Corn Shredlage: Equipment, storage and animal perspectives

L.F. Ferraretto, L.M. Vanderwerff, G.G.S. Salvati, G.S. Dias Junior, and R.D. Shaver
Whole-Plant Corn Silage

Grain ~40-45% of WPDM
- Avg. 30% starch in WPDM
- Variable grain:stover

Stover = ~55-60% of WPDM
- Avg. 42% NDF
- Variable stover:grain

80 to 98% StarchD
- Kernel particle size
- Duration of silage fermentation
- Kernel maturity
- Endosperm properties
- Additives

40 to 70% IVNDFD
- Lignin/NDF
- Hybrid Type
- Maturity
- Additives

Variable peNDF as per chop length

Adapted from Joe Lauer, UW Madison Agronomy Dept.
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- Variable peNDF as per chop length

Adapted from Joe Lauer, UW Madison Agronomy Dept.
Corn Shredlage

http://www.shredlage.com/
## Equipment Comparison

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Shredlage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLOC settings</td>
<td>19 mm</td>
<td>26 – 30 mm</td>
</tr>
<tr>
<td>Roll-gap settings</td>
<td>1 – 3 mm</td>
<td>1.5 – 2.5 mm</td>
</tr>
<tr>
<td>Roll speed differential</td>
<td>21%</td>
<td>32%</td>
</tr>
</tbody>
</table>

TLOC – theoretical length of cut
2014 Dairy Farm Survey

- Farm Sampling April – June 2014
  - 76 samples from 69 farms (WI, MN, IL)
- 46 Class SPFH with Shredlage processor
- 5 Loren Cut rolls

Salvati et al., 2015
2014 Dairy Farm Survey

<table>
<thead>
<tr>
<th></th>
<th>Unsure / No change</th>
<th>Increased</th>
<th>Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll wear</td>
<td>81%</td>
<td>15%</td>
<td>4%</td>
</tr>
<tr>
<td>Tons per hour</td>
<td>63%</td>
<td>16%</td>
<td>20%</td>
</tr>
<tr>
<td>Fuel usage</td>
<td>65%</td>
<td>30%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Most Common

- TLOC Settings: 22 - 26 mm
- Roll-gap settings: 1.5 - 2.5 mm
- Roll speed differential: ---

Salvati et al., 2015
Packing Densities

Dairy Farm Survey

<table>
<thead>
<tr>
<th></th>
<th>Unsure / No change</th>
<th>Increased</th>
<th>Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>45%</td>
<td>51%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Salvati et al., 2015

UW Feeding Trial 1

- Similar packing density (272 kg DM / m³)

Ferraretto and Shaver, 2012
Data from the Chr. Hansen Cattle Team & GPS Consulting 2013 corn silage project

**Corn Silage Bunker/Pile Density**

(lbs DM/ft³)

Shredlage

Adapted from source slide provided by Roger Olson, 2014

333.2 310.8 286.7 272.3 (kg DM/m³)
Feeding trials
UW Feeding Trial 1

- 10/20/11 – 12/28/11; UW – Arlington Dairy
- 14 pens with 8 cow each
- Cows stratified by breed, parity & DIM, assigned to pens, and pens randomly assigned to 1 of 2 treatments
  - SHRD
  - KP
- 2-week adjustment period with all pens fed 50:50 mix of Shredlage & KP in TMR
- 8-week treatment period with all cows fed their assigned treatment TMR

Ferraretto and Shaver, 2012
# Experimental Diets (DM basis)

<table>
<thead>
<tr>
<th></th>
<th>SHRD</th>
<th>KP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shredlage</td>
<td>50%</td>
<td>---</td>
</tr>
<tr>
<td>KP Silage</td>
<td>---</td>
<td>50%</td>
</tr>
<tr>
<td>Alfalfa Silage</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Ground Dry Shelled Corn</td>
<td>10.3%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Corn Gluten Feed</td>
<td>7.4%</td>
<td>7.4%</td>
</tr>
<tr>
<td>SBM 48%, solvent</td>
<td>6.9%</td>
<td>6.9%</td>
</tr>
<tr>
<td>SBM, expeller</td>
<td>9.3%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Rumen-Inert Fat</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Min/Vits</td>
<td>4.2%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Ferraretto and Shaver, 2012
Penn State Shaker Box (as-fed basis)

Samples obtained during feed-out from the silo bags

<table>
<thead>
<tr>
<th>Screen, mm</th>
<th>SHRD</th>
<th>KP</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>31.5%</td>
<td>5.6%</td>
</tr>
<tr>
<td>8</td>
<td>41.5%</td>
<td>75.6%</td>
</tr>
<tr>
<td>1.18</td>
<td>26.2%</td>
<td>18.4%</td>
</tr>
<tr>
<td>Pan</td>
<td>0.8%</td>
<td>0.4%</td>
</tr>
</tbody>
</table>

Ferraretto and Shaver, 2012
### Kernel Processing Score

<table>
<thead>
<tr>
<th>% Starch Passing 4.75 mm Sieve</th>
<th>SHRD</th>
<th>KP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75.0% ± 3.3</td>
<td>60.3% ± 3.9</td>
</tr>
</tbody>
</table>

Samples obtained during feed-out from the silo bags

Ferraretto and Shaver, 2012
3.5% FCM Yield by Week

Week × Treatment Interaction ($P < 0.03$)

Ferraretto and Shaver, 2012
UW Feeding Trial 1
Summary & Conclusions

• > % on top (coarsest) screen of PSU box for Shredlage & Shredlage TMR
  ▪ There was no sorting of either TMR
• DMI tended to be greater for Shredlage
• FCM & ECM tended to be 1 kg greater for Shredlage
• > Kernel processing score and > Ruminal & Total tract Starch digestibility for Shredlage

Ferraretto and Shaver, 2012
UW Feeding Trial 2

- Effect of Shredlage on kernel processing score and peNDF
  - BMR Shredlage® (SHRD)
  - Conventional-Processed BMR (KP)
  - Conventional-Processed BMR & chopped hay (KPH)

Vanderwerff et al., 2015
UW Feeding Trial 2

- UW – Arlington Dairy
- 15 pens with 8 cow each
- Cows stratified by parity, milk yield & DIM, assigned to pens, and pens randomly assigned to 1 of 3 treatments
- 2-week adjustment period with all pens fed Shredlage/KP TMR with conventional herd shredlage
- 14-week treatment period with all cows fed their assigned treatment TMR

Vanderwerff et al., 2015
## Experimental Diets (DM basis)

<table>
<thead>
<tr>
<th></th>
<th>SHRD</th>
<th>KP</th>
<th>KPH</th>
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<tbody>
<tr>
<td>BMR Shredlage</td>
<td>45%</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>BMR KP Silage</td>
<td>---</td>
<td>45%</td>
<td>35%</td>
</tr>
<tr>
<td>Alfalfa Silage</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Chopped Dry Hay</td>
<td>---</td>
<td>---</td>
<td>10%</td>
</tr>
<tr>
<td>Ground Dry Shelled Corn</td>
<td>14.2%</td>
<td>14.2%</td>
<td>17.7%</td>
</tr>
<tr>
<td>SBM, expeller</td>
<td>5.0%</td>
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<td>11.1%</td>
<td>11.1%</td>
<td>9.6%</td>
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Vanderwerpff et al., 2015
## Penn State Shaker Box (as-fed basis)

## Silage samples obtained during feed-out

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<td>19</td>
<td>18.3% ± 6.4</td>
<td>7.1% ± 2.8</td>
</tr>
<tr>
<td>8</td>
<td>54.5% ± 4.4</td>
<td>68.1% ± 3.5</td>
</tr>
<tr>
<td>1.18</td>
<td>24.8% ± 3.2</td>
<td>22.3% ± 3.5</td>
</tr>
<tr>
<td>Pan</td>
<td>2.4% ± 1.1</td>
<td>2.5% ± 1.2</td>
</tr>
</tbody>
</table>

*Vanderwerff et al., 2015*
## Kernel Processing Score

### Samples obtained during feed-out from the silo bags

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<thead>
<tr>
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<th>KP</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>% Starch Passing 4.75 mm Sieve</td>
<td>72.4% ± 3.6</td>
<td>67.6% ± 6.5</td>
</tr>
<tr>
<td></td>
<td>Min = 68%</td>
<td>Min = 57%</td>
</tr>
<tr>
<td></td>
<td>Max = 79%</td>
<td>Max = 78%</td>
</tr>
</tbody>
</table>

Vanderwerff et al., 2015
Milk Yield by Week on Treatment

Vanderwerff et al., 2015

Week × Treatment Interaction ($P < 0.01$)

* $P < 0.05$

SHRD > KP
UW Feeding Trial 2
Summary & Conclusions

• > % on top (coarsest) screen of PSU box for Shredlage & Shredlage TMR
  ▪ Similar sorting behavior
• Milk yield 1.5 kg/d greater 6 out 14 wks of the study
• > Kernel processing score and > Ruminal & Total tract Starch digestibility for Shredlage
• No improvement of peNDF based on milk fat and rumination activity

Vanderwerff et al., 2015
Summary & Implications

- Greater lactation performance
- Increased starch digestibility despite the increased TLOC
- No improvement of peNDF based on milk fat and rumination activity
Future research

• Equipment performance

• Ruminal fermentation patterns and in vivo digestions kinetics

• Digestibility of NDF and relative peNDF compared with other sources
Questions

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