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Nutrition Section 320

Principles of Successful Silage Management

Tianna Fife and Mireille Chahine
University of Idaho

Harvesting forages for hay is the most common means of preserving forage for feeding the beef herd; however, silage is an alternative method of preserving forage that may offer advantages for some beef producers. In particular, preserving forage as silage does not require extended time for field drying; therefore, silage is a likely alternative when wet, inadequate climate conditions do not permit field drying to conserve the forage as hay. Likewise, when harvesting forage as silage losses in the field are lower as compared to harvesting it as hay because processes such as respiration, shattering, leaching, and sun bleaching are reduced.

Compared with hay, silages are also typically more palatable with more digestible fiber and may have a higher energy and protein content. On the negative side, silages require more attentive management to prevent dry matter and nutritional losses during storage and feeding. Therefore, these aspects and the costs of production, storage, and feeding need to be evaluated for each situation.

Phases of Silage Making and How Harvest Affects It

The ensiling process allows forage to be preserved at a moisture content that would typically be unsatisfactory for storage. Forages are preserved as silage by an ensiling fermentation process that produces acids to inhibit spoilage. It is important to understand the phases of ensiling fermentation in order to properly manage the forage at both the time of harvest and at feeding. The process in which forages are ensiled has two steps—aerobic and anaerobic.

Aerobic Phase

The aerobic (with oxygen) phase lasts a relatively short period of time; ideally less than 2 days. After the wet forage is packed into a silage structure, whether it be a bunker, upright silo, or a plastic bag, some residual oxygen remains in the forage, despite even the best management efforts of the producer. Before the ensiling process can proceed, this oxygen must be completely eliminated from the structure. This happens by respiration. In the presence of oxygen, respiration converts soluble carbohydrates ($C_6H_{12}O_6$) present in the forage to carbon dioxide (CO_2) and water (H_2O) (Fig. 1). A byproduct of the reaction is heat.

$$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O + \text{Heat}$$

Fig. 1. Chemical reaction involving respiration of plant carbohydrates.

Importantly, the aerobic phase is detrimental to the feeding value of the silage for two reasons: (1) the soluble carbohydrates lost are an important digestible energy source in the forage, and (2) the heat produced may damage or denature the protein contained in the forage (Fig. 2). For this reason, it is critical to eliminate as much air from the silo as possible when packing and

Fig. 2. Wet, unpacked silage quickly produces heat from respiration, as evidenced by the rising vapors. This extensive respiration will reduce the energy value of the silage and will result in lower nutritive values since the heat will denature, or damage, the protein.