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PREVENTING FIRE LOSSES FROM
SPONTANEOUS IGNITION OF HAY

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Extension Specialist in Soils

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Federal Cooperative Extension Service
Oregon State College
Corvallis

Cooperative Extension Work in Agriculture and Home Economics
Wm. A. Schoenfeld, Director
Oregon State College and United States Department of Agriculture, Cooperating
Printed and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914

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PREVENTING FIRE LOSSES FROM SPONTANEOUS IGNITION OF HAY

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Every year in Oregon barns are lost from fires caused by the spontaneous ignition of hay. These fires would never occur if proper precautions were taken before storing the hay.

What is spontaneous ignition?

The simple answer is heating. Technically, spontaneous ignition or combustion is a combination of biological and chemical processes working on organic material and resulting in the generation of heat. Heat generated inside of the pile of hay cannot escape because the hay is an excellent insulating material; therefore, the heat accumulates until it finally becomes great enough to ignite the hay, and may result in the loss of both hay and barn.

Hay wet from rains most dangerous.

Hay that has been wet from rain is more susceptible to spontaneous combustion than undercured hay. This does not mean that undercured hay will not heat.

When is hay safe?

For safe storage the moisture content of hay should be below 25% and preferably down to 20%. Hay chopped into the barn should be drier than when stored loose.

An actual moisture determination is impractical on the farm. Through experience most farmers know when the hay is cured to a point where it is safe for storage. Two indicators may be helpful: Scrape a few stems with a finger nail; if the outer layer peels off the hay is too moist for storage. Twist a handful; if the hay is tough and there are signs of moisture where the stems are broken, again there is too much moisture for storage. Take samples for trial from the center of the shock or windrow.

Usually fires from spontaneous combustion result when the farm operator decides to take a chance and gain a day or two on the busy summer season. It pays to play safe.

Hay cures more quickly in the swath and windrow than in the shock. Time in curing can be greatly reduced if the hay is left in the windrow until practically cured before shocking.

Heating often starts from small amounts of wet hay, such as might be picked up in the bottom of a shock. It will pay to throw this material to one side.

Salting reduces the amount of fermentation, but not enough to provide any real assurance that the hay will not heat. Never store or stack wet hay with the thought that salt will prevent it from heating.

The larger the stack or the mow the more danger there is from fire. Heat is developed in the center of the pile. If the heat can escape rapidly enough there is no danger of fire. Well-ventilated mows help carry off the heat. In large mows the hay should be stored a bent at a time. If practical, a means of air circulation between these bents is helpful. Mowing the hay in bents has another advantage; usually only a small portion of the hay is subject to heating and if the dangerous hay is all in one bent it may be possible to remove it without endangering the remainder.

In stacking hay the same principle applies. There is more danger in a large stack than in a small one. It is poor policy to put stacks close together in one stack yard. If one stack heats, the entire hay supply may be lost. If stacks are 150 feet apart or more it will usually be possible to save the remainder of the stacks even though one catches fire.

Moisture coming from leaky roofs or from rain blowing through open windows can wet properly cured hay to a point where it will begin to heat.

Odor indicates trouble

Any odor other than the "smell of new mown" may be an early trouble sign. An odor resembling silage is a sure sign that heating has started.

Mow temperatures predict danger.

There is some rise in temperature with most stored hay. Temperatures of 100 to 120 degrees are not unusual, but if the temperature inside the stack goes above 125 degrees the hay should be watched carefully. If the temperature rises to 150 to 170 degrees arrangements should be made to take temperatures at close intervals. When the temperature gets to 175 degrees a fire can be expected. There may be spots much higher than this. Close all doors and other openings in the lower part of the barn to avoid the possibility of strong draft starting a blaze. Windows and ventilators in the upper part of the mow should be left open to avoid the possibility of an accumulation of explosive gas.

When the temperature reaches 180, make arrangements to remove all livestock and removable equipment from the barn. Assemble all possible fire fighting equipment and get ready to remove the hay.

When the temperature reaches 190, the hay had better be removed to avoid the loss of the barn -- and here is where many barns burn. When the pile is opened up for removal air reaches the hot material giving it a chance to burst into flames. Hay will not ignite at a temperature of 190 or even 212 (boiling), but once these temperatures are reached increase up to the point of ignition takes place with extreme rapidity.

The use of carbon dioxide suggested for removing hay.

The following method of handling hot hay was developed by the Wisconsin Mutual Insurance Alliance. It has been used effectively in saving several barns in that state.

Hay is cooled down to the point where it can be safely removed by the use of compressed carbon dioxide. The following equipment is needed:

1. Several sections of three-quarter inch pipe each five feet long with sleeves to permit connecting and disconnecting. The number will depend on the depth of the hay.
2. One section of pipe equipped with a steel point on one end and with threaded connections on the other. This pipe should be drilled with 3/16-inch counter-sunk holes at 6-inch intervals, spaced alternately on opposite sides of the pipe. The carbon dioxide is released through this perforated point.
3. One "T" equipped with short lengths of pipe to be used as a handle for the probe.
4. One cylinder or cylinders of compressed carbon dioxide and four or five feet of high pressure hose to permit discharging the carbon dioxide from the cylinder into the pipe.

In operation the hottest points in the mow are located with a thermometer probe. Enough joints of the pipe are connected together to permit placing the perforated point at the center of the hot spot. The handle is then removed, the cylinder connected, and the gas is allowed to escape. It may require a cylinder or more to cool down one spot to make the removal safe.

This method will cool down the hay to a point where it can be removed safely. It should not be considered a means of stopping the heating so that the hay can be left in the barn.

Community farm fire crews could furnish real service by preparing in advance for such emergencies by providing the equipment and locating a quick source of supply for the carbon dioxide.

Taking temperatures of hay.

The use of a thermometer is absolutely necessary to provide temperature information on dangerous hay. Two types are suggested:

1. A mercury thermometer fitted in the end of a long pole approximately 3/4" square or 1" in diameter. One end of the pole should be pointed. Just back of the point a slot in which the thermometer can be placed flush with the outer surface should be made. The thermometer is securely wrapped in place with tape. This probe should be used for checking the temperature to determine whether or not action is necessary.

2. In connection with the above equipment for using carbon dioxide the thermometer can be attached to a strong cord and inserted inside the pipe.

In taking hay temperatures the probe or pipe should be forced into the hay. The thermometer should be left for two or three minutes; then it should be rapidly withdrawn and a reading taken. The reading should be taken from several points over the mow. Always close the holes made by the probe to prevent air from reaching the hot spot and starting a fire. The same holes can be used for taking temperatures at intervals if they are immediately plugged with a stick the same size as the probe. The danger from an open hole increases as the temperature rises.

Hot hay dangerous.

When the temperature in the mow reaches 190 to 200 degrees there may be extreme danger in working with the hay. There is always the possibility that there is some hotter spot that may have actually ignited. There is always the danger that the upper part of the hay may cave in and drop someone into a mass of burning hay. It is safest to work on planks laid over the top of the hay or from some type of movable platform.