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Utilizing Corn Stalk Residues for Dairy Cattle

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Corn stalks have been successfully used in Wisconsin as a high fiber (**NDF**; neutral detergent fiber) forage in dairy heifer and dry cow diets for many years. A summary of nutrient composition of corn stalk silages analyzed at Dairy One Laboratories (Ithaca, NY) is presented below. General summaries of Wisconsin corn stalks are not readily available for ensiled, dried or baled corn stalks but nutrient composition is likely similar to slightly lower, especially for CP and NDF digestibility. Corn stalk residues should be tested for nutrient composition prior to feeding since deviation from these tabular values is likely high.

Item	Samples	Average
% Dry Matter	1,920	54.5
% Crude Protein	879	6.2
% ADICP	150	1.0
% NDICP	119	1.8
% Lignin	379	6.8
% Acid Detergent Fiber	1,030	48.2
% Neutral Detergent Fiber	1,084	65.5
% Non Fiber Carbo. (NFC)	780	20.0
% Crude Fat	183	1.8
% Ash	596	13.2
% TDN	787	51.9
NDFD 48hr, % of NDF	699	50.4
% Calcium	594	1.81
% Phosphorus	339	0.18
% Magnesium	337	0.24
% Potassium	337	1.19
% Sodium	278	0.36

The primary concern with feeding corn stalks to dairy cattle is the physical nature of the stalks. Dairy cattle will greatly sort corn stalks when included in a TMR if not finely (1.0-0.5 inches) chopped prior to feeding. Research has commonly reported corn stalks being processed in choppers or grinders fit with 3.0-4.0 inch screens but little specific particle size information has been reported. The physical characteristics of corn stalks are so diverse (wet, dry, chopped, baled, shredded) that it is difficult to define a simple system of materials handling and storage for dairy operations. Because harvest, treatment and storage options are so diverse dairy producers may need to utilize on-line farmer to farmer networks (i.e. Ag Talk: http://talk.newagtalk.com/category-view.asp) to seek peer advice on how best to handle, harvest,

treat and store corn stalks for their particular situation. Listed below are some common harvest and storage scenarios for utilizing corn stalk residue.

Ensiling: Corn stalks can be successfully ensiled after grain harvest if the stalks contain sufficient moisture (>45 %) to ensile. The utility of ensiling corn stalks is often highly dependent on fall weather and drying conditions. Likewise, successful salvage of wet corn stalks for direct chopping from a harvested corn field is highly dependent on wheel traffic and machines utilized during grain harvest. Often grain harvest wheel traffic is so heavy salvaging wet corn stalks for direct ensiling is unmanageable. If attainable, ensiled corn stalks make an excellent dry cow and heifer forage. Corn stalks should be finely chopped prior to ensiling to aid packing, fermentation and to minimize sorting when feeding.

Baling: Corn stalks are commonly baled using large square or round balers when moisture contents are < 15 - 20 %. As with ensiling, baling dry corn stalks in Wisconsin is dependent on fall weather and drying conditions.

Treatment with calcium hydroxide (hydrated lime), calcium oxide (quick lime), or sodium hydroxide (lye or caustic soda): Alkali treatment of corn stalks can be utilized to improve fiber digestibility (10-20 percentage units). Treatment involves adding a lime and water mixture to dried-ground corn stalks to bring the moisture content to approximately 50%. The corn stalks need to be chopped to reduce particle size for treatment. Treatment rate is 5% (dry matter basis). Lime treatment will require mixing for uniform application. Application of CaO or CaOH to corn stalks (100 lbs/ton) requires water (H_20) to activate an exothermic process and must be added so that moisture content of the final product of 50 % . Producers should wear safety clothing and goggles when handling CaO or CaOH. Lime treated corn stalks do not ferment. Treated material actively heats for 3-7 days and turns brown resulting in pH being high, not low as in silage. The exothermic reaction will effectively kill microflora and fiber digestibility is improved.

Dairy producers should recognize that research regarding the treatment of corn stalks with hydrated lime was primarily conducted for use in beef cattle feeding systems. A short-term dairy study done at Purdue with lactating cows suggests minimal benefits. Lime treatment of corn stalks turns increases the calcium content from 1.40 % to > 4.5 % Ca. There is little data on the effect of feeding lime treated corn stalks to dry and pre-fresh dairy cows. Thus influences on dietary cation-anion balance, milk fever, and metabolic disease are unknown. Likewise, there is little research data on the possible effects of feeding lime treated corn stalks and distillers grain mixtures on milk components, rumen health, bio-hydrogenation of fatty acids (low milk fat test), and mineral adsorption interactions. Lime treated corn stalks appear best suited for feeding to dairy heifers if increased fiber digestibility is needed. In scenarios where base forages (corn silage, alfalfa silage) are providing excessive energy to dairy heifers utilizing untreated chopped corn stalks naturally high in fiber and low in energy may be preferred over corn stalks treated to improved fiber digestibility

Treatment with ammonia: Treatment of corn stalks with ammonia has a similar effect as CaO or CaOH treatment on fiber digestibility. However, anhydrous ammonia treatment will increase the crude protein content of corn stalks. Anhydrous ammonia is typically applied to stacks of

dry forage covered in plastic with a treatment rate of 3% of dry matter in the pile. After treatment, the pile typically requires at least 21 days to absorb the ammonia and the stack is opened a day or two before feeding to allow any free ammonia to escape. Similar to lime treatment, ammonia is not safe to work with without wearing protective gloves and goggles. Producers should become familiar with first-aid and safe handling procedures by reading the material safety data sheet. Ammoniating corn stalks can improve digestibility by up to 30% and consumption by up to 20%. An excellent resource on ammonia treatment of corn stalks and other high-fiber forages can be found at http://www.ag.ndsu.edu/drought/feeds-and-feeding/ammoniation-of-low-quality-roughages

Treatment with urea: Urea is typically applied to wet corn stalks (50% moisture) and ensiled. A 3% (dry matter basis) treatment rate is common in literature, but a number of commercial molasses-urea mixtures are also available. Urea treated corn stalks must be stored in a manner to exclude oxygen and stored for at least 21 days before feeding. Overall, urea treatment does not improve the digestibility to the extent of the other treatment methods, but urea is safer to handle and more accessible than the alternatives.

Feeding: Any corn stalk residue based feedstuff should be tested prior to feeding. Typically corn stalks are included in diets at < 20 % of the total dietary dry matter. Dairy cattle will sort corn stalks within TMRs if they are too long; thus, fine chopping is recommended. Feeding long corn stalks in diets when pens are overcrowded may result in increased production or growth variation within the pen. It should be remembered that corn stalks can be low in vitamin A and E and modest increases in supplementation of these vitamins may be required. Finally, if CaO or CaOH treated corn stalks are fed to dry and pre-fresh cows dietary cation-anion balances and potential influences on the incidence of milk fever should be carefully monitored.