

ANR-964

ALABAMA A & M AND AUBURN UNIVERSITIES

# Guarding Against Hay Fires

Hay fires cost farmers thousands of dollars through lost revenues and replacement of buildings and feed. These losses can be practically eliminated through proper harvesting and storage practices.

## Understanding How Hay Fires Start

Hay fires usually occur within six weeks of baling, but they may occur in hay several years old. Fires can occur in loose hay, small bales, round bales, or stacks. They can occur in hay stored inside or outside. Excessive moisture is the most common cause of fires.

Freshly cut forage materials are not dead. Some respiration continues, and a very small amount of heat is produced. This heat generated by respiration is probably of little consequence except that it may help provide proper conditions for growth of bacteria. As the moisture content of the crop decreases during the curing process, respiration will slow and eventually cease.

Forage crops are always contaminated with countless microorganisms. These microorganisms are no problem when the hay is harvested and cured to the proper moisture content before baling and storage. After baling, however, a small supply of air and a favorable moisture level cause the microorganisms to begin to feed and multiply, generating heat in the process. This heating continues up to a temperature of 130° to 140°F. At this temperature the heat tends to kill the microorganisms.

Depending on the exact conditions, the temperature may decrease slowly at this point as the microorganisms are killed. The hay may go through several similar heating cycles during the next weeks as the population of microorganisms increases and decreases, but the highest temperature will usually be lower each time. Eventually the temperature will stabilize near the ambient temperature.

In a case like the one just described, no fire occurs although the hay may become very hot and damaged. If thermophilic (heat-loving) bacteria are present and the 130°F heat is retained, a second heating phase could begin. This heating could generate enough heat to raise the temperature as high as 160° to 170°F before bacterial activity ceases. The thermophilic bacteria and the heat they generate convert the hay to a form similar to a carbon sponge with microscopic pores. In this form and at the high temperatures present in heated hay, the material combines readily with oxygen. In the presence of air, the material can self-ignite very quickly.

Hay fires can also result from causes other than spontaneous ignition. Some of these causes are lightning striking nearby trees or fences, arson, contact with electric fences, and sparks from cigarettes, welding, or nearby fires.

## Preventing Hay Fires

To prevent hay fires, the hay crop should be cured to the proper moisture content before baling. Moisture content is a key factor in microbial activity and the resultant heating. The Alabama Cooperative Extension Service recommends a range of 15 to 18 percent moisture content of the hay at time of baling.

Weather conditions greatly influence the rate at which the crop dries. Ideal hay curing weather has less than 50 percent relative humidity and some wind. The moisture content of the hay will increase overnight when the air is humid, especially if there is dew or fog. Weather forecasts should be monitored carefully before hay making operations are scheduled.

Conditioning equipment which crimps or abrades the crop stems is helpful because it speeds the drying process. Using tedders or hay rakes to very gently fluff windrows may also speed the curing process.

When properly used, drying agents and preservatives may be advantageous with some crops, such as high-quality alfalfa. Correct application of these chemicals is essential to avoid potential problems.

New hay, which is stacked in the field or placed in a barn, should be checked frequently for possible heating. At first, the new hay should be checked in the morning and the afternoon. If no signs of abnormal heating are found, the intervals may be lengthened. If the temperature reaches 130°F, the hay should be moved to allow increased air circulation and cooling.

Hay which is to be stored uncovered outdoors (in big round bales or stacks) should be formed into the tightest packages possible to resist penetration by rain. Unprotected bales or stacks should not be packed tightly against each other. Instead, the bales should be located so that air can circulate freely. The bales should be protected from ground moisture, runoff, and precipitation. A bed of gravel, old tires, poles, or pallets will keep the bales off the ground, and plastic or other waterproof covers will shed precipitation.

If hay is stored inside a barn, the roof must be weathertight, and plumbing must not leak. Likewise, the barn must have adequate drainage so water will not enter the barn during storms. Hay may be at the proper moisture content when baled and stored, but wetting from a leak can allow bacterial activity to increase and result in a fire.

## Determining Hay Temperatures With A Probe

You should use a probe and thermometer to accurately determine the temperature inside a stack of hay (Figure 1). Push or drive the probe into the stack, and lower the thermometer to the end of the probe on a lightweight wire. If the probe is horizontal, use a heavier wire to push the thermometer into the probe. After 10 to 15 minutes, retrieve the thermometer and read the temperature. Refer to the following temperature interpretations:

<b>Below 130°F</b>	No problem.
<b>130° to 140°F</b>	No problem yet. Temperature may go up or down. Recheck in a few hours.
<b>150°F</b>	Temperature will most likely continue to climb. Move the hay to provide air circulation and cooling. Monitor temperature often.
<b>175° to 190°F</b>	Fire is imminent or may be present a short distance from the probe. Call the fire department. Continue probing and monitoring the temperature.
<b>200°F or above</b>	Fire is present at or near the probe. Call the fire department. Inject water to cool hot spots before moving hay. Have a charged hose ready to control blazing when moving hay.

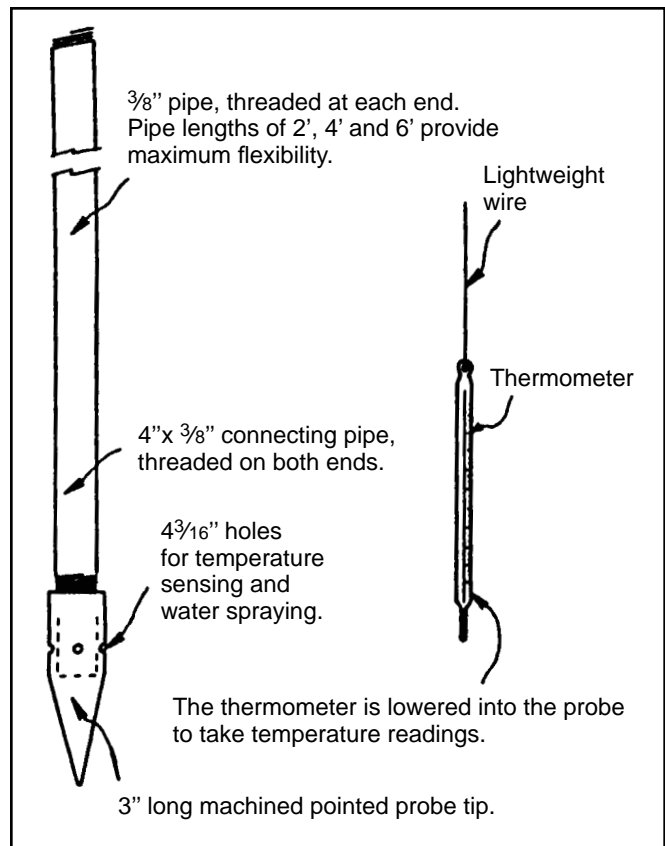


Figure 1. Probe and thermometer.

Another way to check the temperature is to push or drive a 3/8 to 1/2 inch diameter metal rod into the hay and leave it 10 to 15 minutes. Then pull the rod out and test its temperature with your bare hand. If you can hold the probe comfortably in your hand, the temperature is below 130°F. If you cannot hold the probe comfortably in your hand (it's too hot), then the temperature is above 160°F, and a fire is imminent or nearby.

You can use several probes and thermometers or several rods at the same time in various locations through the stack to complete the survey in a shorter period of time.

**Caution!** If you see or smell smoke coming from the hay, place boards or plywood on the hay before walking on top of it. This will spread your weight over a larger area to prevent falling into burned out cavities. Also use a lifeline in this case.

## Controlling Hay Fires

If you detect temperatures above 175°F, a fire is imminent or one is nearby. If you see or smell smoke, a fire is definitely present. In any of these cases, call the fire department immediately.

Do not move any of the hay. This would expose the overheated or smoldering hay to oxygen and may result in a fire raging out of control.

The proper procedure for controlling a hay fire is as follows:

1. Knock down any visible flames. Use a straight tip hose nozzle for deeper penetration.
2. Probe for hot spots. Inject water through the probe to cool the material and raise it to a moisture content that prevents burning.
3. Move the hay to a safe location.

The firefighter operating the probe should wear full turnout gear, a lifeline, and a self-contained breathing apparatus. Steam may blow back along the probe or through other openings when water reaches a fire. Boards, plywood, or a ladder should be used to distribute the person's weight and prevent a fall into a burned-out cavity (Figure 2).

Another firefighter should assist from a safe location nearby. This person should also wear full turnout gear and should have a charged hose ready in addition to the hose needed for the probe.

When you think that the hot spots have been sufficiently cooled, begin removing the hay from the barn or stack. Keep a charged hose ready and a person standing by to quickly control any blazes that may result from missed or insufficiently cooled hot spots.

Move hay which has been damaged by heat, smoke, or water to a safe location for disposal. Use damaged hay as mulch for erosion control on slopes and in gullies. If you are uncertain whether heat has damaged hay too much for feeding, have a sample tested.

## Reference

Prather, T.G. 1988. Hay Fires—Prevention And Control. Tennessee Cooperative Extension Service, Knoxville, TN.

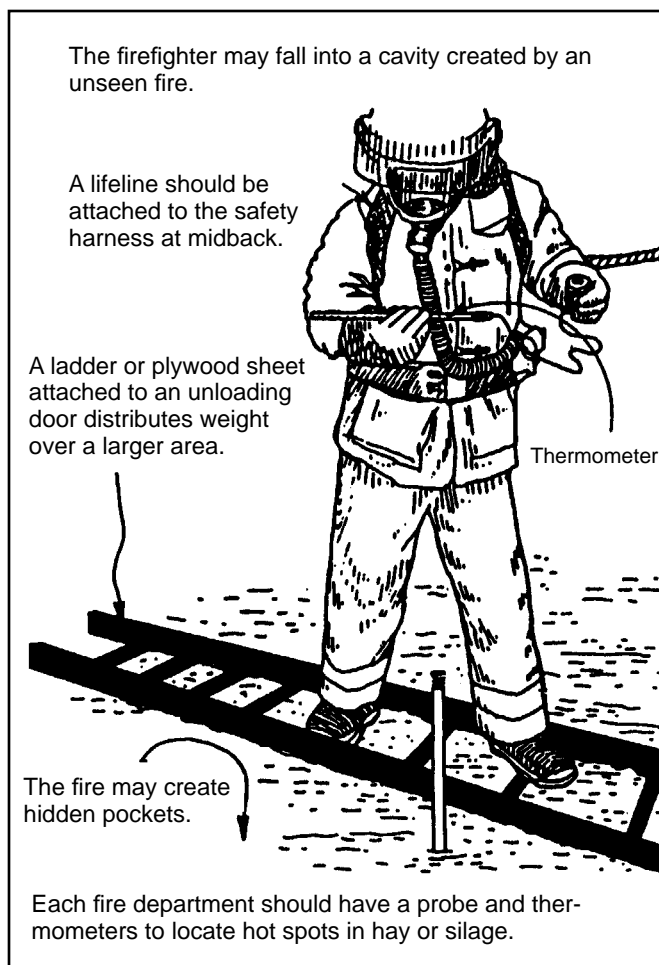
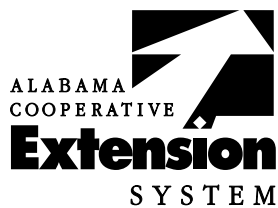


Figure 2. Probing for hot spots.



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