

New Tool for Evaluating Silage Quality

Over the last five years, interest in evaluating silage quality has increased sharply. The fermentation process results in the production of acids that preserve the silage. Environment, crop type and management influence the amount and type of acids produced. Generally referred to as volatile fatty acids (VFA), the amount of the different acids produced has a direct affect on storage and feeding quality. Though many different acids can be produced, those of primary interest include.

Lactic acid – has the greatest preservative effect. It should make up at least 65-70% of the total silage acids in a good silage.

Acetic acid – elevated levels may be the result of a prolonged aerobic phase if silage is put up too dry, too slowly and/or not packed or covered adequately. A prolonged aerobic phase may also result in continued yeast and mold growth, excessive heating and subsequent loss of available protein, dry matter and energy. Elevated levels can also occur when fermentation is prolonged by the high buffering capacity of legume silage or in ammoniated silage. Moderate concentrations of acetic acid may be present if the silage was treated with certain bacterial inoculants. Because acetic acid is good at inhibiting the growth of yeasts and molds, these silages tend to have better shelf life.

Butyric acid – high moisture contents at harvest and/or lack of adequate sugars may result in a clostridial fermentation and the production of butyric acid. Field observations suggest that excessive soil contamination may also be a predisposing factor. High DM losses occur in clostridial silages because clostridia bacteria convert sugars, organic acids and proteins into butyric acid, carbon dioxide, hydrogen gas, acetic acid, ammonia and amines. High butyric acid silage is often low in feed value and may have a negative impact on animal performance and health. Total removal or dilution of the poor silage may be advised.

Fermentation profiles typically include lactic, acetic, propionic, butyric and iso-butyric acids along with ammonia and pH. In general, high lactic acid values are indicative of a good fermentation, while high butyric acid is associated with a poor fermentation resulting in reduced feed value and problems with animal health.

To assist producers and their advisors sort through fermentation information, the Dairy One Forage Lab has developed a **VFA Score**. The score weighs the positive impact of lactic and acetic acids against the negative impact of butyric acid to arrive at a single value for evaluating silage quality. The concept is similar to Relative Feed Value (RFV), which is a score used to evaluate forage feeding value. "We saw the need for developing a scoring system as questions arose from producers trying to compare different silages. Our goal was to develop a system that accounted for the positive and negative factors influencing silage quality and would serve as a practical guide for ranking silages" says Paul Sirois, Dairy One Forage Lab Manager. "The VFA Score combines several measurements into a single value that is a direct reflection of the success or failure of the fermentation process" he says.

The positive impact of lactic acid, the lactic:acetic ratio, and acetic acid are combined with the negative impact of butyric acid to produce the final score. The score will be between 0 - 10, with higher scores indicative of better fermentation. The scores are broken down as follows:

Table 1. VFA Scoring System

<u>VFA Score *</u>	<u>Rating</u>	<u>Comments</u>
8 - 10	Good	
6 - 8	Satisfactory	
3 - 6	Needs Improvement	Generally due to poor lactic and excessive acetic production.packing procedures, filling speed, and good silage management practices. Ammoniation may result in elevated acetic levels by elevating pH and delaying the onset of normal fermentation.
< 3	Poor	Review and improve as required: moisture content, length of cut, filling speed, packing procedures, air exclusion, structural integrity of the silo, use of additives and overall silage management practices

***Note:** The VFA score does not include mold counts or mycotoxin levels that could also have a negative impact on aerobic stability and/or animal health.

Table 2. displays some typical silages and their corresponding scores.

Table 2. Typical silage scores.

Silage	Lactic	Acetic	Butyric	VFA Score	Rating
A	5.94	0.83	0.01	8.74	Good
B	4.37	1.96	0.05	7.42	Satisfactory
C	2.06	5.32	0.24	5.74	Needs Improvement
D	0.91	4.42	1.79	0.30	Poor

Table 3. Silage comparison.

Silage	Lactic	Acetic	Butyric	VFA Score	Rating
E	5.21	0.48	0.09	8.92	Good
F	6.13	2.37	0.24	8.22	Good

Table 3. is a comparison of two silages. Although Silage F. is higher in lactic acid, Silage E. scored higher due to the more favorable lactic/acetic ratio. Both silages, however, scored in the Good category and are acceptable. "The overriding intent of the VFA scoring system is to categorize the silages and not to heavily emphasize individual numerical scores. We want producers and their advisors to use this as a guide for evaluating silage management skills and making improvements when required." says Sirois.

"Once fermentation is complete, little can be done to change the quality" says Janet Fallon, Dairy One Field Representative. A fermentation profile is a report card on the finished product.

"However, the rating and comments presented above will be useful to identify the best feeding

strategy and/or to minimize losses during feed out. A poor score is a call to action and should prompt you to speak to your advisors about specific management changes that may help improve silage quality in the future" she states.

Located in Ithaca, NY, Dairy One is a farmer owned cooperative providing herd management and forage analysis to dairy farmers throughout the US. For more information, visit their web site www.dairyone.com or call 1-800-344-2697.