Update on Corn Shredlage for Dairy Cows

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Introduction

There continues to be a lot of interest in corn silage harvested with a self-propelled forage harvester (**SPFH**) equipped with an aftermarket processor with cross-grooved processing rolls set for 2- to 3-mm roll gap and greater roll speed differential than has typically been used (32% versus 21%). Also, the developer of this processor recommends that the SPFH be set for a longer theoretical length of cut (**TLOC;** 26 to 30 mm) than has typically been used in the past (19 mm TLOC).

This silage has been called corn shredlage by the developer of the new processor (Shredlage®, LLC; http://www.shredlage.com/). Thus far this processor has just been adapted for Claas SPFH, although shredder roll kits have been made available for the other makes of SPFH. During the 2014 harvest approximately 600 shredlage processors and shredder roll kits were in operation according to the developer of the shredlage processor.

We recently completed a second controlled feeding experiment with corn shredlage at the University of Wisconsin - Madison dairy farm in Arlington, Wisconsin. We also recently completed on an on-farm survey of dairy farms about their corn silage harvest, processing and feeding practices, and collected corn silage samples during feed-out for determination of processing score and particle length. The purpose of this article is to provide an update on corn shredlage based on the results from the feeding experiment and the on-farm survey.

Feeding Trial Results

For a detailed summary of our first feeding trial refer to Ferraretto and Shaver (2012). In that study we used a conventional corn silage hybrid harvested as either corn shredlage (30-mm TLOC) or conventional-processed (19-mm TLOC) corn silage. Key findings were as follows:

- The percentage on the top screen of the Penn State shaker box was greater for corn shredlage (32% versus 6% as-fed particles retained on the top screen of the shaker box) and for the TMR which contained corn shredlage (16% versus 4% as-fed particles retained on the top screen of the shaker box); we observed no sorting of either TMR when fed.
- Fat- and energy-corrected milk tended to be 2.3 lb/day per cow greater on average across the treatment period for cows fed the corn shredlage treatment, while feed efficiency and milk composition were unaffected by treatment.

- Corn silage processing score or the percentage of starch passing through a 4.75-mm sieve was greater for corn shredlage (75% versus 60%) and total tract starch and neutral detergent fiber (**NDF**) digestibility were greater for cows fed the corn shredlage treatment.

In the second feeding trial, we evaluated: 1) the response to corn shredlage in a brown midrib (**BMR**) corn silage hybrid, and 2) whether the greater TLOC setting on the SPFH for the harvest of corn shredlage increased the physically-effective fiber (**peNDF**) content of the silage (Vanderwerff et al., 2014).

A Mycogen® BMR corn silage hybrid (F2F627) was harvested in September 2013 with a Claas 940 SPFH equipped with either a Claas conventional processor or a Shredlage® processor on the same day at ½ kernel milkline stage of maturity. The conventional processor was set for a 2-mm roll gap and 40% roll speed differential with the SPFH set for a 19-mm TLOC for harvest of the conventional-processed corn silage (**KP**). Harvest of the corn shredlage (**SHRD**) was done with the Shredlage® processor set at a 2-mm roll gap and 32% roll speed differential with the SPFH set for a 26-mm TLOC. The KP and SHRD were stored in separate silo bags until the bags were opened to begin the feeding trial in January, 2014.

Mid lactation Holstein cows were used in a 16-week continuous-lactation experiment in our university dairy herd with 15 replicated pens of 8 cows each. The respective treatment TMR contained 45% (DM basis) from either SHRD or KP. Both TMR treatments contained 10% alfalfa silage and 45% (DM basis) of the same concentrate mix comprised of dry ground shelled corn, corn gluten feed, solvent and expeller soybean meal, rumen-inert fat, minerals, vitamins, and monensin. Additionally, a third treatment TMR (**KPH**) was included in the experiment to focus on the peNDF question. This ration was formulated with 35% KP, 10% alfalfa silage, 10% chopped hay, and 45% (DM basis) of the same concentrate ingredients adjusted in proportions in the mix to balance dietary crude protein and starch concentrations across the three treatments.

The SHRD and KP were similar in average dry matter (**DM**; 39%) content and pH (3.9). Corn silage processing scores on feed-out samples averaged 72% for SHRD and 68% for KP with less variation observed for SHRD over the duration of the experiment. The sample range (difference between maximum and minimum samples) was 10%-units for SHRD and 21%-units for KP. For SHRD, all processing scores were above 65%. However, for KP 43% of the samples obtained on a weekly basis throughout the feeding trial were at or below a processing score of 65% (refer to Figure 1).

The proportion of coarse stover particles was greater for SHRD than KP for samples collected during feed-out from the silo bags throughout the feeding trial (18% versus 7% as-fed particles retained on the top screen of the shaker box). For the TMR fed throughout the trial, the proportion of as-fed particles on the top screen of the shaker box was greater for SHRD than KP or KPH. Our measurements of weigh-backs during the trial indicated minimal sorting and no differences in sorting among the three treatments.

Averaged over the treatment period, milk yield was 2.5 lb/day per cow greater for SHRD than KP with the SHRD cows averaging 113 lb/day; feed efficiency was similar for the two treatments. Milk yield was 5.9 lb/day per cow lower and feed efficiency was reduced for KPH compared to KP. Milk yield by week on treatment is summarized in Figure 2.

Milk fat content was greater for KPH (3.7%) than KP or SHRD (3.3%). Rumination activity measured using the SCR rumination collars averaged 8.4 hours per day and was not different among the treatments. Using milk fat content and rumination activity data to assess peNDF suggests that the peNDF content of SHRD was not improved despite its longer TLOC and increased percentage of as-fed particles on the top screen of the shaker box compared to KP. Milk fat yield was not statistically different among the treatments, but was numerically greatest for KPH and lowest for KP. Similar to the milk yield differences, milk protein and lactose yields were greatest for SHRD and lowest for KPH. Body condition score (3.1 on average) and body-weight change (1.2 lb/day per cow on average) were similar among the three treatments.

Total-tract DM and organic matter (**OM**) digestibility were greater for cows fed KP and SHRD than for cows fed KPH. Total-tract NDF digestibility (**TTNDFD**) tended to be greatest for KPH and lowest for SHRD. Lower TTNDFD for SHRD may be related to increased dietary starch content for SHRD compared to KPH and increased kernel processing and ruminal starch digestibility for SHRD compared to KP and KPH. The ruminal in situ starch digestibility was greater for SHRD than KP corn silage (88.3 vs. 76.0%, respectively). Total-tract starch digestibility was greater for SHRD than KP. Differences in total-tract starch digestibility between SHRD and KP were, however, biologically small (0.5%-units) and starch digestibility was near 100% for all treatments. Small differences in total-tract starch digestibility along with much larger differences ruminally may be explained by post-ruminal compensatory digestion of starch. Nearly complete digestion of starch in the total-tract may be explained by the nearly 6 month lag between ensiling and the midpoint of the feeding trial, since length of the ensiling period has been shown to increase starch digestibility in corn silage.

In summary, the lactation performance response to corn shredlage using a BMR corn hybrid was of similar magnitude to the response observed in our earlier trial with a conventional corn hybrid. Despite a longer TLOC setting on the SPFH and increased particle size for corn shredlage relative to conventional-processed corn silage, milk fat content and rumination activity were not increased. Evaluate particle size and processing score of corn shredlage to determine the best ration formulation strategies.

Farm Survey Results

Seventy-six corn silage samples were obtained from 69 dairy farms during farm visits April to August 2014. Farms were located in Illinois (n = 1), Minnesota (n = 15) and Wisconsin (n = 53). Detailed results are presented by Salvati et al. (2014). Most farms (61%) harvested corn silage using a Claas SPFH equipped with a Shredlage® processor. Bunkers (95%) and inoculants (87%) were used by most farms. Corn hybrids were solely dual-purpose type for 43% of the farms. Most farmers reported a 22-26 mm TLOC (79%) and a 1.5-2.5 mm roll gap (82%).

Although the percentage retained on the top or coarsest Penn State Separator (**PSS**) sieve was 7%-units greater for shredlage than the other defined sample categories on average, the percentage retained on top 2 PSU sieves and the Wisconsin Separator (**WIS**) mean particle length (**MPL**) were similar. This suggests that there may not have been much improvement in peNDF for the shredlage samples compared to the other samples collected in this survey. The average percentage retained on the top PSS sieve for shredlage was substantially lower than that reported by Ferraretto and Shaver (2012) from their feeding trial (20% versus 32%). It should be noted that the TLOC setting on the SPFH was 30 mm in the study of Ferraretto and Shaver (2012), while the TLOC was usually 22-26

mm for the shredlage samples in this survey. The ranges for PSS top sieve, PSS top 2 sieves, and WIS MPL in the shredlage samples were 32%-units, 21%-units, 6 mm, respectively.

All sample types fell in the adequately-processed category based on processing score. The processing score was only 2%-units greater for shredlage than the other sample categories on average. This was achieved, however, coincident with the greatest percentage fibrous-particle retention on the top sieve of the PSS for shredlage. The range for processing score in shredlage was 33%-units, and both the greatest and lowest processing scores were observed within the shredlage samples.

Feeding experience with new-type corn silage was limited with only 20% of respondents using for over 12 months. Only 22% of respondents increased the total forage content of their diets, while 47% increased the corn silage content of their diets which indicates a greater proportion of corn silage in the total forage DM. With regard to the inclusion of hay or straw in the TMR, 54% of respondents still did so and only 40% of those had reduced the amount fed.

In summary, the physical form and DM results indicate considerable opportunity to improve corn silage quality by reducing variation through better process control during harvest for shredlage and non-shredlage type samples. It appears that major changes in feeding programs were not made coincident with the use of new-type corn silages. Because this survey was a single snap-shot in time and most farmers still had very limited experience harvesting and feeding new-type corn silage, a follow-up survey is warranted.

References

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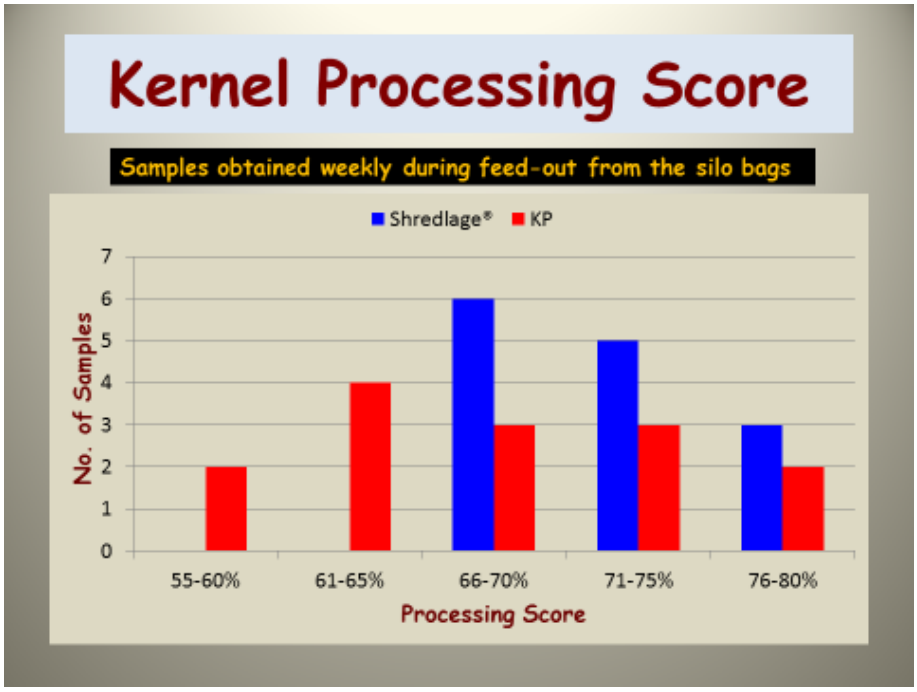

Figure 1. Frequency distribution for corn silage processing score on samples of brown midrib corn shredlage (SHRD) and conventional-processed corn silage (KP).

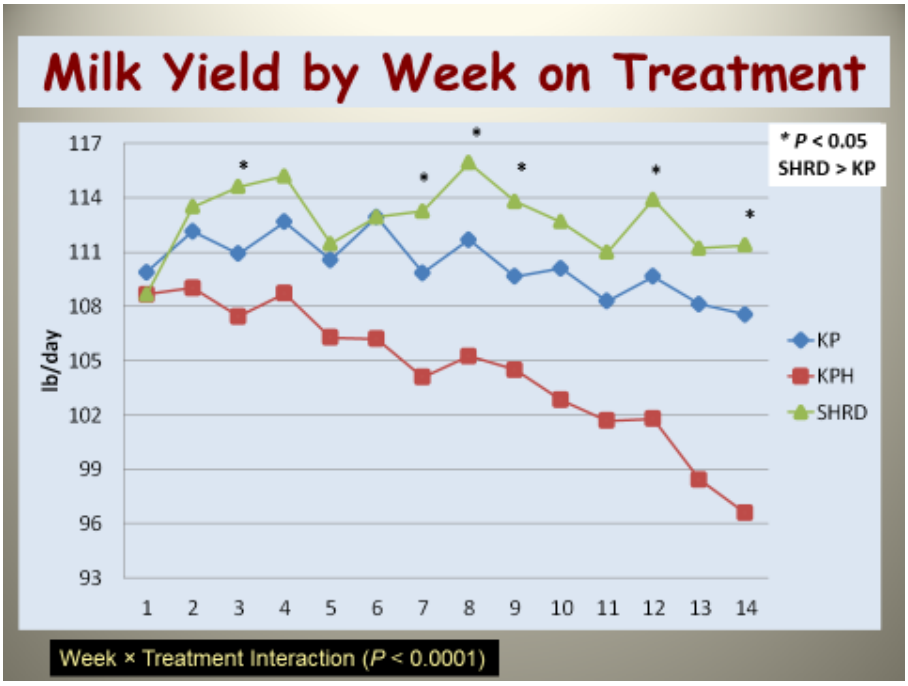

Figure 2. Milk yield by week on treatment for total mixed rations containing brown midrib corn shredlage (SHRD), brown midrib conventional-processed corn silage (KP), and brown midrib conventional-processed corn silage plus hay (KPH).

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