RELATIONSHIP BETWEEN THEORETICAL LENGTH OF CUT AND MEAN PARTICLE LENGTH IN WHOLE-PLANT CORN SILAGE

G. G. S. SALVATI, L. F. FERRARETTO, G. S. DIAS JÚNIOR & R. D. SHAVER
INTRODUCTION

- Dairy farmers increase theoretical length of cut (TLOC) with the aim of increasing mean particle length (MPL) of whole plant corn silage (WPCS) to provide greater physically effective fiber (Johnson et al., 2003)

- However, other factors can influence the MPL in WPCS such as:

1. Kernel processing (Roberge et al. 1998)
2. Plant DM content
OBJECTIVE

- Evaluate the relationship between verbal TLOC and MPL measured through two methodologies in both as fed whole-samples or stover fractions

- Our hypothesis was that MPL measured on the stover fraction would be related to TLOC due the elimination of the grain fraction
SAMPL ES

- 80 WPCS samples

- 4 samples from 2 feeding trials (Ferraretto and Shaver, 2012; Vanderwerff et al., 2014)

- Field survey (Salvati et al. 2014) → 76 samples

- Representing varied verbal TLOC settings and processor types and settings
### Table 1. Verbal theoretical length of cut (mm) on self-propelled forage harvesters

<table>
<thead>
<tr>
<th>TLOC:^1</th>
<th>Number of farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;26 mm</td>
<td>10</td>
</tr>
<tr>
<td>26 mm</td>
<td>33</td>
</tr>
<tr>
<td>22 mm</td>
<td>22</td>
</tr>
<tr>
<td>≤19 mm</td>
<td>5</td>
</tr>
</tbody>
</table>

\^1 TLOC: Temporal Location Code

### Table 2. Verbal roll gap (mm) on processor on self-propelled forage harvesters

<table>
<thead>
<tr>
<th>Roll gap</th>
<th>Number of farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;2.5</td>
<td>2</td>
</tr>
<tr>
<td>2.5</td>
<td>10</td>
</tr>
<tr>
<td>2.0</td>
<td>30</td>
</tr>
<tr>
<td>1.5</td>
<td>11</td>
</tr>
<tr>
<td>1.0</td>
<td>7</td>
</tr>
<tr>
<td>&lt;1.0</td>
<td>3</td>
</tr>
</tbody>
</table>
PARTICLE SIZE

- The PSPS procedure was conducted manually using 3 sieves (19-mm, 8-mm, and 1.18-mm) and a pan (Kononoff et al. (2003))

- Samples measured with WI-OS were sieved mechanically using 5 sieves (26.9-mm, 18-mm, 8.98-mm, 5.61-mm, and 1.65-mm) and a pan (ANSI, 2001)
A sub-sample of 1 kg as fed of each sample was used to separate grain and stover fractions through the hydrodynamic separation procedure (Savoie et al., 2004)

All samples were dried at 60°C for 48 h in a forced-air oven prior to immersion in water
Figure 1. Chopped whole-plant corn placed into water.

Figure 2. Gently agitating material to help the kernels sink to the bottom of the container.
Figure 3. Skimming and removing the floating stover.

Figure 4. Carefully draining the water so only the kernels remain in the container.
Figure 5. Example of separated stover and kernel fractions using the water separation technique.
After stover and grain fractions were separated, the stover fraction was re-dried at 60°C for 48 h in a forced-air oven.
Proc Reg (SAS, 2004)

- Best-fit regression (linear or quadratic)
- highest $R^2$ and lowest RMSE
Figure 1. Distribution plot of varied theoretical length of cut settings (mm) and mean particle length (mm) measured by Wisconsin Oscillating Particle Separator.
Figure 2. Distribution plot of varied theoretical length of cut settings (mm) and mean particle length (mm) measured by Penn State Particle Size Separator.
Figure 3. Relationship between mean particle length (mm) measured by Penn State Particle Size Separator and mean particle length (mm) measured by Wisconsin Oscillating Particle Separator.
Figure 4. Relationship between stover mean particle length (mm) measured by Penn State Particle Size Separator and stover mean particle length (mm) measured by Wisconsin Oscillating Particle Separator.
Figure 5. Distribution plot of varied theoretical length of cut settings (mm) and stover mean particle length (mm) measured by Wisconsin Oscillating Particle Separator.
Figure 6. Distribution plot of varied theoretical length of cut settings (mm) and stover mean particle length (mm) measured by Penn State Particle Size Separator.
Figure 7. Relationship between geometric mean length (mm) and stover geometric mean length (mm) measured by Penn State Particle Size Separator.
Figure 8. Relationship between geometric mean particle length (mm) and stover geometric mean particle length (mm) measured by Wisconsin Oscillating Particle Separator.
CONCLUSIONS

- Verbal TLOC was not related to MPL of WPCS
- The elimination of grain through hydrodynamic separation did not improve this relationship
- MPL may be measured adequately on farm using the PSPS
ACKNOWLEDGMENTS
QUESTIONS?