

On-Farm Safety for Grain Wagons, Semi-Tractor Trailers and Trailers

Sammy Sadaka,
Ph.D., P.E.
Associate Professor -
Extension Engineer

Donald M. Johnson, Ph.D.
Professor - Agricultural
Education, Communications
and Technology

This fact sheet contains safety tips to help farmers and producers operate their grain wagons, trailers and trucks safely. Grain wagons (Figure 1) are large, heavy pieces of equipment pulled by tractors. Large trucks (Figure 2) are often used to transport grain to storage bins or grain elevators. Semi-tractor trailers (Figure 3) are large-capacity trailers supported by the towing vehicle at the front and by their own wheels at the rear. On the other hand, full trailers (Figure 4) ride on their axles on the front and rear. Normally, they are connected to the tractor by a drawbar.

All of these pieces of equipment are being used on the farm. Therefore, the following scenarios and tips will help farmers and producers to use these items safely.

Before looking at safety hazards and precautions specific to grain wagons, trucks and trailers, we will review a few precautions common to all.

- Be aware of and avoid contact with all overhead electric wires when moving grain transport equipment.
- Stay out of loaded grain wagons, truck beds and trailers in order to avoid potential grain entrapment and suffocation hazards.
- Do not allow children to play in or near grain wagons, trucks or trailers.
- Use extreme caution when backing grain transport equipment in order to prevent running over bystanders or other workers.
- Use extreme caution when traveling on public highways. Use hazard flashers and warning vehicles as necessary to alert other drivers of your presence.



Figure 1. A grain wagon attached to a tractor.



Figure 2. A farm truck.



Figure 3. A semi-tractor trailer.



Figure 4. A full trailer.

- Be extremely careful when operating loaded wagons, trucks and trailers near ditch banks. At a minimum, stay away from the edge of the ditch bank a distance equal to the depth of the ditch.

*Arkansas Is
Our Campus*

Visit our web site at:
<http://www.uaex.edu>

For example, if the ditch is 6 feet deep, stay at least 6 feet away from the edge of the ditch.

- Avoid overturns by keeping grain evenly distributed, and slowly travel up and down the slope on hilly fields.

Safety Tips for Grain Wagons

Old grain wagons were pretty simple: the wagon was hitched to a tractor drawbar and the unloading auger was connected through the driveline to the power takeoff shaft. Typical grain wagons had a capacity of 150 to 400 bushels and required several minutes to unload. Today's grain wagons may be pulled by a tractor-trailer rig and unload 1,000 bushels of grain into the trailer in 2 minutes with a feeding rate of about 500 bushels per minute.

Grain wagons share some safety issues with combines in that they have augers, hydraulics, wheels and tires (or tracks), grain tank, shafts and U-joint connectors. Grain wagons may appear to be pretty safe until you look more closely to see what could go wrong during normal grain wagon operation.

Always read and refer to the operator's manual.

Grain wagons have potential hazards including human contact with augers, drivelines or chains and sprockets; high-pressure hydraulic leaks; run-over of bystanders; crush and run-over accidents when hitching; and traffic accidents when using public highways. They should always be hitched to the tractor drawbar and with a connector pin appropriate for the task. Pull pins should have a retaining device to prevent the pin from moving out of the hitch during movement over uneven ground. Always attach the safety tow chains to the tractor.

Operators should not move grain wagons to place the connector pin until the tractor drawbar is lined up properly, the tractor engine shut off, parking brake set and wagon wheels chocked. This precaution will help eliminate sudden changes of the wagon positions and avoid trapping the worker.

The same cautions apply to hooking up the power takeoff (PTO) shaft on the grain wagon to the power takeoff drive shaft of the tractor. The operator should be certain that all guards are in place and the shafts turn freely inside of any appropriate guards or covers. He/she should take extreme care to never step over or onto any power takeoff shields or guards when operating. Make this a habit even when the PTO is not operating so the caution becomes ingrained.

When the wagon and tractor are hooked together, some changes will take place because they are no longer separate units, but one. The grain wagon is now in tow, increasing the overall length of the unit.

Wider turns may need to be made to keep the tractor tires from engaging the wagon drawbar when turning. The operator should remember that the tractor driver cannot see behind the grain wagon, and he/she should exercise extreme caution to prevent any accident before a wagon is backed up.

The stability of the tractor may be impacted by the weight of the tow, which will change as grain is added to the wagon. The operator should choose the proper size tractor to pull the grain wagon. The wagon and tractor may be operating in deep mud in rice fields, so the tractor driver should always consider the condition of the wagon wheels to be sure they are turning without restrictions and do not have a buildup of mud and straw that could create a "drag" situation. Once again, the tractor chosen to pull the grain wagon must be large enough and heavy enough to control the loaded grain wagon. A wagon full of grain may place a strain on the tractor and change the center of gravity if the load becomes too heavy or is increased by clinging mud, or the wheels of the wagon may "break through" a soft spot or washout in the field.

Combine operators are watching their operation and are depending on the grain wagon operator to position the wagon properly to receive unloading grain. Also, combine operators cannot see behind the combine. Therefore, the wagon operator should remember that the steering wheels for the combine are on the back. Combine operators, when reaching their current cut at the end of the field, may suddenly stop, back up and turn while moving to the rear to position the combine-header to begin the next cut rather than make a wide sweeping forward turn to position the header. An inexperienced grain wagon driver may position the wagon too close to the combine, which might lead to the combine colliding with the wagon as the combine backs in its turn. The combine driver and the grain wagon driver should work as a team to avoid any collision.

Some older grain wagons may have a stationary unloading spout, but wagons of more recent manufacture may have a hydraulically controlled swinging or folding sectional unloading spout. Such a spout may be folded against the wagon until the wagon approaches a truck or bin for unloading. The tractor driver will then use hydraulics to unfold the spout until it locks into place as one unit for unloading. The tractor operator must take careful note of the relational position of the wagon, tractor and truck so no damage to the equipment occurs during the unloading approach.

The truck driver should take particular care to avoid endangering himself/herself or others who may be working around the unloading site. As mentioned earlier, some wagons are capable of unloading an enormous amount of grain into a truck in a short

period. Always be sure nobody is on the side or in the bed of the receiving truck who could be knocked off or entrapped as the grain is unloaded from the wagon.

Make sure that no one enters the grain tank of a wagon when the unloading auger is running or even when the unloading auger and PTO are shut off but the tractor engine is running. Every precaution should be taken to ensure that there is no way the tractor can be started and the PTO engaged with someone in the grain tank.

Grain wagon maintenance should be performed with extreme caution. If the wagon is hooked to the tractor, the parking brake should be set on the tractor and the wheels of the wagon should be chocked to prevent any movement before getting around, under or into the wagon for maintenance or cleaning. Care should be taken to avoid wagon “tip up” if the wagon is not attached to a tractor or some device that keeps the wagon drawbar or “tongue” from raising if weight is added to the rear segment of the grain tank.

Operators should review and follow all the precautions that relate to hydraulic lines and pressures, PTO shafts and auger safety, because they all apply to grain wagon operational systems. In addition, all grain wagons should be equipped with a clean and correctly positioned slow-moving vehicle (SMV) emblem.

Safety Tips for Semi-Tractor Trailers

Over-the-road semi-trucks are now commonly used to pull farm trailers for grain transport. These large “semi-tractor trailer” rigs require a particular set of skills and license to operate and require maintenance which is beyond the scope of this fact sheet. So, please refer to your state regulations for grain trucks. However, there are some thoughts to consider.

- The trailers are quite large and may hold loads of 60,000 lbs (1,000+ bushels) or more of grain and have eight wheels. They have their own set of brakes (usually air brakes) independent of the towing truck, which is generally referred to as a “tractor.”
- The tractor is usually diesel-powered and may have as many as 10 wheels (eight driving and two steering) and also have air brakes. When the tractor is started for the first time in the morning, a certain amount of time may be required for the brakes’ air pressure to be pumped up to operating pressure. Thereafter, the brakes will release and the tractor and trailer will move. The tractor and trailer may have separate air tanks, and both may need to be charged before the brakes will release. Also, it is imperative that all the trailer’s brakes be operational and will evenly apply, or an accident might occur.

- When the loaded tractor-trailer rig (referred to in the singular as a “truck”) reaches the mill or storage, it may be pulled across a grated dump. In the case of a hopper-bottom trailer, each section of the trailer may be emptied by opening a sliding gate and letting the grain from that section flow by gravity into the dump grating. Then the truck will be pulled up to empty each segment of the trailer. NOTE: The truck may be pulled across the dump for weighing and then be backed up to the dump grate after weighing in. The driver will not be able to see behind the trailer and may need a ground guide to back safely onto the dump, so as not to endanger dump personnel.
- If the trailer of the truck is not a hopper-bottom, the entire truck (both tractor and trailer) may be raised by a lift to an angle sufficient to allow the grain to flow from the rear of the trailer into the grated dump until the trailer is empty. The lift is then lowered to level, the truck is driven off the dump and returns to the field to be refilled and the trip to the mill is repeated.
- Safety in the truck loading, transporting, unloading and return phases of the hauling operation cannot be overstated. Operators should be cautious during the transition from field roads to public roads, stops, starts, foot traffic during loading in the field and unloading at the mill because each phase has its unique safety hazards.
- It should be noted that many of the drivers of hauling rigs may be owner-operators and have many hours of experience in over-the-road operations with large loads, but some may be farm workers who get little experience except during harvest season each year. Caution and practice to build familiarity with the equipment and extensive training in the specifics of transporting grain should be seriously considered before allowing workers to operate this equipment.

Trailer Use Safety Tips

As with all particular equipment, operating and following appropriate trailer safety tips would help to manage risks and minimize the chances of personal injury. While the types of loads vary, some general guidelines have broad application.

- Make sure the trailer is in a good operating condition, which includes the appropriate lights.
- Never overload the trailer or the tow vehicle. Always refer to manufacturer’s specifications for details and limits when in doubt.
- Make sure that about 60 to 65 percent of the total load is placed in front of the trailer axles. This balance affects how well the trailer “follows” the tow vehicle. It also affects the traction and “steerability” of the tow vehicle. You should notice that when properly loaded, the rear of the tow vehicle should “squat” down a little. Too

much “rear squat” and too much front lift of the tow vehicle indicates the trailer load is too far forward. On the other hand, lifting of the rear of the tow vehicle indicates the trailer load is too far to the rear.

- While loading the trailer, remember to set the tow vehicle brakes and to chock the wheels. This is important to prevent the tipping and movement of the trailer during the loading of wheeled vehicles.
- Use caution to assure proper wheel alignment when using ramps, and prevent ramp movement.
- Make sure that trailer loads should not fall from the trailer or move within the trailer during transportation. It is necessary to use appropriate load wedging or binding to prevent this.
- For wheeled vehicles, especially heavier ones such as tractors, the tie downs should go from the four corners to the trailer.
- Make sure that the sum of the working load limits for the tie downs is at least half of the vehicle weight.
- Make sure that the tie downs are in good condition. Protect ropes and straps from sharp edges or corners on the load; these serve as wear points and locations of failure.
- Secure tarps so wind cannot get under the front edge of the tarp. This will prevent the low air pressure at the rear of the load from lifting the tarp. Avoid flapping as it leads to tarp damage which can reduce its capacity to protect/contain the grain.

Use of Remote Cameras

Run-over of bystanders and highway accidents are hazards associated with all grain wagons, trucks, trailers and other large, moving farm equipment items. It should be mentioned that about 25 percent of all truck accidents involve run-overs while backing. These hazards are largely due to a lack of operator visibility. One recent safety advance is the availability of remote cameras that partially eliminate operator blindspots. For example, a camera mounted on the rear of a grain wagon (Figure 5) can provide the tractor operator with rear visibility and prevent accidents when backing the wagon or when traveling on a public highway. Inexpensive remote cameras and monitors are widely available from a variety of original equipment manufacturer (OEM) and aftermarket vendors. Remote cameras can be quickly and easily moved from one piece of equipment to another in order to reduce costs.



Figure 5. Backup camera mounted on the rear of a grain wagon.

Resources for More Information

Margentino, Marjorie R., and Karyn Malinowski, *Farm Machinery and Equipment Safety Part II: Preventing Machinery Accidents During Operation*. Rutgers Cooperative Extension (National Ag Safety Database) <http://nasdonline.org/1046/d000845/farm-machinery-and-equipment-safety-part-ii-preventing.html>

Health and Safety Training Manual: Chapter 1 – Farm Machinery and Equipment; *Health and Safety Training Manual*: Section 4 – Agricultural Safety Rules. Oregon State University, College of Agricultural Sciences/Research.

<http://agsci.oregonstate.edu/research/section-4-%E2%80%93-agricultural-safety-rules/chapter-1-%E2%80%93-farm-machinery-and-equipment>

Committee on Agricultural Safety and Health Research and Extension. 2009. *Agricultural Equipment on Public Roads*. USDA-CSREES, Washington, DC. Accessed from <http://lib.dr.iastate.edu/>

Mechanical Hazards: Freewheeling Parts. (2013). *Farm and Ranch eXtension in Safety and Health (FReSH) Community of Practice*. Retrieved from <http://articles.extension.org/pages/64419/mechanical-hazards:-freewheeling-parts>

Printed by University of Arkansas Cooperative Extension Service Printing Services.

SAMMY SADAKA, Ph.D, P.E., is an associate professor - extension engineer with the University of Arkansas System Division of Agriculture in Little Rock. **DONALD M. JOHNSON**, Ph.D., is a professor in the Agricultural Education, Communications and Technology Department at the University of Arkansas in Fayetteville.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director, Cooperative Extension Service, University of Arkansas. The University of Arkansas System Division of Agriculture offers all its Extension and Research programs and services without regard to race, color, sex, gender identity, sexual orientation, national origin, religion, age, disability, marital or veteran status, genetic information, or any other legally protected status, and is an Affirmative Action/Equal Opportunity Employer.