The Effect of Alternative Bunk Silo
Ballast Systems on the Qualitative Value of Corn Silage
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Introduction

On most large dairy operations feed preservation involves the ensiling of forages into horizontal silos (bunk silos). In order to reduce dry matter and nutrient losses from the silage mass, many bunk silos are covered with plastic. The plastic is held in position with a ballast system, usually in the form of automobile tires of varying sizes and weights. Due to the conventional ballast system's lack of handling and storage ease along with the collection of stagnant water that can harbor disease-carrying pests, alternative methods to hold down bunk silo covers needs to be considered.

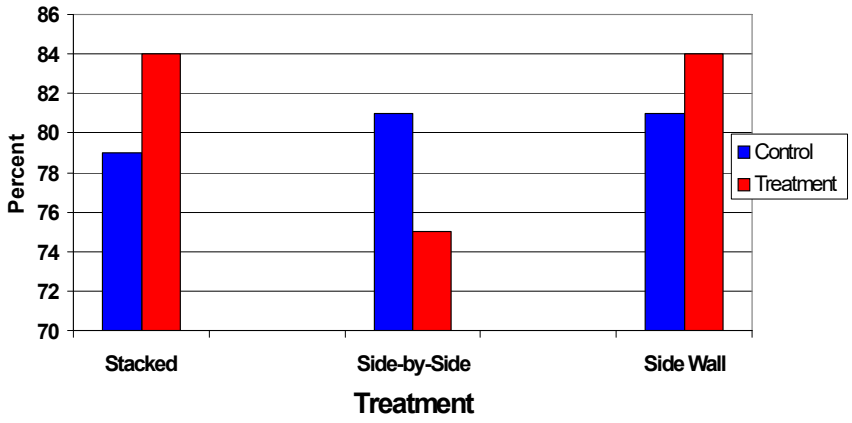
However, the qualitative integrity of the fermentative product must be preserved. In order for the fermentation process to be successful, oxygen must be excluded from the silage mass. If oxygen is present or continuously infiltrates into the forage due to inadequately sealing the top of the bunk silo with a plastic cover and weighted ballasts, plant respiration occurs causing the breakdown of sugars into carbon dioxide, water and heat. This can reduce the availability of nutrients for the proper anaerobic fermentation to occur and result in a reduction in available carbohydrates along with an increase in forage NDF and lignin. Plant proteins may also be rendered unavailable for animal digestion.

Volatile Fatty Acid Production

Volatile fatty acid (VFA) production can be used as an indicator of how successful the fermentation was during the ensiling process. Total VFA content should be less then 10% of the dry matter and in many cases below 8% for corn silage. Total VFA values will typically be lower as forages become drier. All corn silage treatment samples fell within this acceptable range.

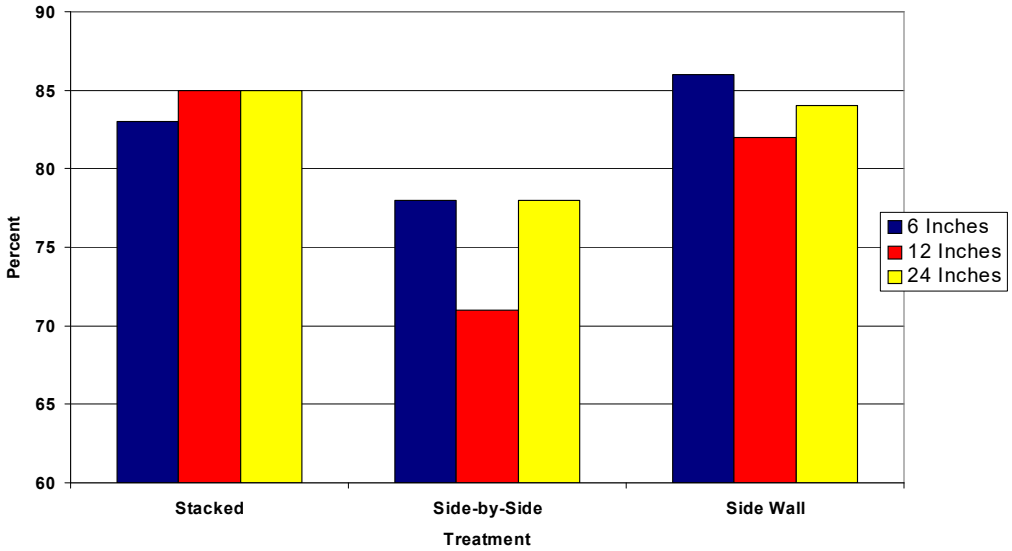
When analyzing the profile of VFA's produced during the fermentation process, lactic acid should constitute greater then 75% of the total. Figure 5 displays the composite lactic acid % of the three treatments as compared to their control's. All treatments had adequate levels of lactic acid production implying that the fermentation process was successful in all instances. Though adequate, the side-by-side treatment, which correspondingly put forth the least amount of weight per square foot also demonstrated the lowest lactic acid percent.

Figure 5: Composite Lactic Acid %



It is generally agreed upon that the top two to three feet of the silage profile is more susceptible to inadequate packing and subsequently poorer fermentation outcomes. However, figure 6 suggests that at depths of 6,12 and 24 inches from the top of the silage

Figure 6: Profile Lactic Acid %



mass, the percentage of lactic acid produced was indicative of a successful fermentation. Only at the 12-inch level on the side-by-side treatment were values questionable.

Forage Quality

Table 1 summarizes the nutritive values of each treatment relative to benchmark parameters. The control values represent a combination of all control treatments from the experiment. All nutritive levels for the stacked and side-by-side treatments were within range of the benchmark values and agree with temperature, VFA and lactic acid profile results. As mentioned earlier, the sidewall dry matter% was higher then recommended and represents the last and most mature material ensiled during the harvest season.

Due to this "maturity" factor, the sidewall treatment also exhibited high levels of non-structural carbohydrates and starch. However, these levels were biologically lower then the side-by-side values. This could be due to the enhanced duration of respiration that occurred with the sidewall treatment (figure 4). An extension of the aerobic phase would convert a larger quantity of available carbohydrates into carbon dioxide, water and heat, thus reducing the levels of non-structural carbohydrates and starch in the forage.

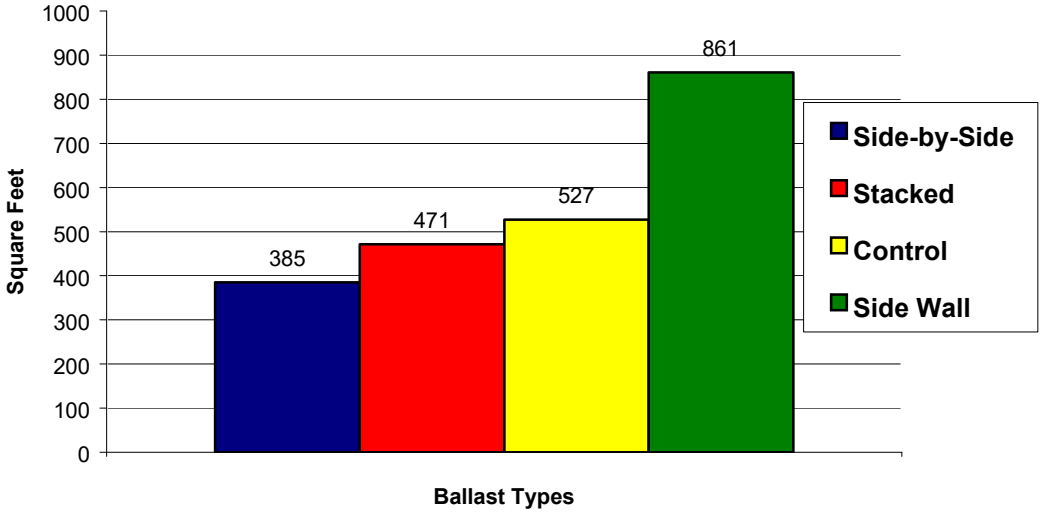
Table 1: Forage Quality Comparisons

	Benchmark	Control	Stacked	SBS	SWall
DM%	30 - 35	32.4	30.1	30	40
NDF%	40 - 45	44.4	46.7	37.7	40.4
NSC%	35 - 45	42	40	49	46
Starch%	25 - 35	28.2	26.2	36.1	33.4

Labor Efficiency

Figure 7 depicts the area of square feet covered per hour with each type of ballast system. **The most efficient system was the sidewall treatment with 63% more coverage occurring hourly compared to the control (861 vs. 527 sq.ft.).** The stacked system was uncharacteristically inefficient. This was a function of defective tie clips on the ballasts that if not carefully placed, could potentially punch holes into the plastic cover. To reduce this risk the ballasts were slowly and deliberately placed onto the plastic cover. This defect has since been remedied which would allow labor efficiencies on the stacked ballasts to be similar to the sidewall treatment. Due to the awkwardness of handling, the side-by-side ballasts were the least efficient. Sidewalls are most effiecient

Figure 7: Labor Efficiency: Square Feet Covered Per Hour



Conclusion

There may be small levels of oxygen infiltration occurring to 12 inches of depth with ballast systems that are light in weight. This effect is minor when working with a product such a corn silage which normally has an over abundance of fermentable carbohydrates. Conversely, with haylages, which are considerably lower in fermentable carbohydrates this trend may have a more adverse effect on forage quality.

This experiment has shown that under proper corn silage harvest management practices, alternative ballast systems can effectively be used instead of conventional tire systems. Dependent upon the type of ballast system selected, labor efficiency can be enhanced compared to conventional ballast systems. Furthermore, there is the potential to reduce breeding sites for mosquitoes and other vermin that may pose a health threat to both humans and livestock.