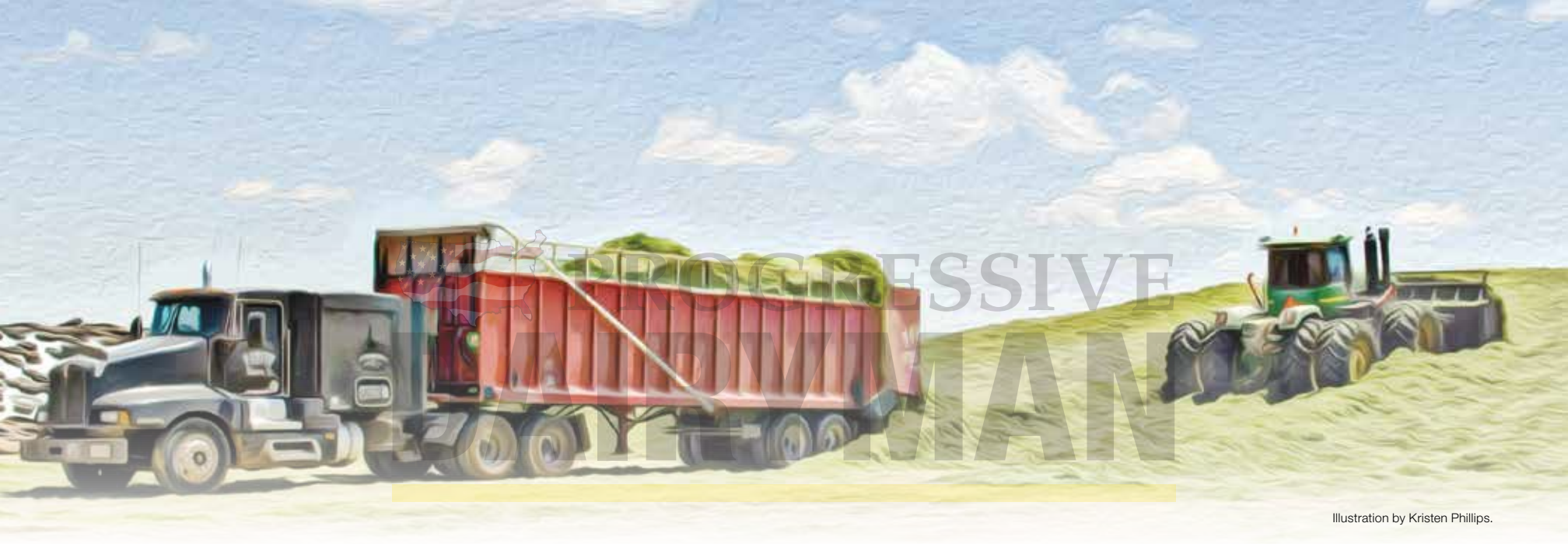

Illustration by Kristen Phillips.

The drive for better silage

John Goeser for *Progressive Dairyman*

Editor's note: This is the first article in a series.

Silage's drive from point A to point B: This probably sounds like a bad agriculture cartoon, as silage clearly does not sit down in a car and drive; however, forage preservation can be compared to a situation we have all encountered when driving to a new destination. When traveling to a new or unknown location, we may expect to answer: Did we get to the final destination directly, quickly or efficiently? Did we conserve or waste fuel?

Forage is preserved by either drying (think hay) or sealing the forage tight, eliminating oxygen and stopping microbial activity (think haylage or silage). The latter takes fuel in the form of readily digestible sugars and some soluble cell wall. In either case, the aim is to preserve and feed out nearly 100 tons of each 100 tons harvested, limiting shrink.

Unfortunately, some dairies and feedlots feed out fewer than 70 tons for every 100 tons harvested. This has been documented in both 1980s research and observed much more recently for commercial forages using a published fermentation shrink measure. At $45 per ton, this shrink equates to $1,350 in losses for every 100 tons harvested.

Limit shrink: Stabilize forage quickly

Making silage effectively requires control over four stages: aerobic, fermentation, stability and feed-out. In part one of this article series, the focus is on the stages leading up to stability, including eliminating oxygen and halting microbial activity quickly. These two actions can be compared to choosing the fastest route and driving a fuel-efficient vehicle. Making wrong turns, leaving the vehicle running when stopped or missing your exit can all be compared to inefficient forage preservation during these stages – too much fuel is burned to get from point A to point B, directly affecting the costs of the journey.

Step 1: Eliminate oxygen

To effectively preserve forage by

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ensiling, all oxygen must be driven from the system. We can remove oxygen through management and also biologically. The management component involves sealing the forage quickly from air and squeezing gas out of porous space within the forage, reducing porosity.

Silage experts professor Brian Holmes and professor Richard Muck, recently retired from the USDA and University of Wisconsin – Madison, have taught that reducing porosity by increasing silage density (pounds per cubic feet) improves efficiency and stability. With upright silos, the additional weight of fresh chopped forage pushing down on forage lower in the silo increases density, and not much can be done further. With bags, bunkers, piles or pits, managers can increase density by packing more feed into a confined space. For bunkers, pits and piles, the density comes through pack tractors and added weight on the silo during filling. Use the following equation to calculate the minimum amount of total tractor weight that should be on the silo during filling:

Tons harvested per hour x 800 = total tractor weight needed

For example, if harvesting 100 tons per hour, then 80,000 pounds in tractor weight should be driving around on the silage; more weight will increase density and reduce porosity.

Then, when sealing the “silo,” take care to use high-quality plastic. Consider oxygen-barrier films or oxygen-scavenging strategies, and seal the edges well. Professor emeritus Keith Bolsen, Kansas State University, showed in the early ’90s that air getting into the silo at the top can cause substantial shrink and add anti-nutritional factors to feed.

Step 2: Stop microbial activity and preserve feed

Stabilizing forage and preserving feed for anywhere from several months to several years is not an easily managed process. In the absence of food-grade preservatives, keeping oxygen out as described above and then decreasing the forage pH to an acidic level effectively hinders negative microbial activity.

Before pH drops to an acidic level, somewhere between 4 and 5, negative microbes are able to grow. Yeast and mold are largely detrimental to stabilizing forage because they consume readily digestible carbohydrates that should be available for the cow. Letting these negative organisms grow is akin to leaving your car running for an hour before you even leave. Valuable fuel is burned.

After the air is removed, shrink can still occur in some cases; fuel conversion efficiency may be poor with naturally present fermenting bacteria. There are two types of fermenting bacteria – those from the wild (called epiphytic) and those specifically applied to ferment forage (called inoculant). Without a microbial inoculant or aid, bacteria from the field and air colonize on the fresh feed, consume sugars and produce fermentation acids. The epiphytic bacteria eventually produce enough acid to acidify the silage, stabilizing feed, but this process can take weeks and the acids produced may be weak. This situation is akin to driving an eight-cylinder instead of a four-cylinder to your destination; more valuable fuel is burned than necessary.

Ultimately, the aim is to decrease forage pH as quickly as possible and stop microbial activity. And to be clear, forage-digestible carbohydrate losses are what we mean by fermentation shrink. These forage shrink losses must be offset in your ration with either sugar or corn – which means money out of pocket.

Management goals

Work with your forage consulting team and consider these management steps and benchmarks, with the goal being to store and stabilize each and every ton harvested.

Limit the time between harvest and effective sealing to less than two days. With bags and upright silos, the forage is effectively sealed continuously as more forage is packed into the silo. With bunkers, pits and piles, consider packing and splitting massive piles into smaller ones to limit time from harvest to seal. For example, convert one 15,000-ton pile that takes three weeks to finish into two 7,500-ton piles that each take 1.5 weeks to harvest and cover.

Avoid waiting until all forage is harvested to cover. Cover silage each night and seal finished sections as the silo grows. This is tough, given wind, but the farms and managers that have exceptional silage get this done.

Pack, pack and pack some more to achieve an as-fed forage density greater than 55 pounds per cubic foot. Historically, we have considered dry matter density to be the gold standard; however, it has been taught that as-fed density is a better indicator of oxygen exclusion.

Forage pH should be less than 4.0 to 4.5. Note that effective preservation pH depends on the forage type, dry matter and mineral content (buffering capacity).

Whether you’re driving to a wedding in a town you’ve never visited or making quality silage, the keys remain the same – being most efficient means taking the most direct route for time with the most fuel-efficient vehicle for the task at hand. Don’t waste money by burning gas or losing silage to shrink. Planning ahead and managing the first two ensiling stages of the drive effectively contributes to on-time arrival with minimal gas used or quality silage volume harvested and stabilized for months on the farm. **PD**

References omitted but are available upon request.

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