Feeding High Corn Silage Diets

Ration Considerations and Economics

Darin Bremmer, Ph.D.

What is a High Corn Silage Diet?

50% of Forage Dry Matter

60%

70%

80%

90%

100%
What is a High Corn Silage Diet?

50% of Forage Dry Matter

- 60%
- 70%
- 80%
- 90%
- 100%

Cows require a well balanced diet. They don’t require haylage.

What is a High Corn Silage Diet?

- Corn silage contains corn grain (starch)
- Amount of starch in corn silage can vary.
  - I am feeding 8 to 37% starch corn silage this year.
- Monitoring forage level in a high corn silage diet is deceiving because a portion of the forage DM is starch
  - 60 lbs DMI, 50% forage diet, 80% of the forage DM is corn silage, the corn silage is 30% starch
  - 7.2 lbs of starch from corn silage = 12% of DM
- Monitor NDF from forage; total NDF

15% Starch

32% Starch
**Consistency**

- **Corn Silage vs. Alfalfa**
  - Alfalfa is more difficult to obtain ideal, uniform forage for feed (3-5 crops)
  - Corn silage is more consistent, uniform forage for feeding (1 crop)

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**Alfalfa Haylage**

- 27.4% DM
- 38.0% DM
- 41.1% DM
- 51.4% DM
- 45.0% DM
- 28.3% DM
**Consistency**

- Cows (rumen) like consistent diets
- Very few changes need to be made with a well balanced high corn silage diet
- Haylage changes have less impact in high corn silage diets.
- Monitor inventories to prevent diet swings.
What Has Driven us to Higher Corn Silage Diets?

- The desire for more consistent forages
- Corn silage levels usually increase as herds grow
  - We have to get the most out of every acre
  - Corn silage is highest yielding forage
- Winter kill and drought has hurt haylage inventories
  - Plant more corn silage, emergency crops, and get forage inventories dialed in

Corn Silage vs. Alfalfa

- Alfalfa provides ground cover in offseason
  - But, also carries risk of winterkill
**Winter Crop Followed by Corn in Spring**

- Winter Rye, Triticale, Wheat
  - Rye = highest yielding
  - Trit = mod yield, highest quality
  - Wheat = lowest yield, lower quality
- Can be high protein and highly digestible for milk cows when harvested early
- Can harvest later and target to heifers
- If following up with corn, the later the corn is planted the lower the yield
- Get manure on in fall before seeding and after harvest in spring before planting corn

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**Winter Crop Followed by Corn in Spring**

- Crops planted after an early season forage/cover crop harvest are not insurable
- If terminating a forage/cover crop the crop must be terminated before it reaches the headed or budded stage or can’t insure any crop planted after it
- Can graze the forage/cover crop, and then follow up with an insurable crop. The grazed forage/cover crop must be terminated before it is headed or budded
- Some are concerned with this and others aren’t
**How Much Carry Over Do You Need?**

- I sometimes hear “Changing to fresh corn silage never used to hurt milk production.”
  - But, we used to feed higher haylage diets in the past
- Bigger impact with high corn silage diets
- NDF Digestibility changes little during fermentation
- Negative effects of “fresh” corn silage are mostly due to starch digestibility

![Image](Dairy_Summit_2013)

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Starch digestibility increases after 3 to 4 months of ensiling (3 to 4 percentage points each month)

- Starch/Prolamin protein matrix degraded over time (Hoffman et al. 2011, JDS)
- Figure adapted from Newbold et al. (2006) showing increase in corn silage starch digestibility

![Graph](Dairy_Summit_2013)
Starch/Prolamin Matrix Degrades Over Time

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<td>Starch %DM (sugar incl.)</td>
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How Much Carry Over Do You Need?

- It costs money to inventory 3 to 4 months extra corn silage.
- It costs money NOT to inventory 3 to 4 months extra corn silage.
- Unless there are issues that deplete the extra corn silage, you only have to build carry over once (unless you increase cow numbers).
- It is frustrating to have carry over that is buried behind new crop. Get a plan ready.
How Much Carry Over Do You Need?

- “Cows start milking on new corn silage Jan 1st”
- How much milk loss from lack of carry over?
- Financial impact?
  - 8 lbs in Oct, 6 lbs in Nov, 4 lbs in Dec (conservative estimates in some years)
  - 6 lbs of milk for 3 months for 500 cows, $20/cwt = $54,900.
  - Add in $ for cow health, repro, depressed peaks, etc.

How Much Carry Over Do You Need?

- Cost of carryover (opportunity costs)?
  - Could have harvested the corn as HM Corn/Snaplage.
  - But, you need carry over for those ingredients also.
- Could have sold corn grain.
  - 500 cows x 60 lbs corn silage/hd for 3 mo = 1373 tons
  - 1373 tons/23 tons per acre = 60 acres
  - 60 acres x 170 bushels per acre = 10,200 bushels
  - 10,200 bushels x $5 = $51,000
- Definitely an advantage to having carry over
What if You Have no Carry Over?

- Can excellent processing overcome some of the negative effects of having little or no carry over?
- Can wetter corn silage over come some of the negatives of having no carryover?
- Can BMR over come some of the negatives of having no carryover?
- Put up a pile of short day corn and get it fermenting for one month?
- Plant a more floury variety to chop and feed first?

Kernel Processing

- Excellent processing will make higher corn silage diets more successful
- Most efficient site of starch digestion is the rumen, not the intestines or out the rear
**Value of Starch in Manure**

- In the example below, apparent total tract starch digestibility is estimated to be 74.7%. Using 5% starch and 90% ATTSD there is about 3.1 lbs of corn per cow going through. Using $5 corn that adds up to 28¢/cow/day.
- $ for milk loss and possible cow health issues?
- I like to see less than 3% starch in the manure.

**Starch Digestibility**

- Highly digestible starch can make it a challenge holding butterfat, especially during the summer.
- Rapid drop in rumen pH can cause trans FA to form
- Limit the amount of vegetable oil/LCFA in high corn silage diets
- Wet HM corn/Snaplage in a high corn silage can result in very rapid starch digestion
- Can we decrease starch as digestibility increases over time or will we lose milk?

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**FEED NAME**: dairy solid

**ANALYSIS TYPE**: MISCELLANEOUS

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<td>Starch fecal</td>
<td>12.89%</td>
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<td>1.92%</td>
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Target levels for lactating dairy cows are 5% or less on a DM basis. At 5% fecal starch, the total tract starch digestibility is over 90%.

Samples over 10% fecal starch should examine the processing of corn grain and corn silage.

(Perguson - University of Pennsylvania)

ATTSD is Apparent Total Tract Starch Digestibility
Effective Fiber

- Must have enough effective fiber to maintain a good rumen mat
- Penn State Shaker Box, Z-Box
- Monitor sorting, cud chewing, manure consistency, foot health, and milk fat

Shredlage™/Longer Particle Length

- More effective fiber from longer corn silage
- Longer particles must not be sortable
- Length and processing with a Shredlage™ processor is hard to beat
- Setting up a chopper with 30+% differential between the processor rolls can get close but it is difficult to equal Shredlage™
- Do not give up kernel processing to get more length
- How much length do we really need? I don’t think we know yet.
**Longer Corn Silage**

- Making longer corn silage that ends up in refusals adds no effective fiber

**NDF Digestibility**

- If corn silage makes up a larger portion of the diet, corn silage NDFD has a bigger impact
- High corn silage diet will typically have higher NDFD. Corn silage has greater NDFD than majority of haylage.
- We combat low forage NDF digestibility by decreasing forage
- BMR vs Conventional Corn Silage (yield drag is an issue when limited on acres)
- For every 1 unit increase in forage NDFD (in vitro or in situ) = + 0.37 lb/d DMI and + 0.55 lb/d 4% FCM
  (Oba and Allen 1999, JDS 82:589)
Milk Protein

- Experience tells us that milk protein is typically higher in higher corn silage diets.
- Increased microbial protein production from TDN, digestible fiber, and sources of protein that are more readily used by rumen microbes?
- Can feed more sources of RDP with a more favorable pattern of degradation for the rumen microbes?
- Can feed lower crude protein levels in high corn silage diets than higher haylage diets.
- Milk protein makes up over half of the Class III milk price (58% of the value of Nov 2013 Class III milk)

Potassium in High Corn Silage Diets

- Very little/no haylage results in very low K (1.1 to 1.2% of DM) diets
- NRC requirement for K set at about 1 to 1.1% of DM
- Research indicates a possible need to increase K for milk production and milk fat. Increasing K has reduced production of trans FA in the rumen that can depress milk fat.
- Is it an issue at all times of the year?
- Probably a bigger issue in Summer and when corn silage starch is very fermentable
**Strategies to Increase K/DCAD**

- Decrease NaCl and feed KCl to meet Cl
- Will need to increase S-Carb or NaBicarb for Na
- Can gain about 0.2% K (as % DM) and increase DCAD about 40 mEq/kg DM
- Feed Potassium Carbonate to further increase K
- Feed Delactose Permeate/Whey Permeate
- Feed a molasses or a molasses/whey blend. Beet molasses has more K than cane molasses.
**Alfalfa and Corn Silage Yields**


- From 2007 to 2010 WI averaged 5 tons of alfalfa DM/acre (Hay&Forage 2010, Studying On-Farm Alfalfa Yield, Rankin, UW Agronomy)

  1\textsuperscript{st} crop = 1.6, 2\textsuperscript{nd} = 1.25, 3\textsuperscript{rd} = 0.95, 4\textsuperscript{th} = 0.78, 5\textsuperscript{th} = 0.38

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**Cost per Acre to Raise and Harvest Corn Silage and Alfalfa Haylage**

Rent = $250/acre

Costs about $640/acre to raise and harvest corn silage

\[
\frac{640}{8 \text{ ton DM}} = \frac{640}{8 \times 0.35} = \frac{640}{22.86} = \frac{640}{22.86} = 28/\text{ton as-fed}
\]

Costs about $600/acre/year to raise and harvest alfalfa haylage (3.5 year stand)

\[
\frac{600}{5 \text{ ton DM}} = \frac{600}{5 \times 0.45} = \frac{600}{11.1} = \frac{600}{11.1} = 54/\text{ton as-fed}
\]

Harvesting, hauling, and packing costs:

Corn Silage = $115/acre, Alfalfa = $71/acre x 4 crops

Costs do not include covering

(USDA, NASS WI Custom Rate Guide 2010)
**Corn Silage’s Impact on Feed Costs**

- Which diet costs more, a high corn silage diet or a diet with more alfalfa haylage?
  - Is the protein in haylage less expensive than the protein in commodities?
  - We will look at some example diets

**Corn Silage’s Impact on Feed Costs**

- Corn silage at $50/ton as-fed (34% DM)
- Alfalfa haylage at $150/ton as-fed (45% DM)
- 50% forage, 60 lbs DMI
- 16.5% crude protein
- 2.9:1 Lys:Met
- 0.9% Ca, 0.36% Mg
- Use S-Carb, KCl, NaCl, and K-Carb to maintain 1.3% K, 0.5% Cl, 0.39% Na
- 26% starch in diets with 90%+ corn silage as % DM
- 27% starch in other diets
- Alfalfa hay at $320/ton, Straw at $130/ton
- $190 Corn, $320 Canola, $150 CGF, $355 Cotton, $200 Soyhulls, and $1200 Blood meal
- 2 lbs Soyhulls, 2.2 lbs cottonseed, 0.5 blood meal
### Corn Silage's Impact on Feed Costs

<table>
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<tr>
<th>CrnSlg as % forage DM</th>
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<th>80</th>
<th>80</th>
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<td>Ingredients, lbs DM</td>
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<td>Haylage</td>
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**$/Cow/Day Market Value for CS Hlg**

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- 50% forage, 60 lbs DMI
- 16.5% crude protein
- 2.9:1 Lys:Met
- 0.9% Ca, 0.36% Mg
- Not worried about K, Na, Cl because feeding DLP
- 23% starch in diets with 90%+ corn silage as % DM
- 24% starch in other diets
- Alfalfa hay at $320/ton, Straw at $130/ton
- $190 Corn, $320 Canola, $150 CGF, $355 Cotton, $200 Soyhulls, and $1200 Blood meal
- 2 lbs Soyhulls, 2.2 lbs cottonseed, 0.5 blood meal, 0.5 lbs S-Carb, 4.5 lbs DM DLP across all diets

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</table>

**Corn Silage’s Impact on Feed Costs**

- Big advantage to higher corn silage diets when using market costs for corn silage and haylage
  - Can feed lower priced commodities
- Using actual cost to produce haylage improves the value of protein in haylage vs commodities
  - Difference tightens, but still an advantage to higher corn silage diets when using actual costs to produce forages
**Corn Silage’s Impact on Feed Costs**

- Randall Greenfield’s Diet Comparison
- Low corn silage vs. high corn silage
- Prices recorded 1st of the month since Jan. 1, 2006
- Forage values determined by:
  - Corn silage = 10 X /bu price of corn
  - Haylage = USDA alfalfa hay value adjusted for moisture

<table>
<thead>
<tr>
<th></th>
<th>High Corn Silage</th>
<th>Low Corn Silage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Silage</td>
<td>60.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Haylage</td>
<td>24.1</td>
<td>56.9</td>
</tr>
<tr>
<td>Dry Corn</td>
<td>10.1</td>
<td>16.3</td>
</tr>
<tr>
<td>Wet Distillers</td>
<td>8.6</td>
<td>4.3</td>
</tr>
<tr>
<td>Cottonseed</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Protein</td>
<td>5.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Mineral</td>
<td>1.6</td>
<td>1.2</td>
</tr>
</tbody>
</table>
Corn Silage’s Impact on Feed Costs

- Results?
- High Corn Silage diet vs. Low CS diet:
  - Avg Since 2006 = 11¢ advantage to high CS
  - Avg 2013 YTD = 11¢ advantage to high CS

Summary: High Corn Silage Diets

- Usually more consistent diet
- Winter small grain followed by corn silage increases total yield per acre
- 3 to 4 months of carryover is a must
- Always important to process well
- Longer (unsortable) corn silage contributes effective fiber
- Strategy to raise dietary K/DCAD may be needed
- Corn silage yields more and costs less per acre to produce and harvest than alfalfa
- High corn silage diets are more cost effective in the current market situation
Questions?