Bunker Silo and Drive-Over, Silage-Pile Management

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Management of a bunker silo or drive-over silage pile during harvest, storage and feedout directly impacts the quantity and quality of silage fed to dairy cows. Dry matter (DM) losses can be substantial in bunkers and drive over piles not harvested at the correct moisture, packed adequately, covered with plastic, and weighted down adequately using tires which touch, sandbags or some other weighting system. A study with uncovered bunker silos showed a 75% loss of DM of corn silage within the top 10 inches (25 cm) and 25% losses within the next 10 inches of surface area on top of the bunker compared to bunkers properly covered with plastic and tires. For a 30 ft (9 m) by 100 ft (30 m) bunker, approximately 50 tons (45 metric tons) of corn silage would be lost. This amount of silage is equal to the amount needed to feed approximately 10 lactating cows for a year or $2250 worth of silage (silage valued at $45/ton). These losses are substantial and the extent of losses may not be realized unless the difference between the amount of silage entering and fed out of a structure is measured. To make the best use of forage resources, proper management of forages during storage and at feedout is critical. The following key areas should be reviewed to see whether bunker or drive-over pile management can be improved to reduce feed shrink and improve forage quality at feedout.

Sizing bunkers and piles

Bunkers, trenches, and piles need to be sized such that a minimum of 8 to 12 inches (20-30 cm) is removed daily from the silo face. This is one of the most important and often forgotten calculations when sizing these structures.The height of a structure should always be limited by the safe vertical reach of silage removal equipment.When sizing the width of bunkers, trenches, and piles, they should be at a minimum of 2 times the width of the packing tractor and the maximum width determined by the amount of silage that needs to be removed daily to maintain a “fresh” silo face.For example, if a 500 milking cow herd is fed 20 lbs/day (9 kg/day) of DM from silage per cow (60 lb/day (27 kg/day) as-fed at 33% DM), the maximum width should be 156 feet (47 m) or 78 feet (24 m) if half of the silage DM was corn silage and the remaining half another type of silage.(These calculations assume 10% storage losses, 5% feeding losses, 8 foot

side walls, and daily remove 8 inches of silage face.) To calculate your own silo dimensions, see "Bunker Silo Sizing Spreadsheet" developed by Dr. Brian Holmes. *It is always best to have too narrow of a silo than too wide.* Oversizing silage storage can result in major feed shrink. Provisions should be made to have extra silage in storage elsewhere to feed while the new crop is fermenting for a minimum of 3 weeks. Some may want to plan for additional storage so that corn silage can ferment for a longer time to increase starch digestibility by dairy cattle. Research has shown increases in starch digestibility in corn silage stored for 240 days after harvest. As a practical recommendation in the field, nutritionists generally allow new crop corn silage to ferment for 4 months before feeding it, if sufficient old crop silage is available. Thus, additional storage may be needed if this practice is used on the farm.

Provide concrete or asphalt floors

The floor of a bunker or silage pile should be a solid surface with adequate drainage. All effluent from silage storage structures should be contained and diverted into the appropriate containment facility, i.e. liquid manure containment. Improperly handled silage effluent potentially can be a source of on-farm pollution.

This surface area should be readily accessible to feeding equipment used for loading forages and close to feeds stored in bins or bays within commodity sheds. Unpaved surfaces will become muddy during rainy times of the year especially when drainage is inadequate. If not managed carefully, gravel bases with large particle size rock material will result in the addition of large stones into mixing equipment, resulting in increased wear of equipment and potentially causing equipment failure.

Management at harvest

- Forages need to be harvested at the proper stage of maturity. For example, alfalfa should be harvested at the pre-bud stage, grasses no later than late boot (just before they head out), and corn for silage at the proper DM content.
- Silage in a bunker or drive-over pile should be ensiled between 30 to 35% DM (65-70% moisture) for corn silage, but if weather or cutting schedules dictate, corn silage can be harvested up to 37% DM. For alfalfa and grass silages, plants should be wilted and ensiled at 35 to 40% DM.
- Chopper knives should be keep sharp for optimum chop length. Corn silage should be chopped to about 3/8 to ½ inch with a conventional chopper and ¾ inch with a chopper with a kernel processor. Alfalfa silage usually is chopped at 3/8 to ½ inch theoretical length of cut. A Penn State Separator box can be used to determine if the appropriate chop length has been achieved (see table below).

Penn State Particle Separator	Corn Silage	Alfalfa/Grass Silages
	As fed % retained	
Upper Sieve	3-8	10-20
Middle Sieve	45-65	45-75

Lower Sieve	30-40	20-30
Bottom Pan	<5	<5

Reference: http://extension.psu.edu/animals/dairy/nutrition/forages/forage-quality-...

- Kernel processors on corn silage choppers should be set at 1 to 3 mm between rollers and should be adjusted, such that greater than 95% of the kernels are cracked with approximately 70% of the kernels equal or smaller than 1/3 to ¼ of a kernel. Slices of the corn cob should be broken into at least 8 pieces. On farm, a 32 oz. (0.95 L) beverage cup filled level with chopped corn silage can be used to determine if the rollers of the kernel processer are set correctly. No more than 2 to 3 whole or half pieces of corn kernels should be present in this sized sample. If too many whole or half kernels are present, the clearance between the rollers needs to be decreased to increase starch digestion of the corn grain. (L. Kung, personal communication and W. Mahanna, Feedstuffs).

  Some commercial forage testing laboratories can dry a sample of fresh or fermented corn silage and then measure the amount of starch retained on or passing through a 4.75 mm sieve. From this information, a processing score is calculated. For fresh samples, 70% or more of the starch should pass through the 4.75 mm screen. Since there is a delay in receiving this information on farm, it is difficult to use this information to adjust the rollers at the time of harvesting corn silage.
- Plastic should be placed on the sides of the bunker to minimize air infiltration through the side walls to minimize spoilage. After filling, the excess plastic is placed on top of the pile and the entire top covered with an additional piece of plastic and then weighted with tires that touch, sand bags, or other materials. Use of oxygen limiting barrier films has been shown to decrease spoilage and should be considered.
- Silage piles should be packed using tractors to achieve a bulk density greater than 44 lbs as fed/ft^3. Bulk density measures the weight of forage particles within a set volume. To achieve these packing densities, silage should be spread in thin layers on a wedge and packed continuously and multiple times with the adequate amount of tractor weight. Recommendations are to use 800 lbs (364 kg) of packing tractor weigh per ton of silage delivered per hour of harvest. On larger piles or with rapid delivery of fresh chopped material to the storage structure, more than one tractor may be necessary. Drive over piles should be sized with sides on a 1 to 3 slope (1 foot or meter of height to 3 feet or meter of length). Remember human safety is the first and foremost concern and consideration when packing silage and when feeding out!!
- Bunkers and piles need to be packed well especially the top 6 inches (15 cm) and then covered with plastic or barrier films. If tires are used, they are placed on top of the plastic to not only hold the plastic in place but also exclude oxygen. Tires should touch one another to achieve these goals and minimize spoilage and DM losses in the top layers of silage. Sandbags or other materials to hold the plastic in place can be used effectively.

Managing silage at feedout

- The amount of silage and the manner of silage removal from all types of storage structures directly impacts the quality of silage being fed. **The key principle is to remove an adequate amount of silage every day to keep the silage face "fresh".**
- **At the same time, silage needs to be removed such that the area directly behind the new silo face is not disturbed to prevent the infiltration of oxygen.** If oxygen is allowed to enter the silo face, the silage heats while still in storage (often initiated by growth of yeasts), quality of the silage deteriorates rapidly at feedout, and then less DM or feed may be consumed by dairy cows.
- When removing silage from these structures, always maintain a smooth face and minimize "digging" into the face of the silage. If tractor buckets are used for removing silage, they should remove feed carefully from the top down and not by "digging" into the pile from the bottom or middle of the pile's face. Mechanized silo facers minimize oxygen infiltration into the packed face beyond the amount to be fed and can be cost effective.
    - When removing silage from the face of the pile, only the amount needed for the current feeding(s) should be removed. Unfed, excess feed quickly heats and deteriorates in quality.
- Silos with poor face management generally have a higher pH and temperature at the face compared to 2 to 3 feet (60-90 cm) behind the face. These findings indicate aerobic instability with aerobic yeast activity resulting in silage heating. Generally, bunk life of this feed is shortened and once heated, dairy cattle usually eat less of this silage. To determine the pH or temperature of a silo face versus 2 to 3 feet (60-90 cm) inside the face, measurements should be taken at several locations throughout the silo face. Because of the potential instability of the silo face, extreme caution should be taken by those making these measurements and always have another person close with necessary equipment in case of a silage avalanche. A non-contact thermometer and a 2 to 3 foot (60 to 90 cm) temperature probes (compost temperature probes) or thermal imaging (infrared) cameras can be used to compare the temperature of silage at the face versus 2 to 3 feet (60-90 cm) behind the face. The temperature inside the pile should be within 15°F of ambient temperature at harvest and within 15°F of the temperature of silage at the surface. pH paper or a pH meter can be used to measure the pH of silages when 1 to 2 ounces (30-60 ml) of silage is mixed with equal amounts of distilled water in a disposable cup. For corn silage, pH should be between 3.7 and 4.2 and for grass, alfalfa, or clover silage (30-40% DM) pH should be between 4.3 to 4.7.
- **Silage Sampling—Safety First:** Silage samples to determine DM and nutrient content should not be collected at the face of the silo to ensure the safety of those taking these samples. Instead, silage should be removed across the face of the silo using the normal method of removing silage (i.e. tractor bucket with or without a silo facer), added to the TMR wagon without any other ingredients, allowed to mix, and then discharged on the feeding pad away from the face of the silo. Then, samples can be safely collected for nutrient analysis. Individuals should not be standing closer than 2.5 to 3 times the height of the storage structure to prevent human injury.

Source: http://www.extension.org/pages/73116/bunker-silo-and-drive-over-silage-pile-management#.VcnicvluPdW