

SHREDLAGE IN DAIRY CATTLE RATIONS

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Dairy producers are growing more acres of corn silage and feeding higher levels of corn silage in dairy rations. This is the result of better agronomic information on corn silage management and improved nutritive value of corn silage. Factors including better hybrid genetics, selection of hybrids for fiber and/or starch digestibility, kernel processing (KP) and more attention to harvest dry matter and silo management are responsible for the improvement in nutritive value of corn silage. A new processing process called shredlage was introduced about 3 years ago. This process uses a special corn silage head that replaces the KP head on a Claas forage harvester. This process rips or tears the corn stalk into longer pieces. The rolls in the harvester are also tightened to better breakup the corn kernel. The TLC (theoretical length of cut) is recommended to be set at 26 mm for corn silage with a moisture content of 65 to 70%. The guideline is to have the rolls set at 1.5 to 1.75 mm. As corn silage gets drier (36 – 40% DM), the TLC is reduced to 21 to 23 mm and the rolls are set at 1.25 to 1.5 mm. Harvesting corn silage as shredlage is a slightly slower process, requires more power and uses more fuel. Custom harvesters are charging an extra \$1-2 per ton to account for these differences.

Particle Size

Table 1 contains data on the impact of TLC on corn silage particle size distribution using the Penn State forage particle separator. The percent coarse material (top screen) decreases as TLC decreases. However, the total on the top 2 screens changes very little as TLC changes for the 3 shredlage samples. There was a lower total on the top 2 screens for the KP corn silage. The higher percent on the top screen for the 30 mm TLC shredlage may increase the risk of sorting.

Table 1. Corn Silage Particle Size Distribution^a

Shredlage	% on Top Screen	% on Screen 2	% on Screen 3	% in the Pan
30 mm TLC	35	45	19	1
22 mm TLC	18	58	22	2
17 mm TLC	9	71	18	2
Conventional KP	8	60	30	3

^a Source: Michelle Woodman, Landmark Services Cooperative, 2014

Previous Research

There have been 3 research trials conducted using shredlage in dairy cattle rations. Two of these were done at the University of Wisconsin by Dr. Randy Shaver and his research group. The first trial at the University of Wisconsin compared rations containing 50% of the total ration dry matter (DM) as either shredlage or KP corn silage

(Ferraretto and Shaver, 2012). These rations also contained 10% of the ration DM as alfalfa silage and 40% grain. This was a pen study with 14 pens of 8 cows in each pen. The rations were fed for an 8 week period. The key results from this trial are in Table 2. Both dry matter intake and energy corrected milk tended to be higher for cows fed the shredlage ration. Total tract starch digestibility was significantly higher for cows fed the shredlage ration. Feed sorting was not different between the 2 treatments.

Table 2. University of Wisconsin – Trial 1

	Shredlage Ration	KP Ration
Corn silage particle size^a		
% on top screen	31.5	5.6
% on screen 2	41.5	75.6
% on screen 3	26.2	18.4
CSPS,% ^b	75	60.3
TMR particle size		
% on top screen	15.6	3.5
% on screen 2	38.2	52.9
% on screen 3	38.9	35.8
TMR Nutrient Composition		
CP, % of DM	17.2	17.3
NDF, % of DM	28.1	28.3
Starch, % of DM	25.4	25.5
Dry matter intake, lbs./day	55.9	54.3
Milk, lbs./day	95.9	94.2
Energy corrected milk, lbs./day	99.2	97.2
Milk fat, %	3.74	3.7
Milk true protein, %	3.18	3.21
Lbs. ECM/lb. DMI	1.76	1.77
30 hour in vitro NDF digestibility, % of NDF	50.9	50.8
7 hour in vitro starch digestibility, % of starch	78.5	75.4
Total tract starch digestibility, % of starch, week 8	99.4	97.5

^a Using the Penn State forage particle separator

^b Corn silage processing score

A second trial was conducted by the Wisconsin workers to examine the impact of shredlage when BMR corn silage was used (Vanderwerff et. al., 2015). A treatment was also added that replaced some of the corn silage with dry hay. There were 15 pens of 8 cows each in this trial and the rations were fed for 14 weeks. Table 3 contains the information from this trial. Milk production tended to be higher for cows fed the shredlage

ration compared with the KP ration. Milk production was significantly lower for cows fed the ration containing chopped hay but these cows had a higher milk fat content. Energy corrected milk was similar for the 3 rations. There were no differences in rumination time between the 3 rations.

Table 3. University of Wisconsin – Trial 2

Item	Shredlage ration	KP ration	KP+Hay ration
Corn silage, % of DM	45	45	35
Alfalfa silage, % of DM	10	10	10
Chopped hay, % of DM	-	-	10
Ration CP, % of DM	16.3	16.2	16.7
Ration NDF, % of DM	31.6	31.9	32.5
Ration Starch, % of DM	28.7	29.3	27.1
Dry matter intake, lbs./day	59.2	58.7	58.7
Milk, lbs./day	112.9	110.2	104.3
Energy corrected milk, lbs./day	108.9	106.9	106.5
Lbs. ECM/lb. DMI	1.84	1.82	1.82
Milk fat, %	3.29	3.31	3.67
Milk true protein, %	3.1	3.13	3.14
Rumination, minutes/day	504	503	499
Apparent total tract NDF digestibility, % of intake	38.9	40.8	41.7
Apparent total tract starch digestibility, % of intake	99.1	98.6	98.9

Cornell Trial

A trial was conducted at Cornell comparing shredlage versus KP corn silage. Conventional corn silage hybrids were used and 2 forage harvesters ran side by side during harvest. One had a shredlage head and the other a KP head. The corn silage from each harvester went into a separate bunker silo. This was done to minimize any

differences between the processing methods due to hybrid, maturity and dry matter. Samples of the incoming corn silages were evaluated using the Penn State forage particle separator and the 32 ounce Pioneer cup and the results used to adjust harvester settings during harvest. The bunker silos were opened after about 8 months of fermentation. The rations fed contained 50% corn silage, 14% alfalfa silage and 36% grain on a dry matter basis. This was a pen study using 4 pens of 32 cows per pen. Rations were rotated between pens each 4 weeks so that all pens were fed both shredlage and KP rations during the trial. Table 4 contains key information from this trial. There were no differences in dry matter intake, milk production or milk components in our trial. Total tract starch digestibility was similar between the 2 rations.

Survey Results

A survey of dairy producers' corn silage harvest and processing methods was recently reported (Salvati et. al., 2014). There were 69 dairy farms included in this survey. Some of the results from this survey are:

- 61% of the herds used a Class harvester with a shredlage processor.
- 95% of the herds stored corn silage in bunker silos.
- Theoretical length of cut:
 - o > 26 mm = 14%
 - o 26 mm = 47%
 - o 22 mm = 32%
 - o <19 mm = 7%
- Roll gap setting:
 - o > 2.5 mm = 3%
 - o 2.5 mm = 16%
 - o 2 mm = 48%
 - o 1.5 mm = 18%
 - o <1 mm = 15%
- Mean forage particle size (only shredlage herds):
 - o 19.6% on the top screen of the Penn State box (range = 7.2 to 39.9%).
 - o 75.7% on the top 2 screens of the Penn State box (range = 65.1 to 85.9%).
- Percent forage in the ration:
 - o < 50% = 58.1%
 - o 50 – 60 = 33.9%
 - o >60 = 8.1%
- Percent corn silage in the diet when using shredlage:
 - o Increased amount = 46.9%
 - o No change = 50%
 - o Reduced amount = 3.1%

- 40% of the herds reduced the amount of hay or straw fed when shredlage was used.
- 45.5% of the herds indicated an increase in milk production when shredlage was used while 39.4% indicated no change in milk production.

- 40% of the herds felt that silage pack density increased when shredlage was used while 43.1% indicated no change in silo pack density.

Table 4. Cornell Trial Results

Item	Shredlage Ration	KP Ration
Corn silage particle size ^a		
% on top screen	34.1	18.3
% on screen 2	40.2	57.2
% in pan	25.7	24.4
CSPS ^b	59.5	50.7
Corn silage composition		
DM, %	32.1	30.7
CP, %	7.34	7.9
NDF, %	41.7	44.1
30 hour in vitro NDFD, % of NDF	57.1	56.6
Starch, %	33.5	30.7
7 hour in vitro starch digestibility, % of starch	81.7	76.8
Packing density, lbs./cubic foot, wet basis	49.8	51.9
Packing density, lbs./cubic foot, DM basis	16.3	16.5
Ration CP, % of DM	17.9	18
Ration NDF, % of DM	33.7	33.2
Ration starch, %	23.1	22.9
Pen DMI, lbs./day	55.9	56.3
Milk, lbs./day	90.4	90.9
Milk fat, %	3.7	3.71
Milk true protein, %	3.01	3.0
Apparent total tract starch digestibility, % of starch	97.2	97.1
Apparent total tract NDF digestibility, % of NDF	45.6	46.6

^a Penn State forage particle separator

^b Corn silage processing score

SUMMARY

Shredlage provides another option for processing of corn silage at harvest. The primary advantage appears to be a higher ruminal and total tract starch digestibility due to more extensive kernel processing. In some herds, this improved starch utilization may support removing 1 – 2 pounds of corn grain from the ration. There seems to be limited effect of shredlage on NDF digestibility. In 2 of the trials reported, there has been a tendency for small increases in milk production when KP corn silage is replaced with shredlage. A key question is how much benefit there would be to shredlage if the corn silage processing scores were the same for KP processed corn silage and shredlage. One benefit of shredlage has been to raise the awareness of the importance of kernel processing and the relationship with total tract starch utilization. One measure of this has been the increase in corn silage processing scores reported by forage labs in the last few years.

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