Improving Herd Performance with TMR Audits

Dr. Bill Stone

Areas we evaluate
- Forage quality
- Silo management
- Shrink
- Load preparation
- Refusals
- Feed delivery times
- Ration consistency

Why Diamond V and TMR Audits?
- It gets us on lots of good dairies
- The TMR audits have helped to improve TMR consistency, reduce shrink, and improve herd performance and feed efficiency
- Diamond V products improve production and feed efficiency
Diamond V Peer Reviewed Transition Studies – Early Post-partum DMI Responses

Effects of Feeding Diamond V on DMI of Early Post-partum Dairy Cows
6/6 (100%) positive; avg + 2.5 lbs (+6.7%) (7/7; Ramsing 1.5 lbs.)

Study

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Diamond V</th>
<th>P</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Marquisian</td>
<td>38.3</td>
<td>31.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cows</td>
<td>42.8</td>
<td>26.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.9</td>
<td>40.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42.7</td>
<td>46.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36.9</td>
<td>39.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Robinson, 1997
Robinson, 1999
PP Robinson, 1999
MPD Ann 1-42
Wang, 17 FND P
Wang, 21 FND P
Avg

Multiparous Cows

P = 0.1

Body Weight Change (lb/d) During Early Lactation

First Calf Heifers* Mature Cows* Mixed Cows** Mature Cows*** Mature Cows****

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Diamond V Yeast Culture</th>
<th>0.60 lb/d Average Advantage Of Yeast Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Calf Heifers*</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Mature Cows*</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Mixed Cows**</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Mature Cows***</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Mature cows****</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*S Robinson and Garrett, 1999. JAS. 77:993-999
***Erasmus et al., 2005.
****Robinson, 1997. JDS. 80:1119-1125

Example Of Diamond V Yeast Culture On Feed Efficiency

7% Improvement With XP (South Dakota State University Study)

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>Diamond V Yeast Culture</th>
<th>% Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, lb/d</td>
<td>76.9</td>
<td>78.0</td>
<td>+1.4%</td>
</tr>
<tr>
<td>4% FCM, lb/d</td>
<td>68.7</td>
<td>70.5</td>
<td>+2.6%</td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td>50.9</td>
<td>48.7</td>
<td>-4.3%</td>
</tr>
<tr>
<td>Feed Efficiency</td>
<td>1.39</td>
<td>1.49</td>
<td>+7.2%</td>
</tr>
</tbody>
</table>

*P < 0.05
**Feed Efficiency = 4% FCM/DMI

Observations

Forage quality

- CS – dry
  - Moderately processed
  - Low temps
- Haylage – good odor
  - Stable temps

Effect of Maturity on Whole Plant Corn Silage Digestibility

- 29% DM
- 34% DM
- 41% DM
- 41% DM is for illustration only (not harvest!

5 hybrids
Harvest Considerations with Corn Silage

- Corn silage yield
- Ruminal starch digestibility
- Fiber digestibility NDF
- Newer conv varieties
- Older varieties

Whole plant dry matter

12’ disc bine
- Hlge 2nd 2007
- DM 39%
- CP 22%
- Bound 1%
- Sol CP 61%
- ADF 31%
- NDF 39%

7’ windrow; 7/12 = 57%.
- Ideally windrow width would be > 90% of cutterbar width (~11’)
- 8’ merger

33 – 36 %
Haylage piles 1&2: Left pile; Right pile

Silage temperatures and apparent densities

Forage quality

- Haylage density did not seem nearly as great as CS, which was probably the cause of the higher temps in the haylage (long particles, maybe not enough packing weight)
- Both had good fermentation odors
- The poor quality haylage at the top of the bunker was being selectively removed and fed to heifers
- We would be happy to have a Forage Management Meeting with the crops crew
Forage particle size, % retained

<table>
<thead>
<tr>
<th></th>
<th>CS</th>
<th>BMR</th>
<th>Hlge</th>
<th>Hlge (Purch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse</td>
<td>15</td>
<td>21</td>
<td>51</td>
<td>12</td>
</tr>
<tr>
<td>Medium</td>
<td>59</td>
<td>56</td>
<td>33</td>
<td>58</td>
</tr>
<tr>
<td>Fine</td>
<td>26</td>
<td>22</td>
<td>16</td>
<td>29</td>
</tr>
</tbody>
</table>

Silage Face Management Goals

- Remove spoiled silage
- Vertical smooth faces
- Remove enough silage to avoid heating
- Mix removed silage with loader bucket or mixer wagon
- No loose silage at end of feeding
- Leading edge of plastic weighted with tires and removed at least weekly

Removing Spoiled Haylage

Always Review Worker Safety

$O_2$ limiting two layers of plastic minimizes spoilage
Work to improve silage face management

Face management: repair defacer or try a different manufacturer

Silage Face Heating

Source: Venne. 2007
Silage Face Heating

Defacer
- Fritsch makes a rugged, reliable defacer
- 5” teeth are standard; they have made models with 6” teeth if faster removal is necessary
- The largest one they make is a 10’ model. They could make a larger one if your loader had adequate hydraulic oil flow (60 g/min through the couplers)

Video and additional info at:
http://www.fritschequipment.com/facer.html

Silage Can Heat During The Winter
Excellent Face on Haylage Pile

- This dairy defaced, pushed the feed into a pile, and premixed it with the loader bucket. This reduces silage variation that occurs throughout the bunker, making for a much more consistent TMR.

Reducing ration variation
Forages

Corn Silage DM – Sampling and Laboratory Consistency Evaluation

<table>
<thead>
<tr>
<th>CS 10% average DM deviation among regions</th>
<th>Haylage 20% average DM deviation among regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.0, 31.1, 31.4</td>
<td>31.0, 31.3, 31.3</td>
</tr>
<tr>
<td>31.3, 31.6, 31.8</td>
<td>30.7, 31.6, 31.8</td>
</tr>
<tr>
<td>33.2, 33.3, 33.8</td>
<td>33.1, 33.2, 33.5</td>
</tr>
</tbody>
</table>
Premixing forage to minimize variation

Reducing variation and increasing load preparation speed

- This dairy defaces when the feeder arrives, loads the silage on the the feed truck, and briefly mixes it as the the silage is moved adjacent to the commodity building
- Now the feeder can quickly and accurately prepare a load of feed with CS, Hlge, grain mix, and corn meal
Be wary of layers of poorly fermented feeds

Levels of Butyric/Isobutyric Acid by Silo and Location within Silo

Accuracy of ingredient loading 2000 cow MI dairy
- Corn silage, haylage, beet pulp, corn meal, SBM, cotton seed, protein/min mix
- “We don’t have enough commodity bays to have a lactating cow grain mix”
- “Great feeder. He’s leaving and it’s going to be very difficult to replace him.”
- TMR Tracker – over fed SBM by 1150 lbs/day (~ 15% per day)

How We Add The Liquid Affects TMR Consistency
Whey addition

Load Preparation
- Unique whey application system really distributed the whey uniformly over the TMR.

Great whey manifold

Excellent distribution across the TMR
Make the feeder's life easier, and the rations more accurate

<table>
<thead>
<tr>
<th>Item</th>
<th>Lb. DM</th>
<th>Lb. DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Haylage</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>4.75</td>
<td>4.75</td>
</tr>
<tr>
<td>Corn meal</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>Whole cotton</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>Citrus-Soy mix</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Expeller SBM</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>Minerals</td>
<td>.45</td>
<td></td>
</tr>
<tr>
<td>Dry fat</td>
<td>.1</td>
<td></td>
</tr>
<tr>
<td>Calcium sulfate</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>Limestone</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td>Prefresh grain mix</td>
<td></td>
<td>8.75</td>
</tr>
</tbody>
</table>

Close-up Mixing...Mineral Mix
Hanging Up on Screws

What group was fed before the prefresh cows?

Load Size Too Small
Mineral Not Completely Delivered To the Close-up Dry Cows
When Do You Add Low-Inclusion Ingredients

Make Sure Wagon Is Level: Trioliet 3-Screw Parked In Loading Ramp

Proper Ingredient Mix Order

- Depends on the type of mixer (vertical vs horizontal), experience and if forage processing is required
- Add lower inclusion ingredients early in mix
- Blend like-ingredients together, i.e. haylage and alfalfa squares
- Avoid direct contact of wet sticky by-products with fine particle dry feeds
  1. Large squares or rounds of hay / straw
  2. Dry fine ingredients / Feed Additives
  3. Cottonseed or custom pre-blend
  4. Wet by-products
  5. Haylage
  6. Corn Silage
  7. Liquid
Well Mixed TMRs Obtained By Different Methods

Mixing TMR With A Payloader

“Feed Particles Mix When Falling Together At the Same Time”

“Any ingredient or process that interferes with this will affect TMR consistency”
An Inconsistent Lactation Ration

Visual evaluation of the mixer and its operation

TMR truck

Auxiliary kicker plate and kicker brace needed; goes on leading edge of the flighting

Wagon not cleaning out

Placed at 3/8” to closest point of tub when it is turned
Visual evaluation of mixer wagon

Is the mixer too full with a 16,000 lb load?

Over-loaded reel mixer

Tired mixer wagon
Refusals - Group 3

Hot, spoiled refusal (110º). Cows in bunk? Worn concrete? Friendly rats in broken concrete

Most pens at ~3% refusals

Group 3

PA dairy - Refusals at 7 AM

Fresh cows returning from parlor High Cows
PA dairy - Feeding behavior

Fresh cows ~ 15 min post-feeding – hungry!

Fresh cows that did not get up when fresh feed was delivered

Timing and number of feedings

Today most groups were out of feed
(Monday morning event?)

Want lactating cows, especially fresh cows, to have feed when returning from the parlor

Ideally this would be fresh TMR, but another option is to feed them later in the day

Ideally all groups would be fed at least twice per day,
3x would likely lead to more consistent meals

Delivery of feed once per day

Diagram showing delivery of feed over time.
Delivery of feed twice per day

TMR Evaluation
Penn State Particle Separator:
10 samples per pen

Penn State Particle Separator:
Group 3 – H bunk

We would like each of these lines to be as straight as possible. This would indicate that there was little variation in particle size along the length of the bunk, and that the ration is consistent along the bunk.

Group 1 (west barn)
Group 1 (west barn)

Prefresh

Processed hay
Prefesh diet, hay

Managing ration variation caused by the cow

Processing Straw or Hay
Refusals vs Ration

Penn Shaker Box: TMR vs. Weighback

<table>
<thead>
<tr>
<th>Percent</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh 1</td>
<td>5.6</td>
<td>16.7</td>
<td>6.5</td>
<td>26.8</td>
<td>6.1</td>
<td>26.6</td>
<td>5.5</td>
<td>26.5</td>
<td>5.1</td>
<td>26.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Middle 2</td>
<td>28.7</td>
<td>41.1</td>
<td>30.7</td>
<td>30.7</td>
<td>37.9</td>
<td>28.5</td>
<td>29.7</td>
<td>29.7</td>
<td>29.7</td>
<td>29.7</td>
<td>29.7</td>
</tr>
<tr>
<td>Bottom 3</td>
<td>55.8</td>
<td>42.2</td>
<td>57.0</td>
<td>17.1</td>
<td>56.5</td>
<td>20.3</td>
<td>36.2</td>
<td>15.9</td>
<td>24.2</td>
<td>14.8</td>
<td>35.9</td>
</tr>
</tbody>
</table>

Coefficient of variation (CV):
Measure of the amount of variation around the mean
Goal of < 5% for middle screen and pan

Penn Shaker Box: Overall Average and CV

<table>
<thead>
<tr>
<th>Percent</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh 1</td>
<td>19.0</td>
<td>21.6</td>
<td>42.1</td>
<td>9.6</td>
<td>38.9</td>
<td>5.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle 2</td>
<td>8.3</td>
<td>32.1</td>
<td>53.4</td>
<td>4.5</td>
<td>38.3</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bottom 3</td>
<td>15.9</td>
<td>42.5</td>
<td>49.1</td>
<td>10.3</td>
<td>35.0</td>
<td>6.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coefficient of variation: goal is less than 5%
These next two dairies had the same make and model Kuhn Reel augie.

Data on the next slide are from two dairies with the same type of mixer – Kuhn Knight 4 auger.
Keen attention to detail by the feeder (above)

Proper load size and mixing reduces variation

- Mix time:
  - Adequate?
  - Excessive?
  - Recorded and controlled?
  - Should it vary with varying load sizes?
- Is the load too large for proper mixing?

Contributing Factors to TMR Variation

DIRTY DOZEN

1. Silage face management
2. Premixing forages
3. Loading accuracy
4. Loading liquids
5. Ingredient inclusion amount
6. Ingredient mix order
7. Mixing Times
8. Equipment Wear
9. Hay Quality & Processing
10. Unlevel TMR Loading
11. Grain Particle Size Variation
12. Delivery Times
Keeping shrink low

Consider bin storage for lightweight, expensive ingredients, or pelleting

Reducing Shrink
Reducing Shrink

Simple wind break adjacent to commodity barn

Reducing Shrink

Dual bins per ingredient, with adjacent commodity shed for additional flexibility
Mixer is in protected, recessed area and can be loaded from either side
Dynamica generala NIR sensor in loader bucket

Reducing Shrink

The bin approach – all concentrates in bins. Extended spouts with shade cloth on the walls.
Advantage – look at all of the wasted feed (!)
Disadvantage – pay more for auger delivery
Improving Accuracy and Reducing Shrink With Electronic Feed Monitoring Systems

Feed Watch, EZ Feed, TMR Tracker, Feed Supervisor

Scale head
Display
Software
Wireless modems

Summary of Diamond V TMR Data
– Best mixer is one that is well maintained and managed by following TMR mixing basics

Types of TMR Mixer Wagons Tested During TMR Audits

- HA = horizontal 4-auger
- HP = horizontal paddle
- HR = horizontal auger-reel
- V1 = single auger vertical
- V2 = twin auger vertical
- V3 = triple auger vertical

Number of TMR loads tested: 514
Top 10 Brands of TMR Mixers
Identified in TMR Audit Summary

Number of TMR loads tested: 514

Top 25% of TMRs have coefficients of variation of 3% or less
Goal: 3% CV or less in middle and bottom screens of Penn State Shaker box

Coefficient of Variation Levels for TMR Consistency
- ≤3%:
  - Top 25% of TMRs
  - TMR mixing basics followed
  - Excellent - mostly corn silage, haylage and/or chopped hay: easy to mix, new and well-maintained mixers
- ≤4%:
  - Top 50% of TMRs
  - Not sure cow performance is different from 3% CV
- >4%:
  - Anecdotal evidence has show 1 to 3 lbs inc. in milk and improved milk fat% after corrections are maded
  - Poor TMR Mixing Basics
    - Not mixing long enough after last ingredient
    - Not fulling
    - Worn augers and kicker plates
    - Hay not processed
    - Ingredient mix order not optimized
    - Liquid not loaded in proper position

Top 25% of TMRs have coefficients of variation of 3% or less
Goal: 3% CV or less in middle and bottom screens of Penn State Shaker box
NY Dairy - Recommendations

- Excellent silage management and feed preparation
- Limited opportunities to further reduce shrink
- Feeding more times per day may have benefits
- H bunk needs to be repaired
- PSPS – coarser?
- Prefresh – mix longer
  - New knives???, or process the hay more before adding it to the mixer

Thanks

What questions do you have?