SAFE FARM
Promoting Agricultural Health and Safety

Recognize limitations to avoid injury

Farm equipment operators want powerful machinery to be able to handle the demands of modern agriculture. They recognize the dangers, yet many people become entangled in equipment every year. Here's a common scenario:

The field was wet and a little weedy and the header was clogging too often. The operator was annoyed at having to stop the combine, turn off the engine, climb out of the cab, and pull stalks out of the cornhead. When it happened for the fourth time in 30 minutes, he decided to save time by not turning off the engine. He knew he'd be able to let go of the stalk before the cornhead engaged again.

The situation was ripe for an injury, which took the operator's arm. Before he could even release his grip, the spinning stalk rolls pulled his entire arm into the machine.

Misconceptions about the hazards of specific farm equipment can result in a mangling injury or even death. One of the most common misconceptions is that a human being can react fast enough to avoid potential injury. Relying on your reaction to a situation is never the route to safety.

An average person can respond to a stimulus within three-fourths to one second. This reaction speed is only an estimate, and is affected by many factors. Gender, age, physical condition, and the use of alcohol or medications alter reaction time. However, fast reaction time is not the key issue. **No matter how fast the reaction time, it will never be enough to avoid injury from farm equipment.**

On the back page is a chart that compares the average human reaction time to speeds of various farm machinery. It shows that reaction time alone cannot help you avoid injury on farm machinery. **You also must use proper safety precautions so that you do not get into dangerous situations.**

PTO entanglement

One of the slowest entanglement hazards - and most common, making it the most deadly - is the power take-off (PTO) unit. PTO shafts make either 540 or 1,000 revolutions a minute. At this speed, even slower units can pull in approximately 7 feet every second. Within three-fourths second (the average time it takes someone to react), more than one complete person will have been wrapped around the shaft before he or she could jump out of the way.

What if that person was very quick and could react within 0.1 second? Could he or she avoid injury? No, because even in that short time the PTO would have pulled in .7 feet (about 8 inches, a hand or shirt sleeve). Once entangled, a person has few choices.

PTO entanglement can be avoided by **always** following these precautions:

- Keep all safety shields and guards in place, especially after repairs are made.
- Stay clear of moving parts at all times.
- Disengage equipment and shut off engine before working near PTO.
- Wear close-fitting clothes that do not have loose sleeves or cuffs, and frayed edges. Never wear things that dangle, such as jewelry, jackets with drawstrings, long shoelaces, or scarves. Long hair and braids also pose hazards around PTOs.

Auger entanglement

A six-inch auger entangles at a rate of 10 feet per second. Augers can cause serious injuries because the sharp edge of the auger shears off items caught against the housing.

To prevent auger entanglement **always**:

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How much do you know?

Test your skill with this quick quiz.

1. If your reaction time is very fast, you can avoid being entangled in farm equipment. True or false?
2. It takes three-fourths of a second for most people to respond to something. True or false?
3. At what rate does an arm get wrapped around a power take-off (PTO) shaft?
   a) 1 foot per second
   b) 7 feet per second
   c) 7 feet per minute
4. At what rate does a glove get caught in spinning stalk rolls?
   a) 1 foot per second
   b) 12 feet per second
   c) 12 feet per minute
5. At what rate does a loose bootlace get pulled into a moving belt and pulley?
   a) 1 foot per second
   b) 66 feet per second
   c) 66 feet per minute
6. Reacting quickly is the best way to avoid entanglement in farm machinery. True or false?

See answers on back.

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- Keep safety guards on the auger intake and drive mechanisms. A proper guard will not let fingers touch the hazard when pushed against the guard. Makeshift guards may not adequately protect bystanders.
- Stay clear of moving parts at all times.
- Disengage equipment and shut off engine before working near auger.

Belt and pulley entanglement

Belts and pulleys on some combines and other machinery travel faster than some PTO units, which can be deceptive. Belts running on pulleys travel at various rates, but a common speed is 66 feet per second, about nine times faster than a PTO shaft.

To prevent entanglement **always**:

- Make sure guards are securely fastened and in good repair.
- Stay clear of moving parts at all times.
- Disengage equipment and shut off engine before working near belts or pulleys.

Cornhead entanglement

A cornhead pulls in crops at a rate of 12 feet per second, faster than PTOs or augers. To prevent entanglement **always** shut off the engine before removing stalks or working near the cornhead.

Other hazards

A rotary lawnmower blade makes 52 rotations every second. To avoid rotary blade hazards, **always**:

- Shut off the engine before unclogging the discharge chute.
- Wear close-fitting clothes and leather shoes with good traction.
- Keep rear shields and bags in place while operating the mower.
- Disconnect spark plug while working on the mower to prevent accidental engine ignition caused by manually moving the blade.

Equipment that is propped up or on jacks also can be a hazard. The time it takes for falling equipment to hit the ground is usually not enough time to react and get out of the way. To avoid these hazards **always** mechanically lock and block equipment to make repairs. Do **not** rely on hydraulic systems to suspend equipment for servicing.

Reaction time is important. When driving a tractor, the operator must respond to situations as they are presented. Operator reaction time is critical in avoiding injury in these situations, but never forget that machines are always faster than humans possibly can react.

Common entanglement hazards

Equipment	Average speed (feet/second)	What happens before you can react?* (feet)
PTO	7.0	5.25
Auger	10.0	7.5
Cornhead	12.0	9.0
Belt/pulley	66.0	49.5
Rotary lawnmower	52.0**	39.0**
Falling equipment	32.0***	9.0***

* This is the number of feet that can be entangled in the equipment during the average reaction time of .75 seconds.
** A lawnmower blade makes 52 rotations every second. By the time you can react, a single blade will have gone around 39 times.
*** Gravity moves falling objects at 32 feet/second/second. For example, equipment 9 feet in the air hits the ground in .75 second.
NOTE: This chart is based on estimated values. Conditions vary that can increase or decrease the values shown in the chart.

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What can you do?

No matter how fast you react to farm equipment hazards, it will never be enough to avoid injury. You must use proper safety precautions to avoid potentially dangerous situations.

- ❑ Read the equipment operator's manual to determine potential hazards for each implement.
- ❑ Examine equipment for potential hazards.
- ❑ Always follow recommended procedure to adjust equipment.
- ❑ Read safety decals that explain the dangers of equipment..

Answers to quiz:
1-False; 2-True; 3-b; 4-b; 5-b; 6-False

For more information

Other ISU Extension and Outreach publications may help you develop guidelines for working with animals, or address other related issues. Go to https://store.extension.iastate.edu.

Other publications in the Safe Farm series include:
Evaluate equipment for dangers
Harvest safety yields big dividends
Reduce risks around big round bales
and Practice lawnmower safety on farms.

SAFE FARM

Safe Farm is an Iowa State University Extension and Outreach project helping to make Iowa farms a safer place to work and live.
For more safety information, check the web at www.abe.iastate.edu.