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Alkaline processing of corn stover

Corn stover is a readily available source of fiber in Iowa. The alkaline treatment of low quality forages is something that has been around for some time, and some claim that is has its origins in the late 1800s where it was used in papermaking. Alkaline treatment of forages has worked through multiple options including ammoniation (utilizing anhydrous ammonia), sodium hydroxide, and a sodium hydroxide and calcium oxide combination. The latest of the alkaline treatments of forage is calcium oxide.

Process

Corn stover must be processed prior to treatment to increase surface area. Recommendations for particle screen sizes range between 3 and 6 inches. The CaO is added at 5% of the dry weight of the stover and $Ca(OH)_2$ at 7%. To enhance, or activate the chemical reaction, water must be present. Adding sufficient water to bring the dry matter content of the corn stover to 50% is considered ideal. The chemical reaction that takes place also involves the release of heat. The end result of the reaction is carbohydrates that are made more available through breaking the fiber-lignin bonds. Following processing, the treated stover may be piled, or packed in a bunker or bag. It is necessary to wait at least 7 days prior to feeding to ensure the reaction has taken place. Should it be decided to store longer term, oxygen exclusion is beneficial. The storage of alkaline treatment of stover does not result in a decrease in pH as would occur in silage. Following treatment, if done correctly, the pH of the treated stover will initially increase up to 10-12 and will remain close to 8 during storage.

The treatment of the stover may be done one of three ways. A batch system, where ground stover is placed in a mixer wagon, and the dry CaO is added following the addition of water to achieve the 50% dry matter that is necessary for the reaction. A continuous system consists of applying the CaO and water while the stover is being ground or as the stover is passing along the conveyer belt of the grinder. A third system includes treating the stover after it has been windrowed out of a combine following grain harvest. The CaO and water is delivered via a fertilizer buggy prior to a forage chopper picking up and chopping the treated stover.

Use

Limited research has been conducted utilizing CaO treated stover in dairy cattle rations, but has received more interest for beef cattle, with much during the feed out phase of production. These results may show potential for use in dairy heifer rations. University research has shown improvement in digestibility between 8 and 15% when stover is treated with CaO. In a study conducted by Purdue University with lactating cows, CaO treated corn stover was substituted for corn silage. This resulted in lower feed intake, limited effects on milk production and similar

milk components for animals not consuming treated stover versus those consuming the treated corn stover.

Consideration of costs is necessary when determining the fit of treated corn stover in an operation in comparison to other forage sources. While corn stover may be relatively inexpensive, additional costs of processing including the cost of the CaO, grinding, storage, and labor should be considered.

Summary

As is important in all instances it is important to weigh the available options when choosing forage. In the case of CaO treatment of corn stover, determining the cost of the final product based upon nutrient values is important. The nutrient content of the treated stover does not change significantly and is mostly limited to calcium levels. Work with a nutritionist to determine if changes should be made to a ration.

Shredlage

Research has shown that processing corn silage, especially the grain contained within whole plant corn silage, is vital in ensuring greater starch utilization. A recent development in corn silage processing has arisen, called Shredlage. This processing method is different from the previous method of kernel processing in that it promotes the tearing or ripping of the forage as it passes through the newly developed processor technology. Shredlage originated with a dairy producer in the Midwest and the process is similar in many aspects to traditional corn silage, with the exception of the type of processor. In the case of Shredlage, the grooving of the rolls runs not only horizontal, but also vertical. Additionally, the theoretical length of cut is elongated and number of knives in the forage chopper is reduced. The rolls are run at a greater differential to provide the ripping situation that makes Shredlage.

As with any new technology it is important to weigh the effectiveness of the technology through results. In a feeding study conducted by the University of Wisconsin, Shredlage processed corn silage was compared to kernel processed silage in lactating cows. In the overall study with inclusion of corn silage at 50% of the ration, cows consuming the ration containing Shredlage ate slightly more feed, but did not produce more milk. However when looking at a week by week basis, cows consuming the Shredlage containing diet yielded more 3.5% fat corrected milk in the later portions of the study. Starch and total tract neutral detergent fiber digestibility were improved in cows consuming the diet containing Shredlage.

Summary

Utilization of new technology needs to be tested prior to implementation, and may work best in gradual adaptation depending upon the technology being considered. Additional questions remain regarding the use of Shredlage including utilization in high corn silage diets or low forage diets, dry matter content and its effect on processing, and also impact of the length of storage.