The National Institute for Occupational Safety and Health (NIOSH)

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# Part-time Farmer Dies Following a Tractor Rollover in West Virginia

Case: 02WV003-01
Release Date: June 10, 2002

## SUMMARY

On January 26, 2002, a 57-year-old male part-time farmer (victim) died of injuries sustained when the tractor he was driving rolled over while transporting a round hay bale. The victim was using a 63-year-old tricycle front-end configured tractor. The tractor was equipped with a front-end loader and a locally-fabricated round bale spear attachment. The attachment was estimated to have weighed 400 pounds. Just prior to the fatal incident, he was moving a large round bale from the storage area. The bale was estimated to have weighed an additional 800 pounds. He elevated the bale and began to transport it to the feeding ring. Traversing a 40% grade slope (22 degrees), with his left rear wheel on the downhill side, he began to further elevate the load to clear the top of the ring. As the total load, now weighing approximately 1,200 pounds, was elevated the tractor's center of gravity (C.G.) shifted forward and downhill. This shift placed the C.G. outside of the tractor's stability baseline, causing the tractor to roll downhill to the left and to land on the victim. The tractor did not have a rollover protective structure (ROPS) or a seat belt. The land owner came out to the field to check on the worker and found him lying on the ground. He called the victim's wife who in turn called emergency services. The EMS and county sheriff arrived within minutes and found no signs of life. The medical examiner estimated that the victim had died immediately after tractor impact. The WV FACE investigator concluded that to reduce the likelihood of similar occurrences, the following guidelines should be followed by tractor owners:

- **Equip all tractors with rollover protective structures and a seat belt.**
- **Convert tricycle-configured tractors to a wide front-end configuration.**
- **Prior to their placement, evaluate the location of feeding rings for hazards which can compromise a tractor's stability during bale transport.**

## INTRODUCTION

On February 20, 2002, the WV FACE Program was notified by a West Virginia University County Extension Agent that a tractor-related death had occurred on January 26, 2002. The field investigator traveled to the area on March 8, 2002 and met with the county extension agent to discuss the incident. Photographs and measurements were taken of the tractor and the incident site. The land owner who also owns the tractor was interviewed, as well as the victim's spouse and son. The death certificate and medical examiner's report were obtained.

The victim was a self-employed mechanic and part-time farmer, who had been farming the property his entire life. He was an experienced tractor operator. He had operated and maintained the tractor involved in the incident for at least 20 years. The tractor, as purchased, did not have a ROPS or a seat belt.

At the time of the incident, the victim was transporting a large round bale (weighing approximately 800 pounds) as part of a routine cattle feeding. He had performed the task on a near-daily basis for the past 18 years, using a bale spike attached to the rear of the tractor. Although the victim had used the same tractor for this task for the majority of the 18 years, it was reported that the front end loader bale spike attachment had only been used for the last 2 years.

## INVESTIGATION

On January 26, 2002, a 57-year-old male part-time farmer (victim) died of injuries sustained when the tractor he was driving rolled over while transporting a round hay bale. The victim was using a 1939 FarmAll Model M tricycle front-end configured tractor (see Figure 1). The tractor was equipped with a front-end loader and a round bale spear attachment (see Figure 2). The attachment was estimated to have weighed 400 pounds. Just prior to the fatal incident, he was moving a large round bale from the storage area. The bale was estimated to have weighed an additional 800 pounds. He elevated the bale and began to transport it to a feeding ring whose current location required traversing a hillside. It was reported that the victim usually transported the bale within a few feet of the ground. The speed of transport was unknown. He was traversing a 40% graded slope (22 degrees) with his left rear wheel on the downhill side (see Figure 3). When he got within 25 feet of the feeding ring, the victim apparently began to further elevate the load, to clear the top of the ring. As the total load, now weighing approximately 1,200 pounds, was elevated the tractor's center of gravity (C.G.) shifted forward and downhill (see Figure 4). This shift placed the C.G. outside of the tractor's stability baseline, causing the tractor to roll downhill to the left and to land on the victim (see Figure 5). The tractor did not have a rollover protective structure (ROPS) or a seat belt. The land owner came out to the field to check on the victim and found him lying on the ground. He called the victim's wife, who in turn called emergency services. The EMS, county sheriff, and medical examiner arrived and found no signs of life. The medical examiner estimated that the victim had died immediately after tractor impact.

## CAUSE OF DEATH

The cause of death listed on the death certificate was blunt force trauma.

## RECOMMENDATIONS/DISCUSSION

**Recommendation #1: Equip all tractors with rollover protective structures and a seat belt.**

**[ Owners of older model tractors should contact their county extension agent, equipment dealer or equipment manufacturer to determine if retrofit ROPS and operator restraint systems are available for their equipment. Such systems should be installed by the manufacturer or an authorized dealer. ]**

Discussion: Preventing death and serious injury to tractor operators during rollovers requires the use of ROPS and a seat belt. These structures, either a roll-bar frame or an enclosed roll-protective cab, are designed to withstand the dynamic forces during a rollover. In addition, seat belt use is necessary to ensure that the operator remains within the "zone of protection" provided by the ROPS. OSHA regulations require that all tractors built after October 25, 1976, and used by employees of a farm which employs 11 or more must be equipped with ROPS and a seat belt.[1] In West Virginia, many tractors are in use on family farms with fewer than 11 employees and therefore do not fall under OSHA regulations. Given the uneven terrain and environmental conditions in West Virginia, all farmers should voluntarily have their older tractors retrofit with a properly designed, manufactured, and installed ROPS and a seat belt. A ROPS retrofit kit is not available for the tractor involved in this incident (1939 International FarmAll Model M). Therefore models that can not be fitted with ROPs should be retired from service. If a tractor equipped with a ROPS and a seat belt had been used, this fatality might have been prevented.

**Recommendation #2: Convert tricycle-configured tractors to a wide front-end configuration.**

Discussion: The victim was using an older tricycle-configured tractor. Tricycle-configured tractors are inherently less stable and have stability baselines which leave little room for error. This inherent instability is amplified when dealing with elevated front end loads, such as round hay bales. These types of loads raise the C.G. and move it forward toward the tip of the stability triangle. These changed dynamics caused by the load and the hillside's terrain left little room for changes in the elevated load. When the tractor's load was elevated to clear the feeding ring, the tractor's C.G. was pushed beyond the stability baseline causing the tractor to roll over towards the downhill side. Given the fact that the task being performed involved a front-end elevated load in conjunction with sloped terrain, use of a wide front-end configured tractor may have allowed the C.G. to remain within the stability baseline and therefore prevented rollover.

**Recommendation #3: Prior to their placement, evaluate the location of feeding rings for hazards which can compromise a tractor's stability during bale transport.**

Discussion: Often to prevent damage to the field by the cattle feeder rings are relocated. This particular ring was placed on the edge of the field. Accessing the ring required the victim to traverse a 40% graded slope (22 degrees). Slopes this extreme leave little room for error and should be avoided, especially when transporting loads. A careful evaluation of the path the tractor would have to travel, prior to feeder placement, may have given the person placing it the opportunity to identify and avoid potential hazards. Upon realizing how sloped the path actually was, they may have decided to choose another location. Feeder rings should be located in areas which are as level as possible.

## REFERENCES:

1. Office of the Federal Register: Code of Federal Regulations, Labor, 29 CFR Part 1928.51 (b), U.S. Department of Labor, Occupational Safety and Health Administration, Washington, D.C., April 25, 1975.

## ILLUSTRATIONS

**Figure 1. 1939 FarmAll Model M tractor with bale spike.**
**Note: This photo was taken after repairs and wide front-end conversion.**

**Figure 2. Front end-loader attachment and fabricated bale spear.**

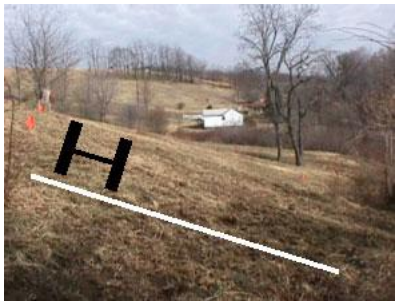


**Figure 3. The line represents the measured 22 degree grade.**
**The tractor was driving toward you. This is from the feed ring's perspective.**

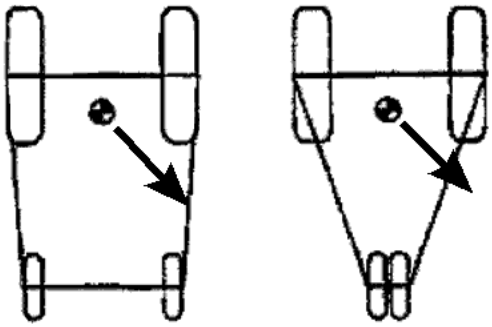

**Figure 4. This illustrates the normal C.G. and the shift which occurred due to a combination of sloped terrain and elevated front-end load. The tractor on the right is similar to the one which rolled in this incident. Once the C.G. left the smaller stability baseline of the tricycle configured tractor, the tractor rolled.**
**Note: A wide front-end tractor will also roll easily when transporting elevated loads on sloped terrain.**

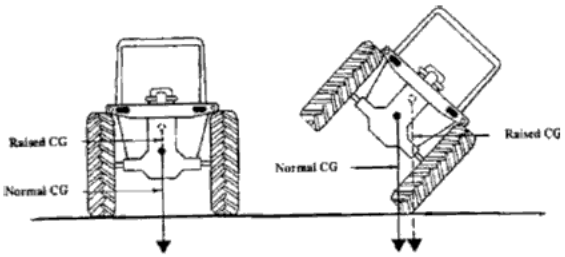


**Figure 5. The tractor on the left is operating on a level surface. The tractor on the right is traversing a hillside much like the tractor was in this incident. When transporting an elevated front-end load on level ground there is no C.G. shift to the side and the C.G. remains within safe limits. When transporting an elevated front-end load while traversing a hill, the C.G. is more prone to leave the safe limits of the tractor's stability baseline. Once this happens the tractor begins to roll. The higher and heavier the load, the less the land needs to be sloped for a rollover to occur.**

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## FATALITY ASSESSMENT AND CONTROL EVALUATION PROGRAM

The WVU Center for Rural Emergency Medicine, through a contract with the West Virginia Department of Health and Human Resources and Bureau for Public Health, conducts investigations on the causes of work-related fatalities within the state. The goal of this program is to prevent future fatal workplace injuries. West Virginia FACE intends to achieve this goal by identifying and studying the risk factors that contribute to workplace fatalities, by recommending intervention strategies, and by disseminating prevention information to employers, employees, trade associations, unions, equipment manufacturers, students, teachers, and others with an interest in workplace safety.

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Last Reviewed: November 18, 2015