Corn Silage: Key Harvest Practices for Reducing Losses

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• **Harvest Date & Dry Matter (DM)**
  – Challenges & Proposed Solutions

• **Packing & Silage Density**
  – Challenges and Proposed Solutions

• **Monitoring During Harvest**
  – DM
  – Length of cut
  – Kernel processing

• **Future Research**
Survey of Corn Silage Management Practices

In spring 2013, a survey was mailed to all dairy producers in the San Joaquin Valley.

- 14.5% response rate
- Herd size (milking)
  - Average: 1,512
  - Median: 1,200

Select results will be presented.
Setting a Harvest Date
Dry Matter (DM)
Setting a Harvest Date

Challenges
The **nutritionist** - match the herd’s needs (starch, fiber?).
The **grower** - timing the last irrigation and maximizing yield.
The **custom harvester** - schedule the harvest, maturity that makes the crew comfortable at harvesting.
Setting harvest date – who are the decision makers? 1st dairy producers, 2nd custom harvesters, 3rd growers, and occasionally the nutritionists.
Large DM Variation within and Across Fields

Dry matter can range widely (19% to 27%; Heguy et al. 2010)

Differences in soil type, fertilization, irrigation and variety genetics within and across fields may explain the large variation in DM observed.
Large DM Variation within and Across Fields

**Harvest window:**
21% of dairies reported harvest window to last 8 to 16 d - two dairies reported 30 d and one dairy 60 d. Dry matter can increase 0.5 to 1% per day during the heat of summer.

**Number of fields:**
30% of dairies put six or more fields in the same silage structure (up to 21 fields, 3,000 cow herd).

**Number of varieties:**
23% of dairies planted three to five varieties.
Timing Last Irrigation

It may take 10 to 20 days before the harvesting equipment can enter the field after the last irrigation. The soil type, field length, and ground preparation of the field are factors that affect irrigation timing.
Harvest time is quite stressful for the harvest crew. They have to work long days. They might face conflicting schedules when clients have the same desired harvest date. Planning is important!!
Setting a Harvest Date

Proposed Solutions
Maturity can be evaluated visually based on the kernel milk line and stover maturity. However, visual maturity rate (kernel and stover maturity) does not explain forage dry matter very well (R-square was 0.63).
Dry matter can be determined prior to harvest. Several (10 - 20) representative plants are collected and chopped to get a composite sample (See Appendix I).
Communication
Silage Team

Grower
PCA

Dairy
Producer

Custom
Harvester

Nutritionist
Feeder
Segregate Forage

If during harvest obvious differences in DM are observed within or across fields, it might be beneficial to: 1) build two silage structures (maybe use bags) or 2) blend forage.
Segregate Forage

If during harvest obvious differences in DM are observed within or across fields, it might be beneficial to: 1) build two silage structures (maybe use bags) or 2) blend forage. NIR technology can make this task easier.
Packing and Silage Density
Wet silage density in 25 structures in California dairies (22 piles, 2 drive over pile, 1 bunker). Most samples in the upper part of the silage structure are below the desired 44 ft³ benchmark.

Silva-del-Rio and Heiman, 2011
Packing and Silage Density

Challenges
Delivery Rate

- In 50% of the dairies, delivery rate ranges from 150 to 200 tons/hour.
- Most dairies are still using a single packing tractor.

“800 lbs” rule of thumb – 800 lbs of packing weight for each ton of crop delivered/h.
Delivery rate of 150 tons/h = 120,000 lbs of packing tractor weight needed.
Delivery Rate

Forage delivered at unequal time intervals. Several trucks arrive at the same time to unload forage.
Layer Thickness

Ideal layer thickness = 6 inches. A truck loaded with 20,000 lbs would need to spread the forage over \( \approx 2,400 \text{ ft}^2 \) before packing.
Packing and Silage Density

Proposed Solutions
The number and size of choppers should match the packing capacity at the silage structure. Discuss this with your custom harvester prior to harvest, and plan accordingly.

- In 25% of the dairy operations, harvest capacity is 16 rows or more (up to 40 rows)
Adjust Delivery Rate

Ensure trucks are delivering forage at a constant rate to avoid clusters that overwhelm the packing tractor.
Enough Packing Time

If there is enough space, adding a tractor could be the difference between a silage structure reaching the desired density or not.
Packing Tractor Efficiency

Check to see if the packing tractor(s) is constantly driving on the pile, and not merely pushing up feed and waiting for the next load to arrive. Ensure tractor drivers compact the entire surface, and pay special attention to the top half.
Monitoring

**Dry Matter**

**Kernel Processing & Length of Cut**

**Importance** –
corn silage is fed year round, but put up in a week’s time
Dry Matter

Why monitor DM?
• Payment when buying/selling
• Inventory
• Regulations
• Variety trials

On-farm measurement options
• Koster
• Microwave
• NIR
Dry Matter Variability
How to Reduce Error in Estimating DM and Yields

Differences between estimated field DM removal and actual field DM removal based on method of sampling on one cooperator dairy.

<table>
<thead>
<tr>
<th></th>
<th>Single Sample</th>
<th>Consecutive sampling (1 hr)</th>
<th>Hourly sampling</th>
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</thead>
<tbody>
<tr>
<td>% difference</td>
<td>-21.5 to + 20.4</td>
<td>-5.14% to + 5.15</td>
<td>-2.71% to + 2.40</td>
</tr>
<tr>
<td>DM difference (lbs)</td>
<td>± 135,000</td>
<td>± 33,000</td>
<td>± 16,500</td>
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</table>
Particle Length

• **General Considerations**
  • Too short – impaired rumen health and function
  • Too long – easily sorted out of the TMR

• Desired particle length is dependent on other forages in the ration, DM at harvest, etc.

• Important to include the silage team, *especially the herd nutritionist*, in this decision.
### Penn State Shaker Box

<table>
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<tr>
<th></th>
<th>3/4 TLC Processed</th>
<th>3/8 TLC Unprocessed</th>
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<tbody>
<tr>
<td>Top</td>
<td>5-15</td>
<td>3-8</td>
</tr>
<tr>
<td>Second</td>
<td>&gt;50</td>
<td>45-60</td>
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<tr>
<td>Third</td>
<td>&lt;30</td>
<td>30-40</td>
</tr>
<tr>
<td>Bottom</td>
<td>&lt;5</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

### Tape Measure

![Tape Measure Image]

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**On Farm Monitoring**
Kernel Processing

Kernel Processing
Improves:

Handling and Packing
Starch Digestion
Fiber Utilization
Feed Intake
Reduces Feed Sorting

Too Much Processing:
Decreases effective fiber
Favors rapid fermentation ->
rumen acidosis

Too Little Processing:
Kernels lost in feces
Difficult Packing
Sorting increased
Corn Silage Processing Score

42% Inadequately Processed
51% Adequately Processed
7% Optimally Processed

Cumberland Lab, 2009 -2011 (n=1131)
Result of Poor Kernel Processing
On Farm Monitoring

Evaluate the Broken Kernels

Separate kernels in a bucket of water – Appendix II

Guidelines:
- 90 - 95% cracked
- 70% smaller than ¼ of a kernel

Nicking and Crushing is not enough

(Mertens, 2005)
Suggested Monitoring

**Hourly, sample a truckload of forage for:**

1. **DM**
   - On-farm (microwave, koster tester, NIR)

2. **Length of cut**
   - Penn State Shaker Box
   - Tape measurement

3. **Kernel Processing**
   - Bucket method (Appendix II)
   - Cup method
Future Work

**Spring/Summer, 2014**
- Custom harvester survey
- Nutritionist survey

**Summer, 2014**
- Corn silage audits
  - Follow up to the producer survey
  - Data collection and identification of bottle-necks in the system.

**Winter, 2014**
- Silage management booklet
Silage pit in the Central Valley (late 1930’s)

*Photo Courtesy of Alan George, retired UCCE Farm Advisor in Tulare County*
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