

Managing Feed for Inventory Maximization

Rachael Bosse¹

On-Farm Support

Alltech

Abstract

Feed management is a critical part of feeding dairy cattle. Feed is the greatest cost of dairy production, often being nearly half of the total cost to run a dairy. Planning ahead when harvesting forages to account for dry matter and shrink losses is a vital part of calculating feed inventory for the next year. Failure to account for these inevitable losses can cause farms to feed forages that are not correctly fermented or can cause unwanted ration changes due to forage shortages. Improvements in technology are constantly helping farms manage ensiled feed better. Proper feed management can set up a farm for success for the next year, in terms of both feed inventory and cattle performance.

Introduction

There are multiple reasons why feed management is important, but it comes down to two main reasons: maximizing inventory and feed quality. Feed costs account for 50-60% of the cost of producing milk on a dairy farm (Thomas, 2012). The better feed is managed on farm, the more profit potential there is for the dairy. Shrink and dry matter (**DM**) losses are inevitable; however, knowing how to manage feed can cut these numbers significantly. When a forage is harvested or a feedstuff is bought, a price is paid for a specific amount of feed. When DM losses or shrink occur, money is also lost as

that feed is already paid for but never made it in front of the cows to eat it. Maximizing feed inventory combines recognizing assumed DM losses, knowing how silage ferments, managing factors like moisture and density, and limiting oxygen exposure.

Recognizing Assumed Dry Matter Losses

When harvesting forages, it is important to know that there are variables that play into DM losses. The very basic lifecycle of a forage is that several acres of a crop are planted in the spring, the crop is harvested and stored, fermentation takes place, and finally it is fed to cows. When silage is harvested, the exact tonnage harvested is not going to be the exact tonnage that is fed. If silage is put up too wet, there will be both nutrient and tonnage losses due to leaching from the pile. If silage is put up too dry, it will not pack as well and there will be DM losses due to more oxygen getting into the pile. If the pile is not covered or not covered tightly, there will be DM losses due to oxygen and spoilage. When harvesting a crop, a 10-15% DM loss should be assumed from harvest and storage (Amaral-Phillips, et. al., 2023). This number only goes up if silage is not packed and covered properly. Things like storage type, feed out rate, dry matter at harvest, packing density, and temperature of the feed all influence the percentage of DM lost in a forage pile.

¹Contact at: 3031 Catnip Hill Road, Nicholasville, KY, 40356, (616) 260-8708, Email: rachael.bosse@alltech.com.



Ways to Calculate Feed Inventory

There are multiple ways farmers and consultants go about calculating feed inventory. As technology is constantly improving and changing, so are the ways inventory is tracked. The most common form of tracking feed inventory is weighing trucks across a scale at harvest time. This is a great method as farmers know what they are starting out with, but if no feed software program is being used, this is only a starting number that is not tracked throughout the course of the year. If a feed software program is used, the starting number is entered and is subtracted from each day as the silage is fed. This is a great tool, but does not always account for DM changes, especially if changes in DM are not entered into the system. If a nutritionist or farmer wants to calculate inventory after the pile is opened, tools like a measuring tape and simple math can be used; however, there is a lot more room for human error. The basic calculation would be $L \times W \times H$, but this doesn't account for ramp measurements. This is why more measurements, such as ramp measurements, can be taken and entered into an online calculator from Holmes and Muck (1999, 2020) at the University of Wisconsin (Figure 1). The newest trend in calculating feed inventory is by drone. Just as agronomists are beginning to use drones for spraying, on-farm consultants are starting to use drones to capture pictures of the pile or bunk at all angles, upload those pictures into a map, and plot out each pile. Cubic foot measurements are calculated, and that number is used in conjunction with DM, density, and sample weight. This new use of technology allows a snapshot in time to be taken, and in turn, a much more accurate inventory number is produced. Failure to know how much feed is on hand at a farm can in the short-term cause rations to need to be changed to limit certain forages and in the long term can cause there to not be enough feed to carry over to the next year.

Knowing How Silage Ferments

Feed inventory is directly related to how well feed is harvested and stored. Knowing how silage ferments points out key factors that need to be considered when harvesting. The first phase of silage fermentation is the aerobic phase. This phase lasts for approximately a day, but it can last for two days if not enough oxygen is eliminated from the pile. Well-packed piles will generally have a shorter aerobic phase, while poorly packed and sealed silos will have a longer aerobic phase (Pretz, 2020). The longer the aerobic phase is, the hotter the silage will be and the greater the DM loss. At this point in time, pH is holding steady, oxygen is decreasing, and bacteria have not started growing yet. The second phase of silage fermentation is the lag phase, and it lasts for about a day. At this point, any remaining oxygen in the pile is used up. The plant cells are broken down and become food for the bacteria. Complex carbohydrates, starches, sugars and plant proteins are all broken down by plant enzymes. Silage pH is still holding steady at 5.5 to 5.7 and any molds and yeasts are starting to grow. The third phase is anaerobic fermentation. This happens 2 to 3 days after ensiling and can last up to 2 to 3 weeks. pH is now dropping below the 5.5 to 5.7 that it was at during the lag phase. Bacteria grow to their highest rate during the fermentation phase due to the rapid growth of lactic acid and some acetic acid. By the end of the fermentation phase, pH is around 3.8 to 4.2. Due to the amount of bacterial growth during the fermentation phase, harvesting silage with an inoculant can be beneficial. While it is not a cure all, it uses specific bacteria to overcome any wild yeasts or molds that grow during this time. The fourth phase of silage fermentation is the stable phase. Changes in pH have slowed, and bacteria growth has slowed or stopped (Pretz, 2020). The final phase is feed out. This is when the farm starts feeding the silage, ideally 2 to 3+ months after

fermentation is complete. Once the pile is open, oxygen can get back into the pile. When oxygen starts getting into the pile, mold and bacteria can begin to grow again. Removing 6+ inches of silage from the face each day will keep mold and bacteria growth at a minimum.

Managing Factors Like Moisture and Density

When harvesting forages, it is important to keep plant DM in mind. If forage is too wet when harvested, it is more prone leaching nutrients and spoiling. While wet forage will pack in a bunk well, its quality will deteriorate quickly. If forage is too dry when harvested, it will not pack in the bunk well. When dry forage is harvested, it does not allow air to be pushed out when it is packed. When oxygen is not pushed out during packing, it makes the forage prone to spoiling and growing mold. For example, corn silage should ideally be harvested at 30 to 35% DM, or 65 to 70% moisture (Figure 2; Cullens and Thomas, 2021). Harvesting at a higher DM will result in a lower packing density and harvesting at a lower DM will cause leaching of nutrients. According to Table 1, density directly correlates to DM losses. The industry standard is at 15 lb DM/cubic foot. Anything below this has greater risk of DM loss and spoilage. The higher the packing density, the less oxygen that is able to get into the pile as shown in Ruppel's chart from 1992. In short, the more oxygen that gets into the pile, the more spoilage that is created, resulting in loss of feed quality and quantity. To achieve optimum packing density, the weight of the tractor is important. A rule of thumb to follow is the 800 rule, stating that if the weight of the tractor is divided by 800, it will determine the number of tons that that one tractor can pack into the pile effectively in one hour (Cullens and Thomas, 2021). If the farm is delivering more than that number of tons to the pile per hour, another tractor is needed.

Limiting Oxygen Exposure After the Pile is Open

Defacing is another management practice that can be used to maintain quality of feed and therefore minimize DM loss. The primary ways that silage is defaced is with a rake, a shaver/rotator, and scooped with a bucket. When looking at infrared camera pictures of the three types of defacing, it is evident that the shaver option keeps the face smoother and lets the least amount of oxygen into the face of the pile. The rake is not far behind but can cause heating to occur if not used properly. Red hot spots (as shown in the picture defaced by a bucket) are spots where the bucket has been forced into the pile and lifted, allowing oxygen into the face. This causes heating in the silage and DM loss to occur.

Summary

In conclusion, the way forages are managed from harvest through feed out impacts the amount of feed inventory for a farm. Following simple, standard practices, such as moisture and packing density, are key players in maintaining both forage quality and quantity. The reason forage quality should be cared about is because it affects forage quantity. Forage quantity affects how rations are built and how much feed needs to be put up the following year. Practicing proper forage management and achieving quality forage will ensure cattle health and profitability of the farm in the years to come.

References

Amaral-Phillips, D.M., N. Roy, C. Lee, and J. Lehmkueller. 2023. Practical corn silage harvest and storage guide for cattle producers. Retrieved from <https://publications.ca.uky.edu/sites/publications.ca.uky.edu/files/ID275.pdf>

Cullens, F., and C. Thomas, 2021. Managing corn silage harvest and feed bunk for nutrient retention. Retrieved from https://www.canr.msu.edu/news/managing_corn_silage_harvest_and_feed_bunk_for_nutrient_retention

Holmes, B., and R. Muck. 1999. Factors affecting bunker silo densities. Retrieved from <https://fyi.extension.wisc.edu/forage/factors-affecting-bunker-silo-densities/>

Holmes, B., and R. Muck. 2020. Silage pile silo silage density calculator. Retrieved from <https://fyi.extension.wisc.edu/forage/harvest/>

Pretz, J. 2020. Understanding the process of corn silage fermentation and starch availability. Retrieved from: <https://www.hubbardfeeds.com/blog/understanding-process-corn-silage-fermentation-and-starch-availability>

Ruppel, K.A. 1992. Effect of bunker silo management on hay crop nutrient management. M.S. Thesis, Cornell University, Ithaca, NY.

Thomas, C. 2012. Not all milk-to-feed ratios are created equal (Part 1). Retrieved from https://www.canr.msu.edu/news/not_all_milk_to_feed_ratios_are_created_equal_part_one#:~:text=The%20logic%20behind%20the%20milk,higher%20profits%20for%20dairy%20producers.

Table 1. The effect of packing density on dry matter losses in corn silage after 180 days ensiling (Ruppel, 1992).

Silage Density (lb DM/ft ³)	Dry Matter Loss (%)
10	20.2
14	16.8
15	15.9
16	15.1
18	13.4
20	10.0

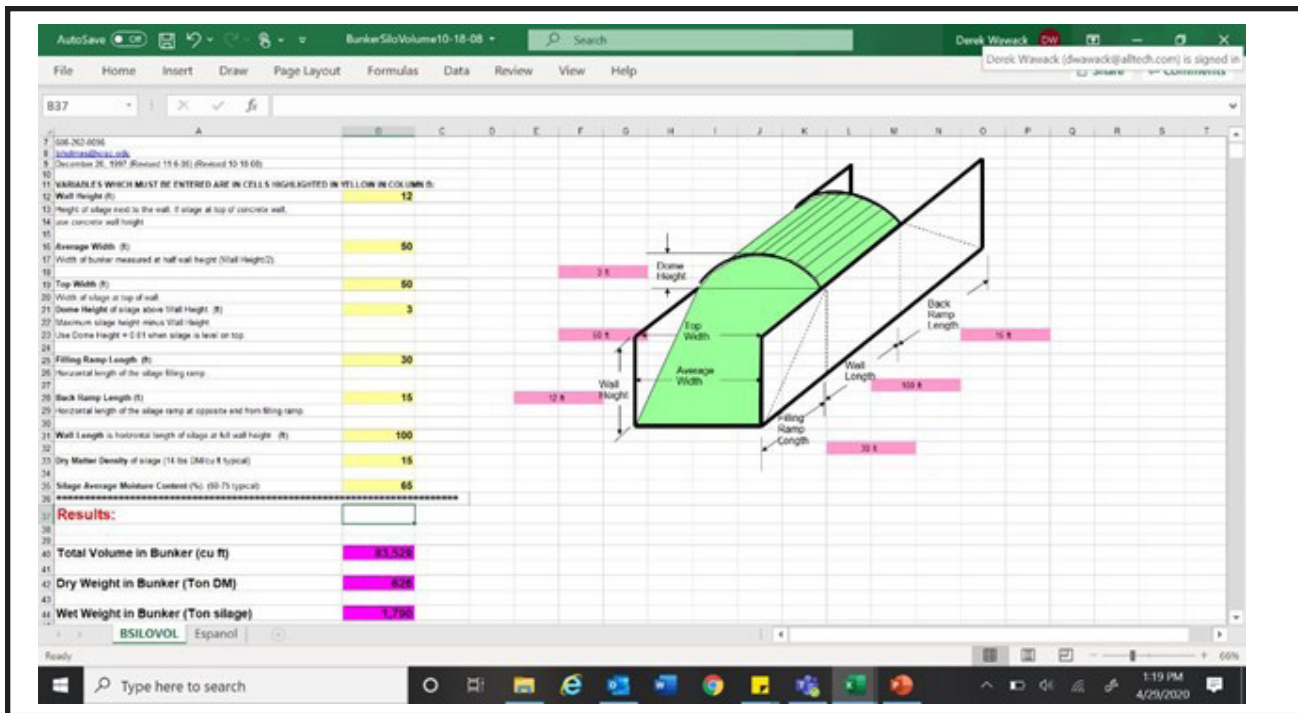


Figure 1. Bunker silo weight and volume calculator (Holmes and Muck, 2008).

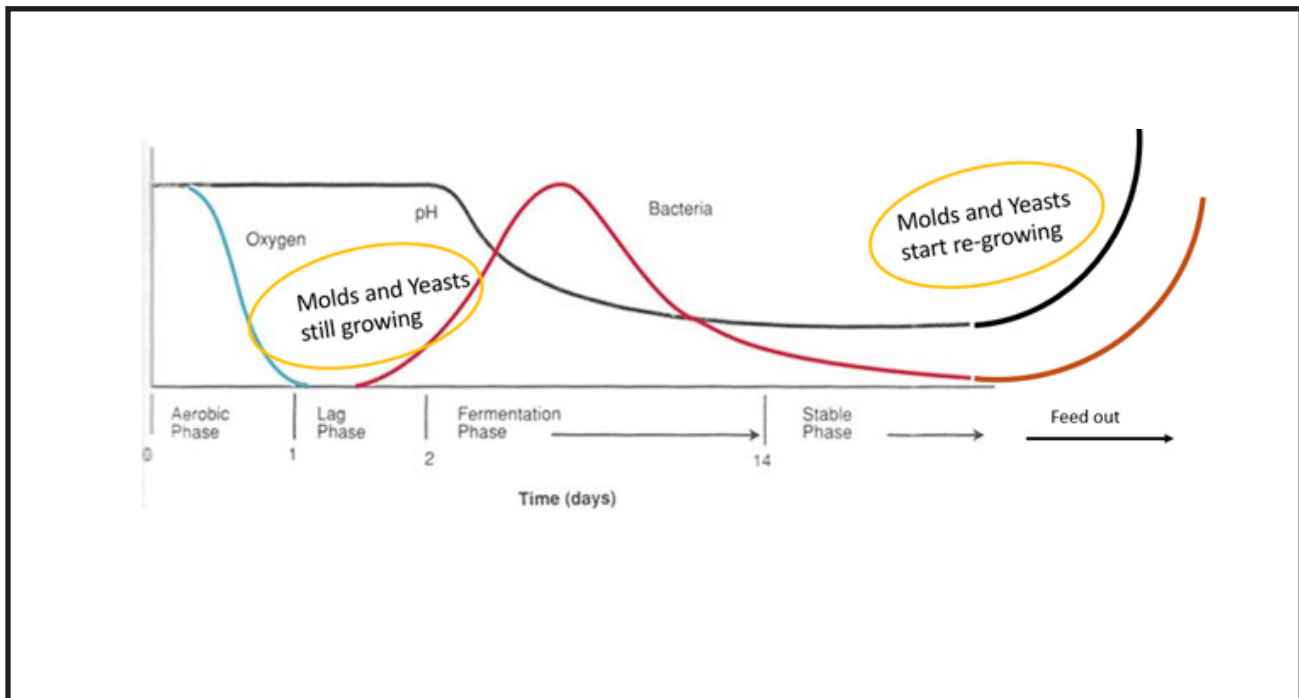


Figure 2. The phases of silage fermentation (adapted from Collins and Owens, 2003).