by John Goeser

What is brewing in your silo?

DISCUSSING the current year's crop quality over beers, post-harvest, is normal etiquette to some, but perhaps how often do you discuss silage and beer similarities?

These subjects may seem like a far cry from one another (unless a few drinks in), but as I have learned more about silage (and beer) making over the past decade, it's become apparent that there are many similarities between these consumable products (albeit consumable by different species — unless your cows love a good porter and you've learned to enjoy silage salad).

Science has led us to realize that similar fermentation processes apply to both beer and ensiled feed. Alcoholic beverages and silage or haylage are produced by fermentation, a process where sugar is fermented into other desirable (and undesirable) products. Within beer, barley, wheat or rice sugar is converted to ethanol by yeast. The process is tightly controlled to manage flavor and quality.

Silage came first

With fermented forage, alfalfa and corn sugars are converted into fermentation acids and other compounds by bacteria (both applied as inoculant and wild) and wild yeast. It might surprise you to learn that fermenting feed predates beer making! Archaeologists have found fermented feed evidence dating back a thousand years, when people in the Middle East stored feed in the ground.

With humans having ensiled feed for hundreds of years, one would assume the process to be perfected. Unfortunately, this is not the case. In just the last few years, substantial opportunities, where growers and farms could have done a better job "brewing" their haylage or silage by better controlling the process, have been apparent.

Feed will nearly always ferment, reaching a stable point in storage. However, the path to stable feed is not always direct or desirable. An analogy can help in understanding what can happen when fermentation is not controlled: Consider taking both a 40 miles per gallon (mpg) and 15 mpg vehicle to go to the store. Both vehicles get there; however, one consumes substantially more fuel and energy.

Fermentation is no different, the process can be direct and controlled (desirable) or prolonged and wild (undesirable). There are very specific bacteria species that are desirable to "brew" quality silage — creating acids from just the right amount of sugar, and no more, to produce stable feed. There are also undesirable wild (epiphytic) bacteria and yeast, which are abundant in the soil, and harvested with the crop, which lead to poor-quality haylage and silage.

With high-quality silage and preservation, 97 to 98 tons are fed out of every 100 tons harvested. Nearly all of the harvested forage is effectively preserved. In the case of poor-quality silage, you end up feeding less than 80 tons for every 100 harvested! In this instance, preservation leaves a lot to be desired. The missing tonnage is consumed by bacteria, yeast and molds during uncontrolled fermentation.

While the results of low-quality silage may drive anyone to open another beer, one can take solace in efforts to gain insight into how well the crop fermentation was controlled with fermentation product measures. The fermentation products routinely analyzed by a commercial laboratory are lactic acid, acetic acid, propionic acid, butyric acid, ethanol and ammonia-N.

Lactic acid is desirable and sugar is efficiently converted into this silage acid. Fermentations with lactic acid greater than 3 to 3.5 percent of dry matter (DM) can indicate greater efficiency –similar to the high mpg vehicle in the previous analogy. However, the other fermentation acids and compounds need to be reviewed and considered before final judgment.

Acetic acid, ethanol, ammonia-N, and other acids are less desirable, with sugar converted less efficiently to preservation acid — similar to a less efficient (or broken) vehicle. When these compounds are produced, protein is broken down and gases are formed — representing lost feed.

Goals for other compounds are feed specific, but generally speaking the desirable silages include (guidelines):

- Acetic acid: less than 1.5 to 2 percent of DM
- Propionic acid: less than 0.25 percent of DM
- No detectable butyric acid
- Ammonia-N: less than 10 percent of total crude protein (CP)
- Lactic acid to acetic acid ratio: greater than 3:1

Just like unique flavors with craft beers or a skunky beer taste, there can be other unique compounds produced during feed fermentation, which can affect animal intakes and performance. This is an evolving area and our industry has a substantial amount to learn.

Improving fermentation

If silage shows a less than ideal preservation, per the guidelines above, here are some points to consider to control fermentation:

1. Harvest crop at optimal moisture — not too wet, not too dry.

2. Pack tightly — the more feed packed into a given space, the less air and oxygen can infiltrate.

a. Oxygen is a potent efficiency robber.

3. Seal the silo (meaning upright, bag, bunker, pit, pile, trench, and so forth) quickly. Silos taking longer than a week to fill are prone to less efficiency.

a. Seal the edges and sides if possible.

4. Keep the air and oxygen out — use tires, tarps, oxygen barrier covering or scavenger on the top, and keep varmints away.

5. Feed silage and haylage out appropriately — oxygen can penetrate up to 3 feet into the face, depending on density.

a. Feed enough silage so that feed is not "exposed" for more than a day.

While a certain amount of finesse is required by the brewmaster to create a tasty beer, following sound management protocols, understanding the biological forage preservation process, and setting measurable goals provide a simple means to create high-quality silage. It's important to remember that while similar in fermentation — optimal fermentation of silage has a much more important role in cattle's performance than the brew's role in our everyday productivity. ●

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