silage with considerable molding, and a large portion was not eaten by the cattle. An undetected hole in a multiple-bale tube would result in all of the rolls spoiling. Further, it was difficult preventing and patching all the holes made by raccoons and other wildlife present in the storage area.

Stretch-Wrapped Bales

Bales were wrapped in four thin layers (each layer 1 mil or 0.001 of an inch thick) of plastic stretched by a machine designed for this purpose. This system showed the most promise of those investigated. The cost of plastic wrap is about $3 per bale, significantly less than single-bale bags, and silage quality has been consistently better than that made with the multiple-bale tubes. The big disadvantage to this system is the $8,000 to $14,000 cost of the machine that wraps plastic around the bale.

Being equipped to make round-bale silage allows a forage producer to make hay when the weather permits and make silage when drying conditions are unfavorable. With this flexibility the producer can harvest forage when the crop is at its nutritional peak, rather than when the weather appears suitable for making hay. Since the nutritional value of many warm season grasses decreases rapidly after about 4 to 6 weeks of regrowth, timely harvesting is important.

Silage Quality Depends on Plastic Cover Integrity

From this point forward this circular covers methods for maintaining the integrity of the plastic envelope around silage so air will be kept away from the bale. All mentions of plastic are the stretch-wrap plastic used in the third system which was judged to be the best from our research.

Baled silage stored in plastic has often been of poorer quality (mostly due to mold) than silage made using conventional silage-making equipment. Air (oxygen) enters the plastic envelope through holes or pores in the plastic and between layers of overlapping plastic. In most instances holes are believed to be the primary pathway for oxygen, since the silage quality of bales without obvious holes in the plastic was usually good. (There was one instance in the testing where the plastic showed no obvious holes and yet the silage was moldy and rotted near the outside of the bale, indicating air had entered. This may have been unique to the specific batch of stretch wrap used.)

The relative importance of oxygen entering through pores and between overlapping plastic sheets is still an unknown.

Oxygen Entry Through Holes in the Plastic

Small Holes

Eliminating small holes in the plastic is difficult, especially after silage bales are stored. They must be inspected regularly for holes, and any holes must be patched with tape to limit spoilage.

Holes can develop when the wrapped bale is dropped by the wrapping machine. The resulting hole can be a long split in the plastic or tiny holes caused by sharp objects such as crop stubble puncturing the plastic. A split is obvious to the wrapping machine operator and needs to be patched with tape or rewrapped, depending on the size of the hole. Stubble punctures often go unnoticed and unpatched.

Holes can also be caused by birds walking on the bales and pecking. In one instance a considerable number of insect larvae emerged from holes in the plastic. It was never determined whether the larvae bored through the plastic or were just enlarging small holes that were caused by birds or crop stubble.

Large Holes

There is considerable variation in how stretch-wrap plastics withstand exposure to direct sunlight. If the plastic contains insufficient ultraviolet light inhibitor, it will disintegrate after a few weeks' exposure to sunlight. This type of failure can only be remedied by rewrapping the bales, and this is costly and time-consuming. It may be impossible to rewrap these bales because bales flattened on one side will not rotate properly on the wrapping machine.

Tests were conducted in 1990-91, 1991-92, 1992-93, and 1993-94 to determine how various plastics endured exposure to the sun when stretched 50 percent: the recommended amount that plastic is stretched when used to cover a silage bale. A 50-percent stretch means that a 10-foot piece of plastic is stretched to 15 feet when wrapped around the bale. Samples of plastic wrapper stretched 50 percent on frames (in the 1991-92 tests) are shown in Figure 1.