nose, throat and chest. However, exposure to heavy concentrations of nitrogen dioxide can result in almost instantaneous death. The nitrogen dioxide is dissolved in the moisture of the lung to form nitric acid. This is a strong acid which burns the sensitive lung tissue, effectively stopping the oxygen supply to the body. Massive bleeding and death follow quickly.

Carbon dioxide (CO₂) is produced in quantity in the silage fermentation process. It is odorless, colorless and tasteless and is 53% heavier than air; thus, it also settles into low spots. It is not toxic, but it displaces the air, lowers the oxygen level and causes a person to gasp for air and become asphyxiated (death from a lack of oxygen).

In only a few hours, as plant materials settle in the silo and begin to ferment, the air space between the top of the silage and the top chute door may be filled with silo gas. This silo gas may flow over the chute door, down the chute and fill an enclosed feed room. Entering the feed room, chute or silo could result in instant death.

To prevent silo gas accidents follow the following safety precautions:

1. Post a **Silo Gas** warning sign at all entrances to the feed room or at the base of the chute. Declare the silo area "off limits" during a three-week period after filling.
2. Provide adequate ventilation to the feed room. Leave doors and windows open, but not into confined areas housing livestock, which can also be overcome with silo gases.
3. Use a distributor to level the silage during filling. Never send a person into the silo to level the material by hand.
4. If it is necessary to enter a silo at the completion of filling to level the surface, install a plastic cover, or position an unloader, etc., do so

immediately after the last load has been unloaded. Never wait a few hours. Leave the blower running when someone is in the silo.

5. If someone must enter a silo during the three-week period immediately after filling:
 - Run the blower for a minimum of one-half hour before an individual begins climbing the chutes.
 - Supply the climber with a life-line and/or pressure demand remote breathing equipment. Fire departments and emergency rescue squads have this equipment.
 - Remove chute doors above the silage level, then allow another half hour for the space to be ventilated with the blower running before entering the silo.
 - Immediately leave the area and get into the fresh air (if any nose or throat irritation or shortness of breath is experienced). Should the irritation or shortness of breath continue, seek medical attention promptly.

You can make a detection disc to detect the presence of nitrogen dioxide. Prepare a solution of two grams of cornstarch and two grams of potassium iodide in three ounces of water. Soak filter-paper discs in this solution and then dry the discs in a warm oven (120 degrees F). Store the dried prepared discs in a sealed plastic bag. To use a disc, place a piece of scotch tape at one edge, punch a hole in the tape, wet the disc with water and hang it at the bottom of the chute or inside the chamber of bottom unloading silos. The disc will turn purple if nitrogen dioxide gas is present. A disc can only be used once; it will not detect the presence of carbon dioxide.

Silo gases are deadly. Don't allow a new tower silo to be the death of you or one of your employees.

Silo Fires

Silo fires can occur in both horizontal and tower silos. While they are not as common as silo gases, they can cause major economic losses, injuries and even death. They occur most frequently in hay silage which is ensiled at too low a moisture content, 30 to

40% moisture. There is a heat build-up and if oxygen is available, spontaneous combustion can occur.

Silo fires normally occur in the top portion of tower silos when the material is too dry, is not densely packed and where more oxygen is available. Entering such a silo can be extremely hazardous. The individual can break through the surface layer of silage into a burning or burned-out area below. Also, the burning silage gives off a number of lethal gases which can cause rapid death.

To prevent the danger of silo fires:

1. Ensilage the hay crop at 45% to 65% moisture (60% is optimal).
2. Chop the plant material not more than one inch in length (1/2 to 3/4 inch is optimal). This will ensure denser packing and less oxygen availability.
3. Seal the silo walls and fit the chute door tightly.
4. Fill the silo rapidly with even distribution to promote even compaction.

Silo fires are extremely difficult and dangerous to extinguish. Should a silo fire occur, contact your county cooperative Extension office. This office can obtain silo fire extinguishing information from the extension safety specialist.