

# Agri Resource

## Volatile Fatty Acids

Volatile Fatty Acids can be analyzed through a Fermentation Analysis, which primarily serves as a monitoring tool for good silo filling management practices. Data from a fermentation analysis can tell us whether an excellent, average, or poor fermentation occurred. The fermentation a crop goes through in most cases can be influenced by both managerial factors and those that occur naturally.

*Volatile Fatty Acids:* These acids evaporate quite easily when introduced to air and are what give silages their characteristic smell. Lactic acid in contrast has a bland odor and does not volatilize upon exposure to air. Lactic acid creates efficient fermentation because it is stronger than the volatile acids. The volatile fatty acids provide aerobic stability properties.

- i. *Acetic Acid:* Provides silages with their characteristic vinegar odor and taste and is usually the predominant acid produced during fermentation for maintaining aerobic stability. Usually found at less than 3% in silages. Anything over 3% suggests inefficient heterofermentative fermentation.
- ii. *Propionic Acid:* Produces a sharp sweet smell and taste and is usually lower levels of this acid are produced during fermentation for maintaining aerobic stability. Usually found at less than 1.0% in normal silages.
  - i. Most silage contains very low concentrations of propionic acid (<0.2 to 0.3%) unless the silage is very wet (<25% DM). In silages with more typical concentrations of DM (35 to 45% DM), concentrations of propionic acid is undetectable.
- iii. *Butyric Acid:* Produces a rancid butter smell and taste. Appropriate levels of butyric acid (<0.5% of DM) indicates again that the silage has gone through a normal fermentation. However, butyric acid (>0.5% DM) indicates that the silage has undergone a clostridial fermentation, this is one of the poorest fermentations. These silages usually hold low nutritive value and have higher ADF and NDF levels because many of the soluble nutrients have degraded.

Table 1: Fermentation End Products of Common Legume and Grass Silages (Dry Matter Basis)

End Product	Legume Silage (30-40%)	Legume Silage (45-55%)	Grass Silage (30-35%)
pH	4.3 – 4.7	4.7 – 5.0	4.3 – 4.7
Lactic Acid %	7 – 8	2 - 4	6 - 10
Acetic acid %	2 – 3	0.5 – 2.0	1 - 3
Propionic Acid %	<0.5	<0.1	<0.1
Butyric Acid %	<0.5	0	0.5 – 1
Ethanol %	0.2 – 1.0	0.5	0.5 - 1
Ammonia – N (% of CP)	10 – 15	<12	8 - 12

Table 2: Fermentation End Products in Corn Silage and High Moisture Corn (Dry Matter Basis)

End Product	Corn Silage (30-40%)	HM Corn (70-75%)
pH	3.7 – 4.2	4.0 – 4.5
Lactic Acid %	4 - 7	0.5 – 2.0
Acetic acid %	1 - 3	<0.5
Propionic Acid %	<0.1	<0.1
Butyric Acid %	0	0
Ethanol %	1 - 3	0.2 – 2.0
Ammonia – N (% of CP)	5 - 7	<10

*Resource:* Seglar, B: Fermentation Analysis and Silage Quality Testing. Proceedings of The Minnesota Dairy Health Conference, University of Minnesota. 119-136. 2003.