Dairy One

730 Warren Road
Ithaca, NY 14850
Phone: 800-496-3344
Fax: 607-257-6808
www.dairyone.com

Fermentation Analysis & Evaluation

The production of high quality silage begins with harvesting at the proper stage of maturity to maximize nutrient yield. After this, the following management practices are essential for successfully fermenting and preserving the forage:

1. Harvest at the proper moisture (DM) content.
2. Chop at the correct particle length.
3. Fill rapidly to avoid excessive respiration and minimize exposure to oxygen.
4. Distribute evenly and pack firmly to exclude oxygen.
5. Seal to prevent exposure to oxygen.

Three of the five practices relate to minimizing exposure to oxygen (air). This is because "**Oxygen** is to **Silage** as **Kryptonite** is to **Superman**". The bacteria responsible for the production of lactic acid are facultative anaerobic, which means that their growth is optimized in the absence of oxygen. The goal of a good fermentation is to maximize the production of lactic acid, thus lowering the pH and establishing an environment less suitable for the growth of unwanted organisms. The best silage is made when exposure to air is minimized, thereby giving the lactic acid bacteria a quick start on fermentation.

As the name implies, a Fermentation Analysis reflects the quality of the fermentation. Once silage has fermented, nothing can be done to improve the quality of it. A fermentation analysis is a tool for evaluating **past** storage management practices, current feed-out practices, and their potential effect on animal performance. Poor results should serve as a guide for improving management practices for ***future*** harvests.

Lactic Acid – the goal of a good fermentation is to maximize the production of lactic acid. Lactic acid is the strongest fermentation acid and most effective in lowering pH. Rapidly dropping pH helps reduce protein breakdown, increases the acid hydrolysis of hemicellulose and slows down unwanted microbial activity. High lactic acid and lactic/acetic ratios indicate that a good fermentation has taken place.

Failure to follow the five basic silage practices listed above will result in low lactic acid values. Reevaluate all of your silage production practices to identify weak points. Adjust management practices accordingly with your next harvest to increase the likelihood of a good fermentation.

Acetic acid production normally occurs during the first 2 to 3 days of ensiling. Anaerobic bacterial production of acetic acid begins to lower the pH of the silage. When the pH drops below 5, lactic acid bacteria begin to grow and take over the fermentation process. Thus, in a typical silage, acetic acid production helps to initiate the production of lactic acid.

Acetic acid can also be produced by yeast degrading lactic acid during feed-out of the silage. Poor feed-out management allows air to penetrate the silage mass setting up conditions suitable for yeast growth.

Acetic acid is normally present in low amounts (<3%). It has some antifungal properties that help extend feedbunk life. High levels may reduce palatability and intake.

Propionic acid is typically found only in small amounts. High levels would indicate that something is radically wrong.

Butyric acid is produced by the anaerobic bacteria clostridia which proliferate if the silage is harvested too wet (<30% DM). In wet silage, the lactic acid bacteria may not produce enough acid to sufficiently lower the pH and prevent the growth of clostridia. Clostridia can also ferment lactic acid to butyric and break down amino acids to produce excessive levels of ammonia. Both of these effects can cause the pH to rise resulting in a unstable silage subject to further deterioration.

Clostridial silage is characterized by a high butyric level, high pH (>5), high ammonia (amm/tN>10), rotten and/or ammonia smell, reduced dry matter intake and possible disruption of the rumen ecology resulting in poor feed utilization.

Ammonia – high ammonia levels are the result of excessive protein breakdown caused by an undesirable fermentation. See under butyric acid above.

Other Considerations
The use of research proven additives may improve the odds of successful fermentation. Additives are not a "quick fix" for substandard management practices. The five basic management steps outlined initially are essential for promoting good fermentation. Additives are not a substitute for poor management. Their role is to enhance fermentation, nutritional value and/or bunk life. Additives are best used when ensiling conditions are suboptimal. For example, during wet years or when conditions exist that cause silage to be put up wetter than normal, an additive may help improve fermentation and decrease the likelihood of an adverse clostridial proliferation.

Good silo and feed bunk management are required to deliver consistent quality feed that promotes high dry matter intakes. Minimum amounts of silage need to be fed every day to provide good quality feed. Tower silos must be unloaded at a rate of 2 – 3 inches/day during cooler months and 4 – 6 inches per day during warmer months to minimize the amount of surface spoilage. Bunk silos should have 4 – 6 inches removed from the face year round. The face should be smooth shaven to minimize the surface area exposed to air.

Feedbunks should be monitored for leftover feed. Left over silage will begin to heat and spoil and should be removed from the bunk. Failure to remove refusals may result in decreased intakes of fresh feed placed on top of it.

Expected Values

	Corn	Legume	Grass	HM Corn
Lactic acid	>4	>3	>3	>1
Acetic acid	<3	<3	<3	<1
Lactic/Acetic	1.5 - 4.0	2 - 3	2 - 3	2 - 3
Propionic acid	<1	<1	<1	<1
Butyric acid	<0.1	<0.1	<0.1	<0.1
Total acids	5 - 10	5 - 10	5 - 10	5 - 10
pH	<4	<5	<5	<4.5
Ammonia	0.6 - 1.0	1.5 - 2.5	1.0 - 1.9	0.4 - 1.0
Ammonia N/Total N	10 - 15	10 - 15	10 - 15	10 - 15