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Maximizing Forage Quality

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Take Home Points

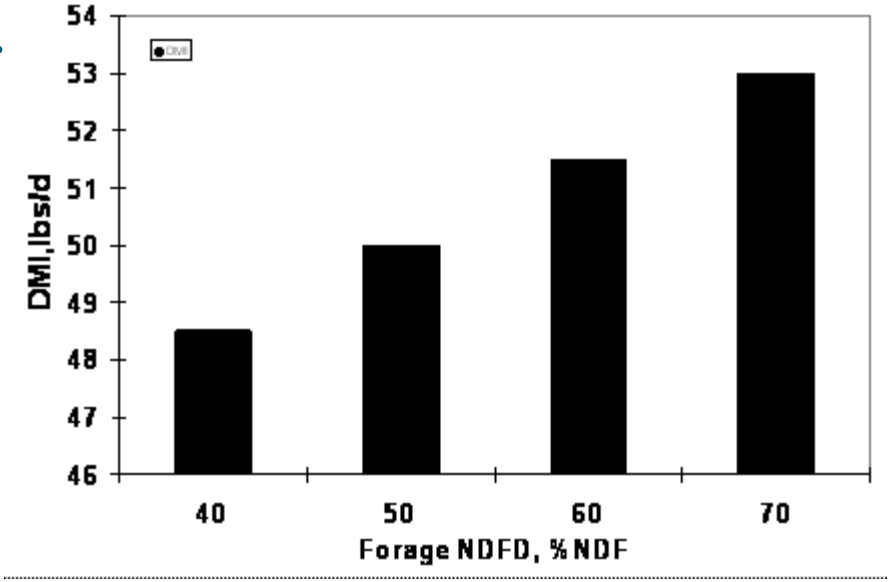
- Pick the right seed.
- Have enough, but not too much soil fertility.
- Harvest & storage management changes quality.

What is Forage Quality?

- A high quality forage increases an animal's production, efficiency, or health.

Increase Forage Quality by…

- Increasing digestible content.
- Increasing digestibility.
- Decreasing anti-forage quality factors.



Wisconsin

Take Home Points

- **Pick the right seed.**
- Have enough, but not too much soil fertility.
- Harvest & storage management changes quality.

Picking the right seed.

- Corn
- Alfalfa
- Grasses
- Small Grains

Corn: Maturity

- Later relative maturity corn **will be wetter** than earlier maturity varieties & delay harvest.

Table 2. Average whole plant moisture of hybrids in the 95-100, 101- 105, 106-110, and 111-115 relative maturity groups at Southview Farms in Livingston Co. on the same day of harvest in 2004, 2005, 2006, 2007, and 2008. About 10-20 hybrids represented each maturity group in each year of the study.

Hybrid Maturity Group	2004	2005*	2006	2007	2008*	Avg.
days			% moisture			
95-99	65.7	69.1	65.8	66.4	66.0	66.6
101-105	66.9	70.7	67.4	68.1	67.4	68.1
106-110	68.2	72.2	69.2	68.9	69.0	69.5
111-115	69.5	73.3	70.2	70.2	70.0	70.6

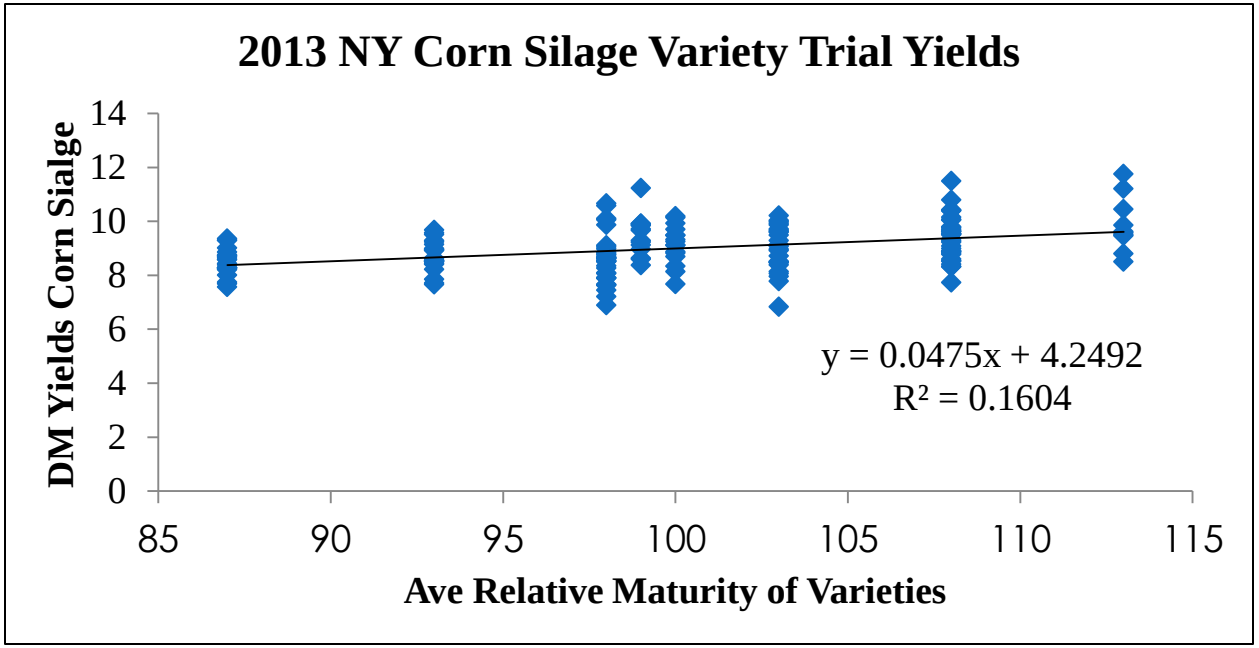
* The Western NY site was harvested on the early side in 2005, to avoid wind damage from remnants of Hurricane Katrina.

Table 3. Tasseling/silking and silage harvest dates (67-70% moisture), and number of growing degree days (GDD) from planting to silking , between silking and harvest, and total number from planting to harvest for 95-100, 101-105, 106-110, and 111-115 day hybrids planted in late April of 2003, 2004, and 2005 at the Aurora Research Farm.

Hybrid Maturity Group	Tassel/ Silk	GDD	Silage Harvest	GDD from Silking	Total GDD
Relative Maturity		°F	Date	°F	°F
			2003		
95-100	7/24	~1250	8/28	~775	~2025
101-105	7/27	~1300	9/5	~850	~2150
106-110	7/29	~1340	9/9	~850	~2190
111-115	7/31	~1380	9/11	~850	~2230
			2004		
95-100	7/20	~1250	8/31	~725	~1975
101-105	7/22	~1300	9/3	~750	~2050
106-110	7/23	~1330	9/5	~775	~2105
111-115	7/24	~1350	9/7	~800	~2150
			2005		
95-100	7/17	~1285	8/21	795	2080
101-105	7/19	~1330	8/22	815	2115
106-110	7/21	~1370	8/25	810	2180
111-115	7/22	~1405	8/26	810	2215

Corn: Maturity

- Yields generally are higher w/later maturities, but not as a rule.



Corn: Fiber

- Brown Mid Rib varieties have lower lignin which increase fiber digestibility (NDFD).
- Some conventional hybrids more NDFD too.

Corn: Starch

- Varieties with **vitreous** endosperm have more ***zein protein*** which is more resistant to proteolytic attack than other proteins found more in floury endosperm.
- But it's more important in corn grain.
- Fermentation reduces differences, traits not as pronounced at silage harvest.

High Sugar Corn

- **High-sugar corn**: no grain w/ yields ≤ normal dent corn.
- Feeding trials have shown **similar animal performance** from high sugar and normal dent hybrids.
- The plants stay greener longer and require a hard killing frost to dry down to acceptable ensiling moistures in upright silos.
- Wisconsin

Waxy Corn

- Normal corn starch contains about 75% amylopectin starch and 25% amylase starch.
- 100% amylopectin in waxy corn.
- Limited feeding trial data for corn silage suggest that waxy corn silage is **equal to normal corn for forage quality**.
- Waxy corn dries down slower.
- Wisconsin

High Oil Corn

- **High-oil** corn has greater energy than normal corn because the calorie content of oil is approximately 2.5 times greater than that of starch.
- Feeding trials show higher dry matter intake, but lower digestibility than silage of normal corn.
- Lower yields have been associated with elevated oil levels.
- Wisconsin

Alfalfa

- Little difference among varieties for forage quality.

Grass: Maturity

- Large range, heading dates: early, medium, late.
- Late maturity in alfalfa mixtures.
- May want a range of maturities in pastures.
- Harvest at boot stage.

Grass: Fiber

- Lots of potential for species and varietal selection.
- Species will differ in NDF.
- Plant varieties with higher NDFD.

Grass: Protein

- Some species (i.e. Timothy) are constantly 1-2% lower.

Grass: Sugar

- Some varieties & species have higher sugar.
- Large diurnal variation in sugar content.
- However much can be lost during harvest.
- Best suited for grazing systems with high fertility and moisture.

Grass: Palatability

- Again species differences and varieties differ considerably in palatability.

Small Grain Silage

- Few varieties available.
- Mostly species selection, mostly triticale, some oat, rye, & wheat.

Take Home Points

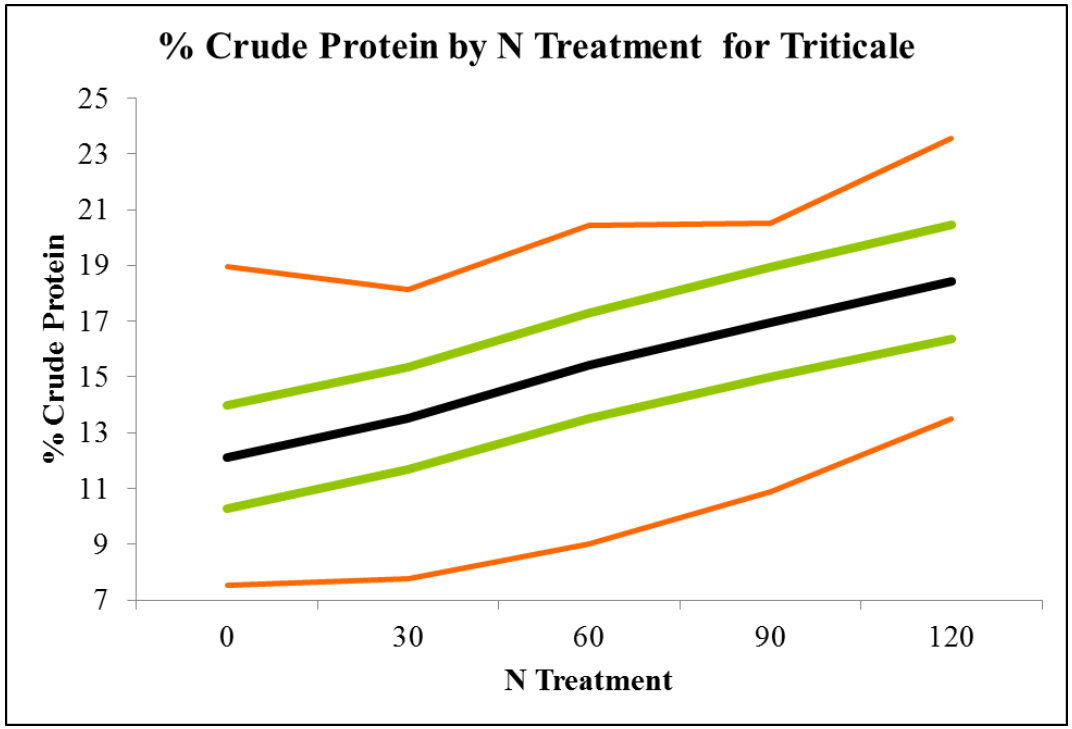
- Pick the right seed.
- **Have enough, but not too much soil fertility.**
- Harvest & storage management changes quality.

Fertility & Forage Quality

- Fertility has larger affects on yields than forage quality.
- Important to pay attention to the situations that matter.

Nitrogen Management

- Increasing N increases forage CP.
- **Grasses & Small Grains,** some in Corn Silage, little in Alfalfa



Nitrogen Management

- Accurately feed the right amount of CP
- Why? Above~ 16.7% CP, nitrogen goes out the back end in the urine as NH3.

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Grass tetany

- Too much N (>25% CP) & K (>3% DM) in forage during rapid spring growth with cloudy days
  - Low forage Mg (<0.2% DM)
- Corrected by
  - Feeding MgO or MgSO3 in diet
    - (free choice mineral with 10% Mg)
  - Liming with a dolomitic lime
  - Not applying K if soil tests high-excessively high

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Doesn't high K cause milk fever?

- Analyze all forages for mineral content
  - Feed corn silage and straw (low %K) to close up dry cows

- **Feed anionic salts (lower DCAD)**
  1. $MgSO_3$ until ration Mg 0.4% DM
  2. $CaSO_3$ or NH_4SO_3 until ration S 0.4-0.5% DM
  3. CaCl or NH_4Cl until
     - DCAD = -5 to -15 milliequivalents per 100 g DM

- Keep NPN <70% if using NH_4^+ salts

Doesn't high K cause milk fever?

- Raise Ca to 1.5-1.8 % of DM

- After 1 week check urine pH
  - >7.0 add more anionic salts
  - 6.5 to 5.5, ok
  - <5.5, remove some anionic salts

  - Don't use NaCl, KCl (doesn't change DCAD)
  - Keep NPN <70% if using NH4+ salts

Should I fertilize my soils with selenium?

- No
- Very small amounts needed in dairy rations, use a mineral mix if needed

Take Home Points

- Pick the right seed.
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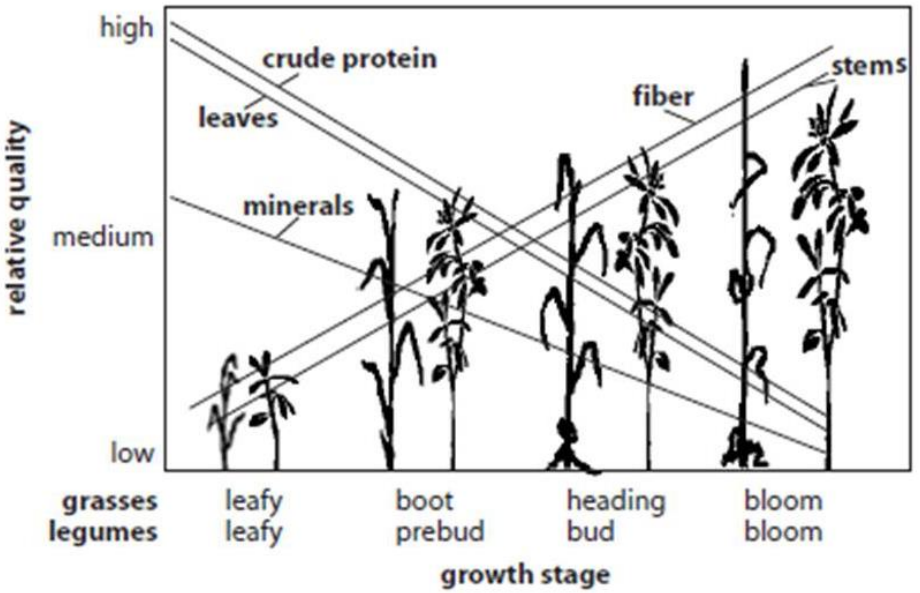
- **Harvest & storage management changes quality.**

Plant Maturity

- Younger plants have higher forage quality than older plants.
- CP, sugars, & fiber digestibility higher in young plants.



Understanding Forage Quality

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Harvest Timing Small Grain Silage

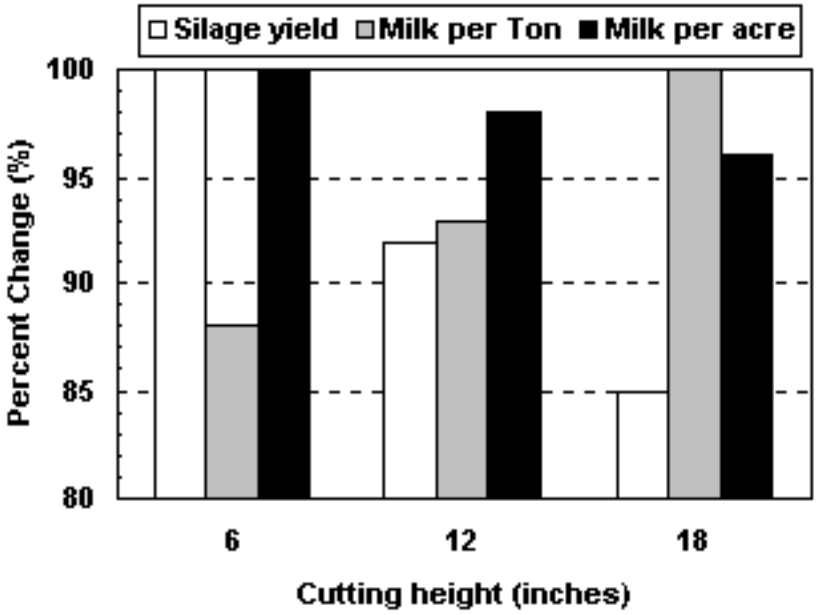
Feekes 9.0
(Flag Leaf)
Milk Cow
Quality

Feekes 10.0
(Boot Stage)
Heifers &
Dry Cow
Quality

- Crop will be between 24-40 inches tall at harvest
- Will be ready before alfalfa-grass haylage

Harvest Management

- Lower cutting height increases yield……
- But it reduces quality



Joe Lauer, University of Wisconsin, 1998, Corn Silage Yield & Quality Trade-offs When Changing Cutting Height

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Frost Damage

Table 1. Estimated risks to corn yield potential and quality from late-season frost damage.[2]

Corn Growth Stage	% Potential Yield Loss (Quality Concerns)	
	Killing Frost	Light Frost
Dough (R4)	40 (Severe)	25 (Severe)
Early Dent (R5)	25 (Moderate)	15 (Moderate)
Half Milk Line	10 (Minor)	0-5 (None)
Black Layer (R6)	0 (None)	0 (None)

NOTE: This table is meant as a guide. Differences among corn products, vigor at the time of frost, and subsequent temperatures will affect yield potential and quality.

Proper Processing

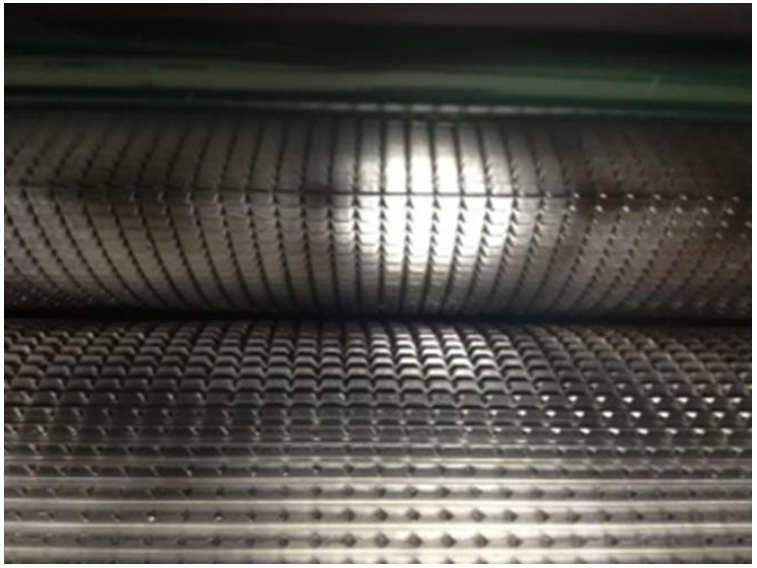
Screen	Pore Size (inches)	Particle Size (inches)	Corn Silage %	Haylage %	TMR %
Upper Sieve	0.75	> 0.75	3 to 8	10 to 20	2 to 8
Middle Sieve	0.31	0.31 to 0.75	45 to 65	45 to 75	30 to 50
Lower Sieve	0.16	0.16 to 0.31	20 to 30	30 to 40	10 to 20
Bottom Pan	N/A	< 0.16	< 10	< 10	30 to 40

When corn silage has been chopped & processed properly most of the material will be in the middle screen of the Penn State Shaker Box.

Penn State University

Shredlage

- Early on-farm use in western NY is showing small increases in milk production.



Proper Processing

- *551 Samples, CVAS 2006 Crop Year.*
- Most of the corn silage has room for improvement as **less than 10% of all samples have optimal processing scores.**
- Shredlage corn silage is mostly “Optimally Processed”.
- The reason why most scores are lower than desired is that adjustments are often not made to the chopping equipment during harvest.

Ranking	% Pass Through 4.75 mm screen	% of Samples
Optimally Processed	>70	7
Adequately Processed	50-70	46
Inadequately Processed	<50	47

Physically Effective Fiber

- Increase forage chop length increases peNDF.
- TMR 20-22% of particles on the 19-mm and the 8-mm sieves of the Penn State Particle Separator.
- For the forages, ≥60% should be retained on the top two sieves.

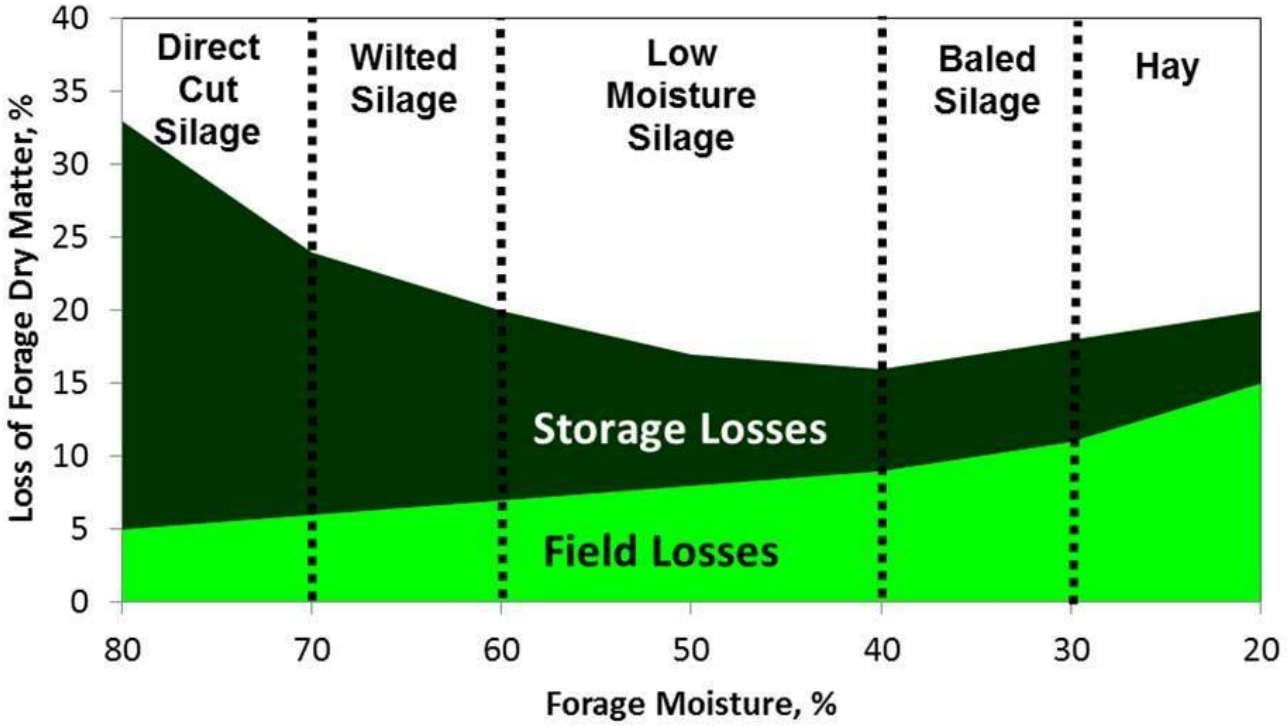
Leave Corn Silage in the Bunk

- Starch availability **increases as the silage cures** in the bunk or silo.
- Generally conventional corn silage varieties need to be stored for **3-6 months** to maximize the availability of starch.

Balage

- Bale at 40-60% moisture.
- Use 5-8 layers of 1 ml of plastic w/50% overlap

Moisture at harvest



Proper feed-out

- Minimize area of bunker, bag, or pile exposed to air.