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Agriculture and Natural Resources

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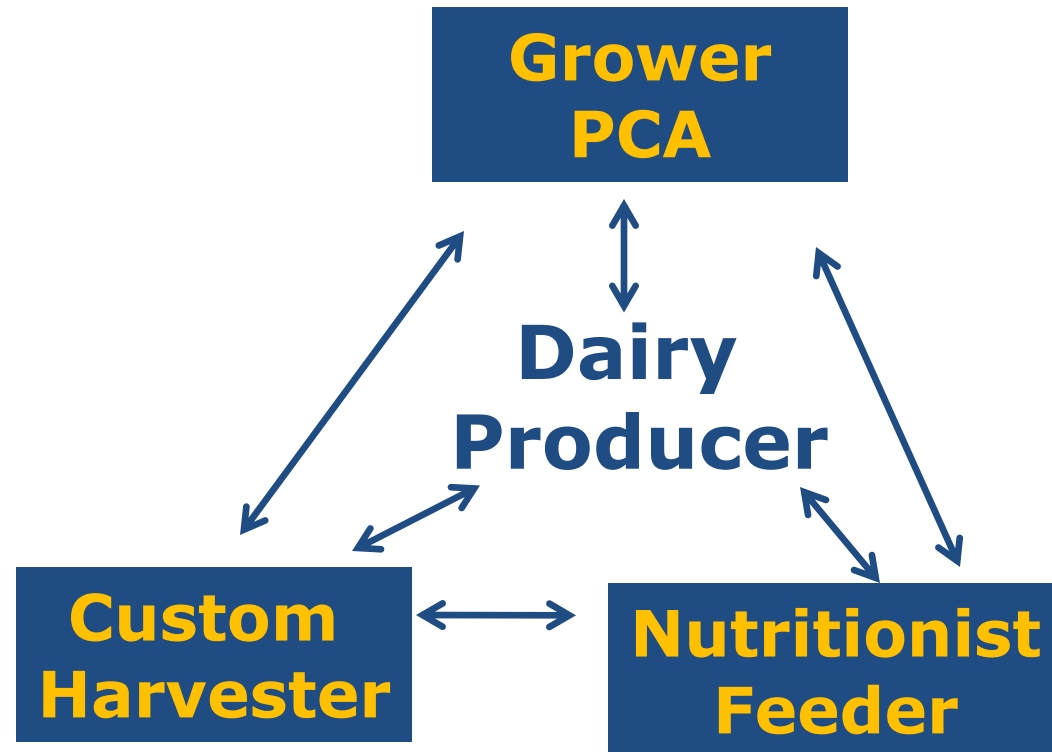
Opportunities to Improve Corn Silage in California

Noelia Silva-del-Río, UCD Vet Med Specialist
Jennifer Heguy, Farm Advisor



High Quality Corn Silage

- Cultural Practices
- Harvesting
- Storage
- Feedout



Outline

- Harvest
 - Targeting proper dry matter
 - Kernel processing and theoretical length of cut
- Storage
 - Packing density
 - Covering
- Feedout
 - Face management

When Is The Corn Ready For Harvesting?

Harvesting

Target 30-36% Dry Matter

Too early < 29%

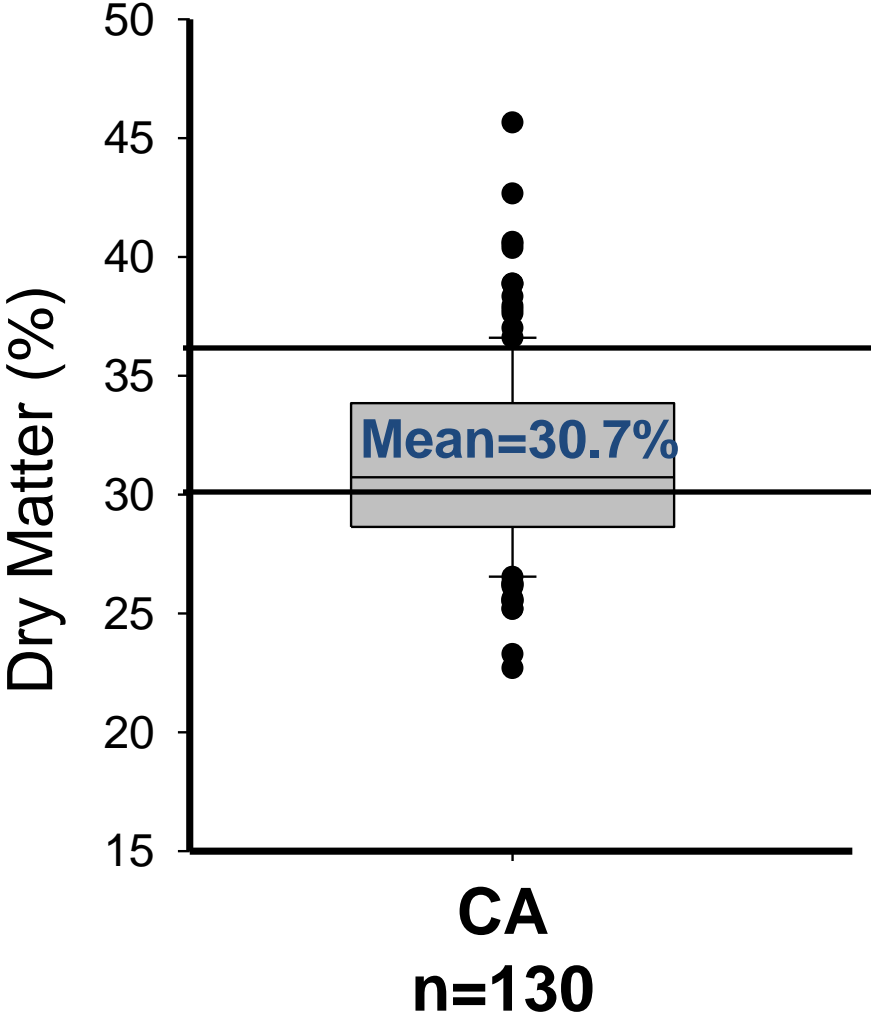
- Low Starch
- Acetic Acid > 4%
- Total fermentation acids > 10%
- Seepage

Too late > 36%

- Starch Digestibility
- Aerobic Stability
 - Packing
 - Lower production of acids that inhibit yeast

**At what DM is corn
harvested in CA?**

Harvesting

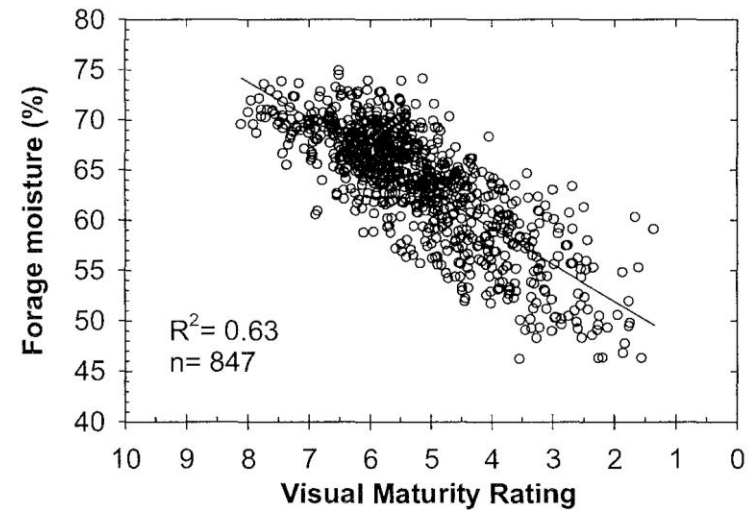
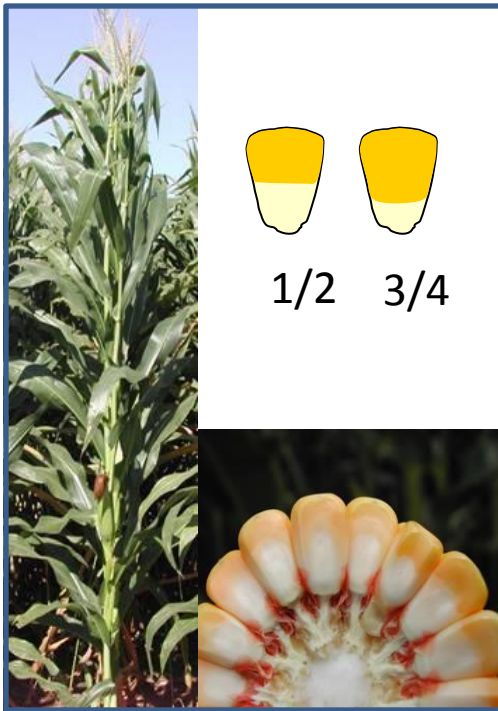


How Do We Determine Dry Matter?

Harvesting

Dry Matter Estimation Visual Evaluation

Milk Line (2/3) Stover Maturity



(Lauer, 2006)

Harvesting Corn Silage

**Dry Matter Determination
Empirical**



Dry Matter Determination of the Corn Crop Prior to Harvest

Noelia Silva-del-Río, UCCE Tulare County, Dennis Craig and Vernal Gomes of Mycogen

The dry matter of the crop standing in the field can be estimated by evaluating the greenery of the canopy, breaking down the stalk and examining the kernel milk line. But, how well does that relate to actual dry matter? We suggest you to take a new approach that may help you to more accurately determine the dry matter of the crop standing in the field.



Step 1. Take a representative sample of the field. **Select 10-20 plants** at different locations away from the head or tail of the field. Enter the field several rows from the edge. You can use a machete or pruning shears.



Step 2. Hand feed the plant to a **chopper** (you can use a chipper shredder). Place a bag to collect the chopped material.



Step 3. Take a **representative sample**:
Method 1 (more accurate): divide your sample in quarters and discard two opposite quarters. Mix the other two quarters and repeat until you get a 1lb sample, or volume of 5-7 cups.
Method 2: Mix the pile well and collect 5-7 cups of forage throughout the pile.



Step 4. Place your **sample in a plastic bag and keep on ice**. Take the sample quickly to a lab or to your dairy for dry matter determination. It is important to get the wet weight as soon as possible.



Step 5. Use approximately **100 g** for **microwave method** or **200 g** for **Koster Tester** (1lb = 454 g). You may also find a nearby lab where you can get timely results.

Kernel Processing and Theoretical Length of Cut

Harvesting

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

Harvesting

Guidelines: Harvesters Settings *(by Mike Hutjens)*

<33% DM

0.75 -0.90 in. TLC
Open rollers

33-38% DM

0.75 -0.90 in. TLC
0.12 in. Rollers

>38% DM

0.50 in. TLC
Close Rollers

Harvesting

Evaluate the Broken Kernels



Separate kernels in a bucket of water

Guidelines:

- **90 - 95% cracked**
- **70% smaller than $\frac{1}{4}$ of a kernel**

Nicking and Crushing is not enough

Physical Form

Corn Silage Processing Score



Coarse Fraction > 4.75mm:
Fiber will stimulate chewing activity.
Starch will be poorly digested.

Fine Fraction < 1.18mm:
Fiber may not contribute to chewing activity or physical effectiveness.

**Starch (%) passing through
the coarse screen**

Ranking

> 70%

Optimum

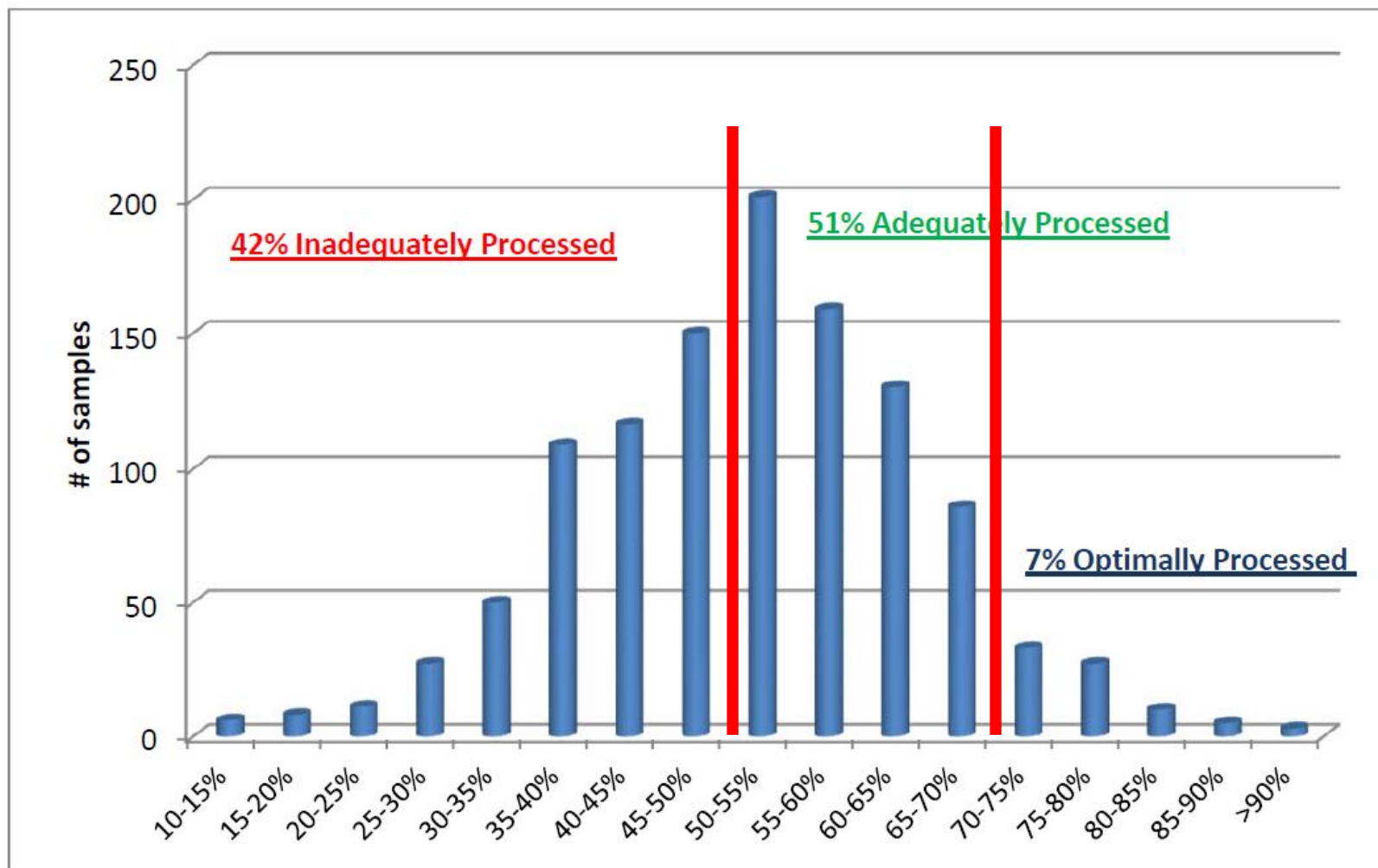
50 -70%

Average

< 50%

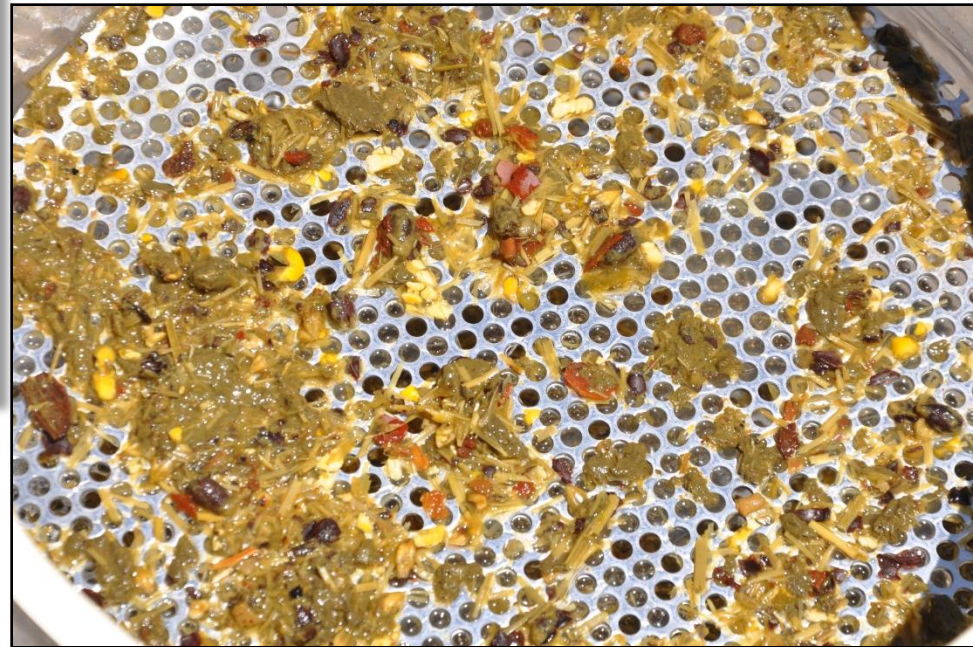
Inadequate Processes

Corn Silage Processing Score



Cumberland Lab, 2009 -2011 (n=1131)

Result of Poor Processing



Harvesting

Evaluate Forage Particle Length

	3/4 TLC Processed	3/8 TLC Unprocessed
Top	5-15	3-8
Second	>50	45-60
Third	<30	30-40
Bottom	<5	<5



Packing Density

Packing Density

- **Dry matter**
- Delivery rate
- Tractor weight
- Tractor time
- Length of cut
- Packing layer thickness



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Packing Density and DM Losses

Density (lbs DM/ft ³)	DM Loss, 180 days (%)
10	20.2
14	16.8
15	15.9
16	15.1
18	13.4
22	10.0

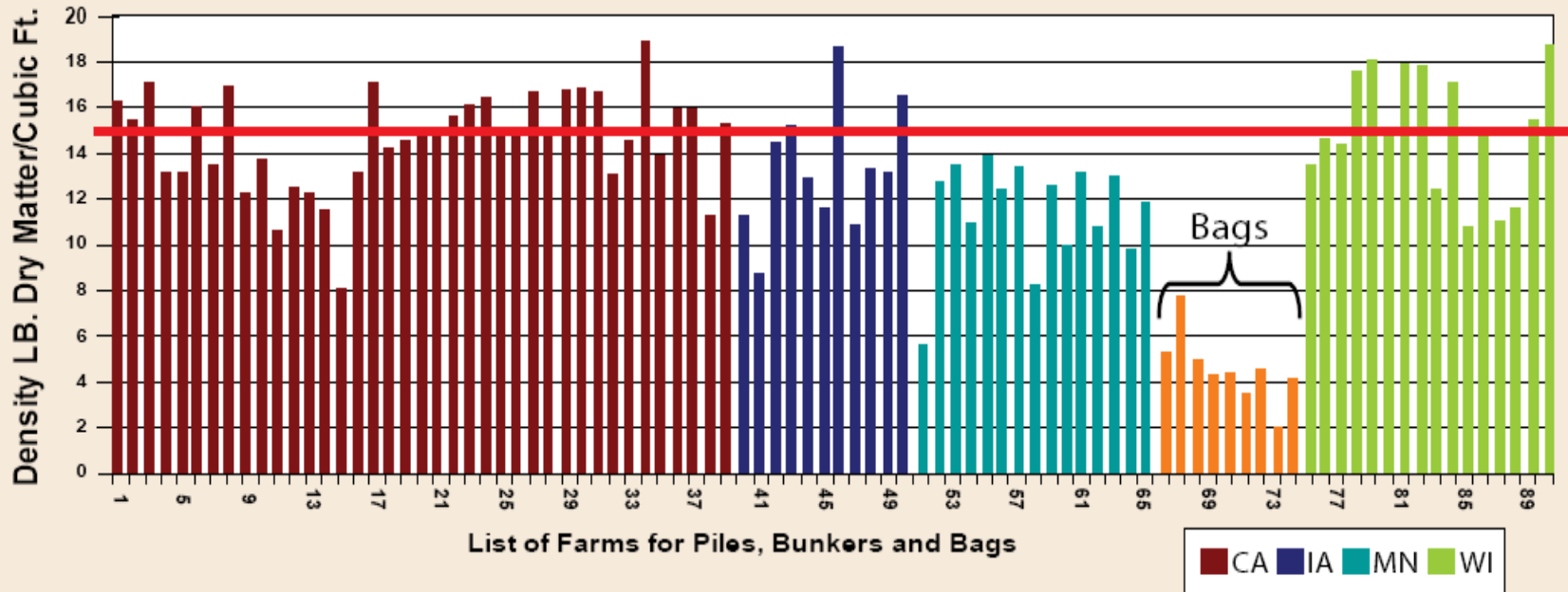
**Increased density =
greater silo capacity +
reduced losses**

**Dry matter loss as
influenced by silage
density (Ruppel, 1992)**

Packing density in California silage structures

Packing Density

2005 - 2006 Monsanto Corn Silage Density Samples in CA, IA, MN and WI
37.0% of the Dairies sampled (30 of 81 total) were above the target density of 15 lb/Ft³



Packing Density

2010 Silage Survey



By Mr. Caley Heiman

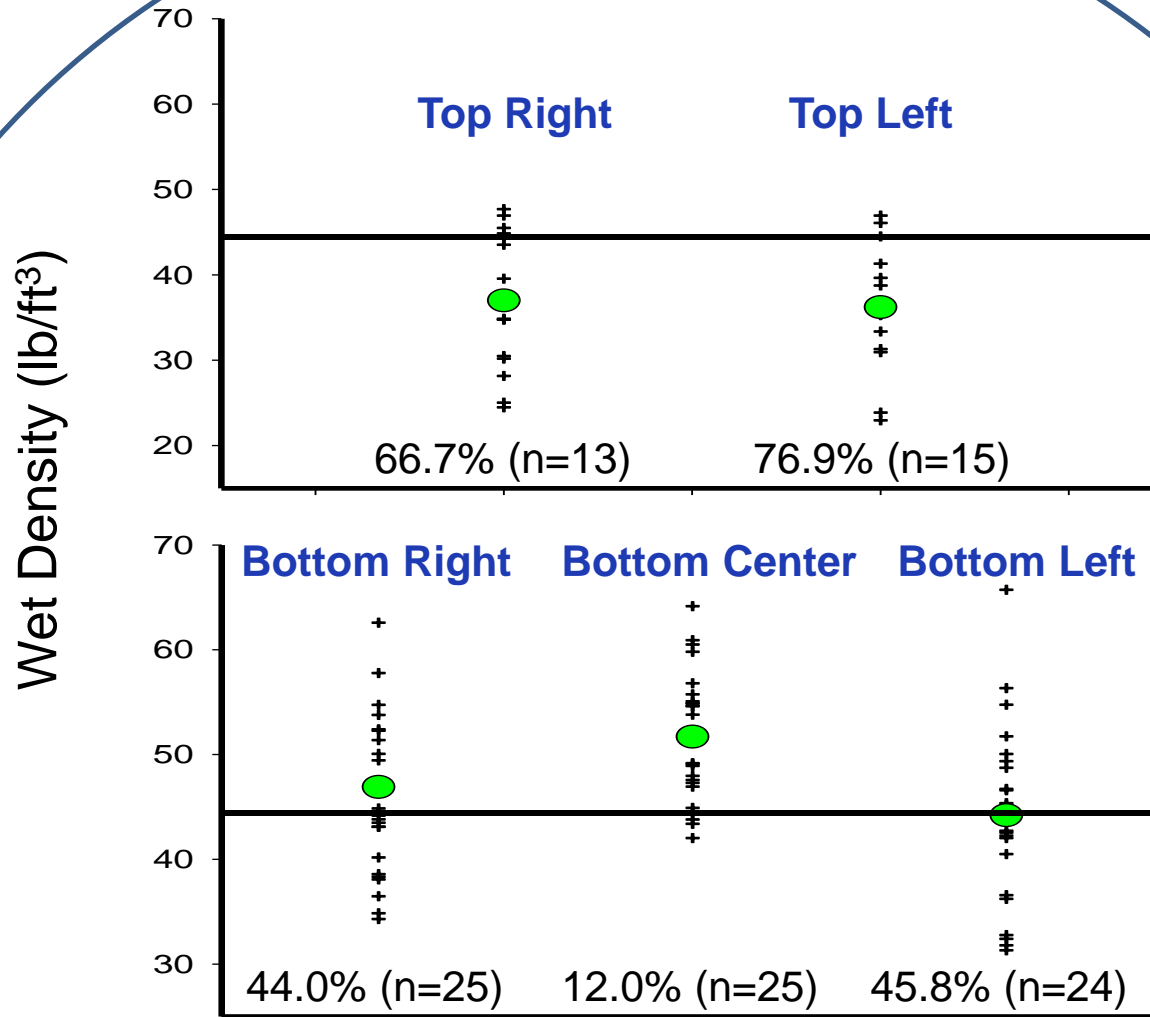


Packing Density

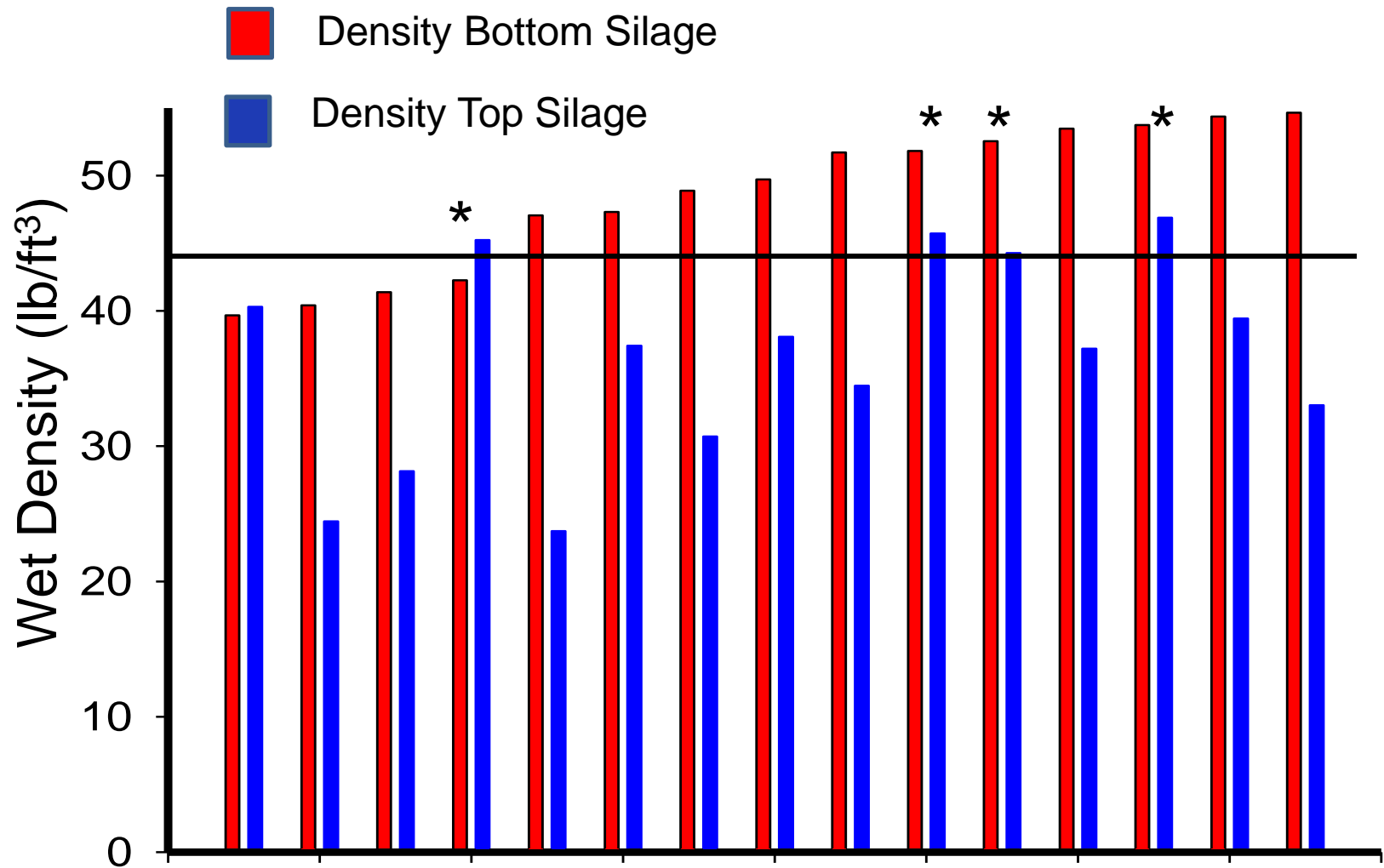
2010 Silage Survey Silage Structure Description

- **Type: 22 piles, 2 drive over piles, 1 bunker**
- **Height: 14 to 30 ft**
- **Dry Matter: average 35% (range = 27 - 42%)**
- **Sample Points: bottom (right, center, left) and top (right, left).**

● Average Density



Percentage of wet density samples below 44lb/ft³ for each of the sample locations.



Packing Density in the Top and Bottom of Silage Piles.

Packing Density

Most of the surveyed silage structures were well packed at the bottom. This may be partially due to the compaction force that the upper forage mass exerts on the bottom.

There is an opportunity to improve silage packing on the top of the silage structure.

COVERING

Covering

Why should I cover my silage?

- Reduces DM losses between 16 to 37% in the top 18 inches (no covering= up to 60% DM losses)
- Good management minimizes the need to discard spoiled silage on the surface.



Covering

- Pack the last layers of forage very well
- Cover as soon as possible
- Use good quality plastic (5mm /0.2 inches)
- Use two plastic layers or OBT (oxygen barrier technology)
- Overlap plastic layers 3 to 4 ft
- Place enough weight, especially where the plastic layers overlap

Plastic Maintenance

The job isn't finished once the cover is in place!

- Routinely check silos for tears in plastic
- Mow area surrounding structures
- Remove debris



Silage Feedout

Corn Silage Feedout

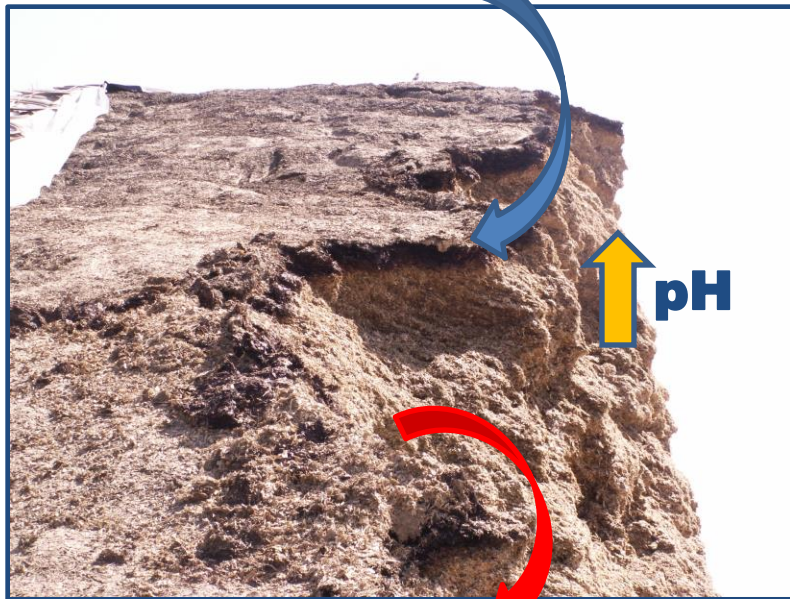
What happens during feedout?

Silo is exposed to oxygen



Corn Silage Feedout

O₂



CO₂ + H₂O + Heat

Silage is exposed to oxygen

Yeast metabolizes lactic acid

pH increases

Undesirable microorganisms grow

Risk Factors for Aerobic Stability

Packing Density: poor packing favors air penetration

Temperature: in the summer yeast and molds grow faster

Starch/sugar in the crop: corn silage is more susceptible than alfalfa silage

Organic acids: acetic, propionic or butiric will inhibit yeast growth

Corn Silage Feedout

- **Depth and width of the face removed**
- **Smooth face**
- **Discard spoiled forage**
- **Minimize silage sitting before feeding**

Depth of Face Removed

Bags

12 inches/day



Piles and Bunkers

6 inches /day



This is the minimum removal rate recommended to prevent heating, based on field observations

Depth of Face Removed

In a well packed bunker, air can move 3ft inside the forage mass.

With a removal rate of 6 inches/day the forage will be exposed to oxygen and microbial deterioration a week before feeding.

So, even if we don't observe heating, removal rate should be higher.

Muck and Huhnke, (1995)

Depth of Face Removed

Bags

12 – 18 inches/day



Piles and Bunkers

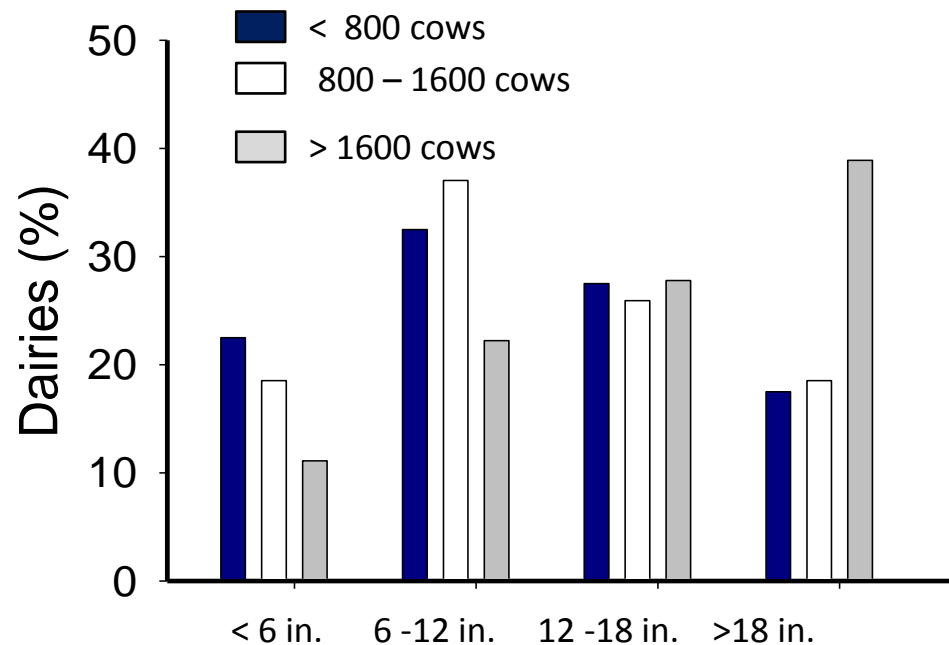
Winter: 12 inches /day

Summer: 18 inches /day



Depth of Face Removed

Depth of the Corn Silage Face Removed per Day by Herd Size



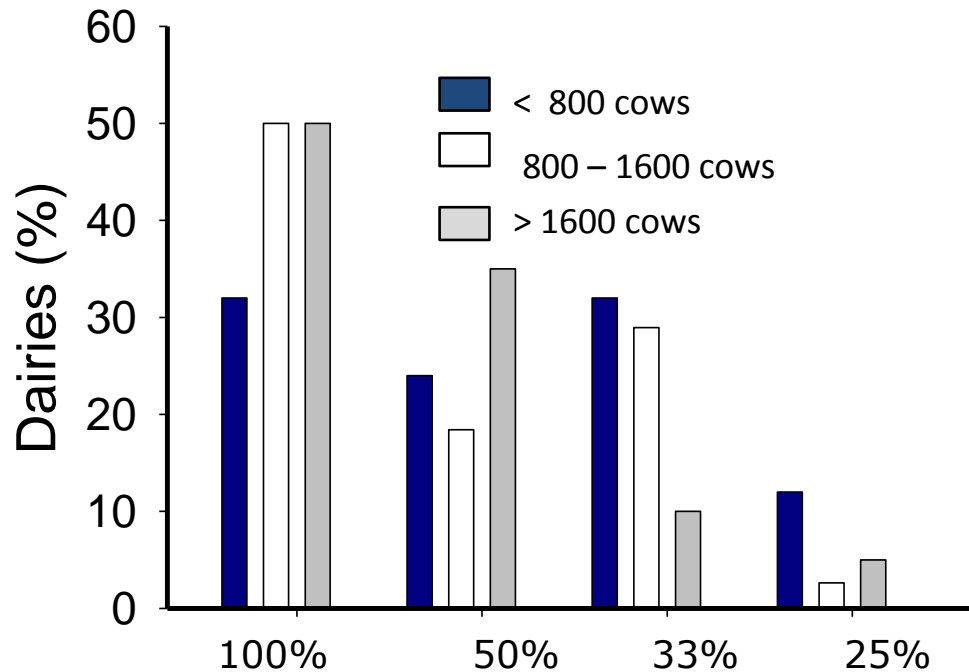
Width of Face Removed

Is your silage structure properly sized for your herd needs?



Width of Face Removed

Width of the Corn Silage Face Removed per Day by Herd Size



Width of Face Removed

If the face is too big to advance the recommended depth, what do you do?

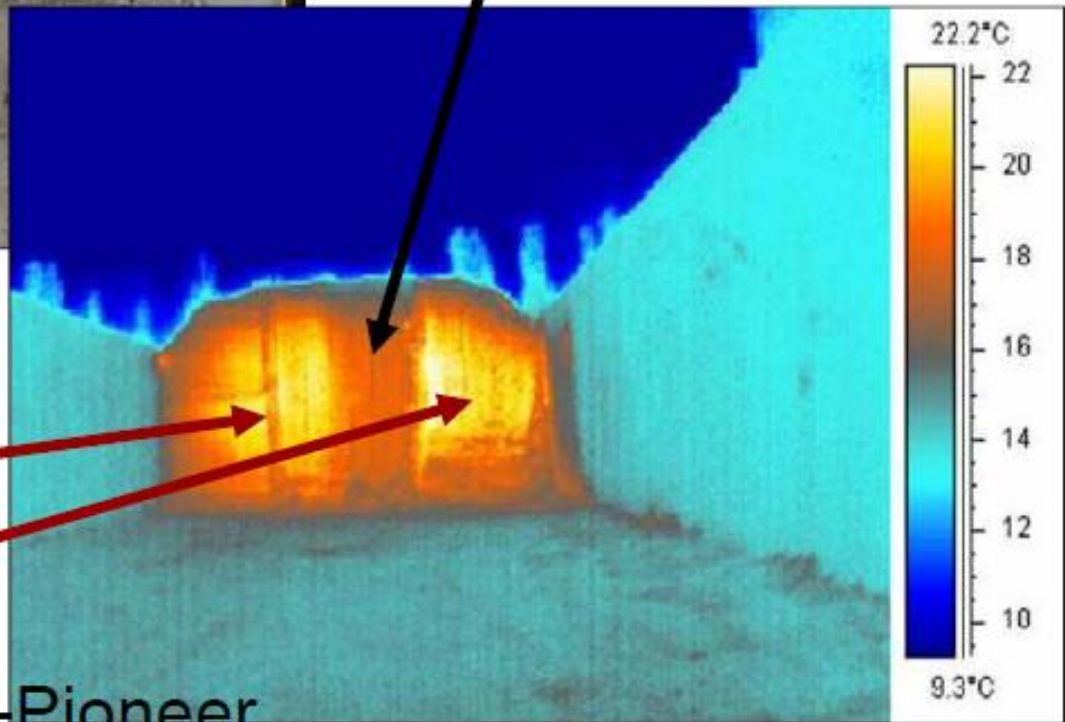
- Do you extract forage throughout the entire face but depth is lower than recommended?**
- Do you split the face in portions?**





Notice area where last faced which is not as hot because aerobic bacteria just starting to multiply

Areas that have had more time for oxygen to penetrate and fuel growth of aerobic organisms causing heating

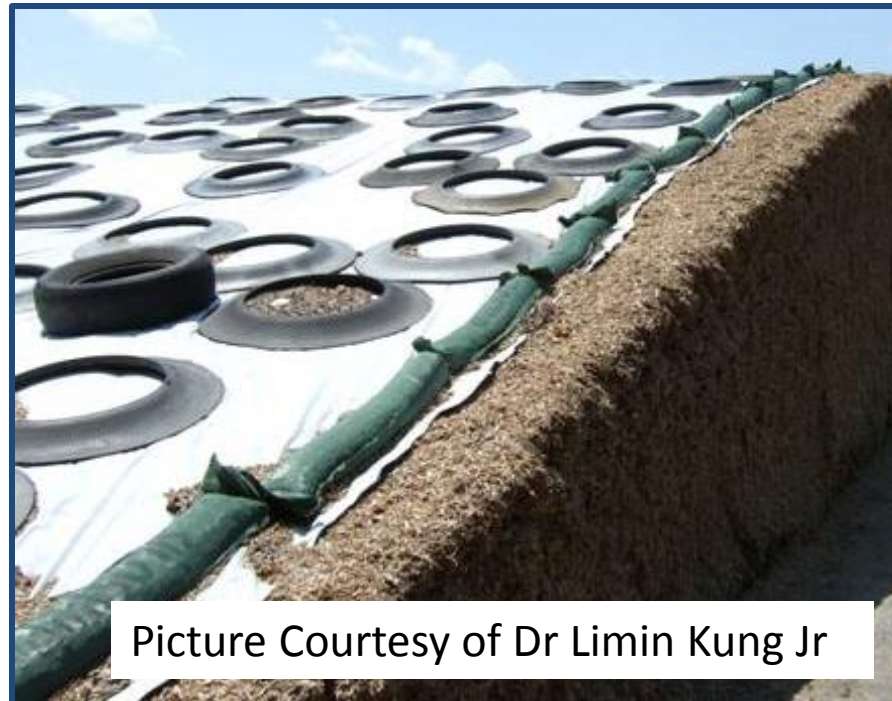


Source: Bill Mahanna-Pioneer

Information obtained from:
<http://kewaunee.uwex.edu/ag/documents/GettingtheMostOutOfStorage.pdf>

Smooth Face

Silage face should be smooth, with no fractures, and perpendicular to the floor.



Picture Courtesy of Dr Limin Kung Jr

Dairy 1





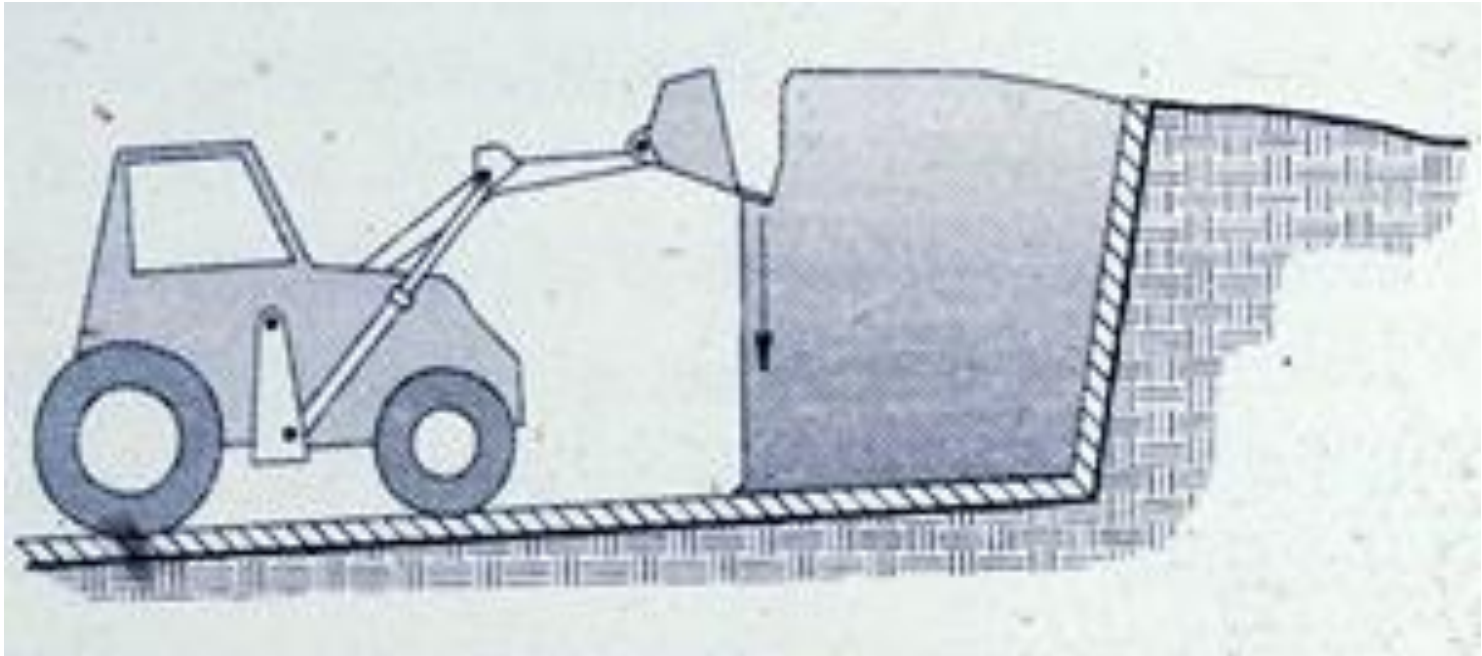






Dairy 1





Picture Courtesy of Drs Norell and Chahine

Dairy 2















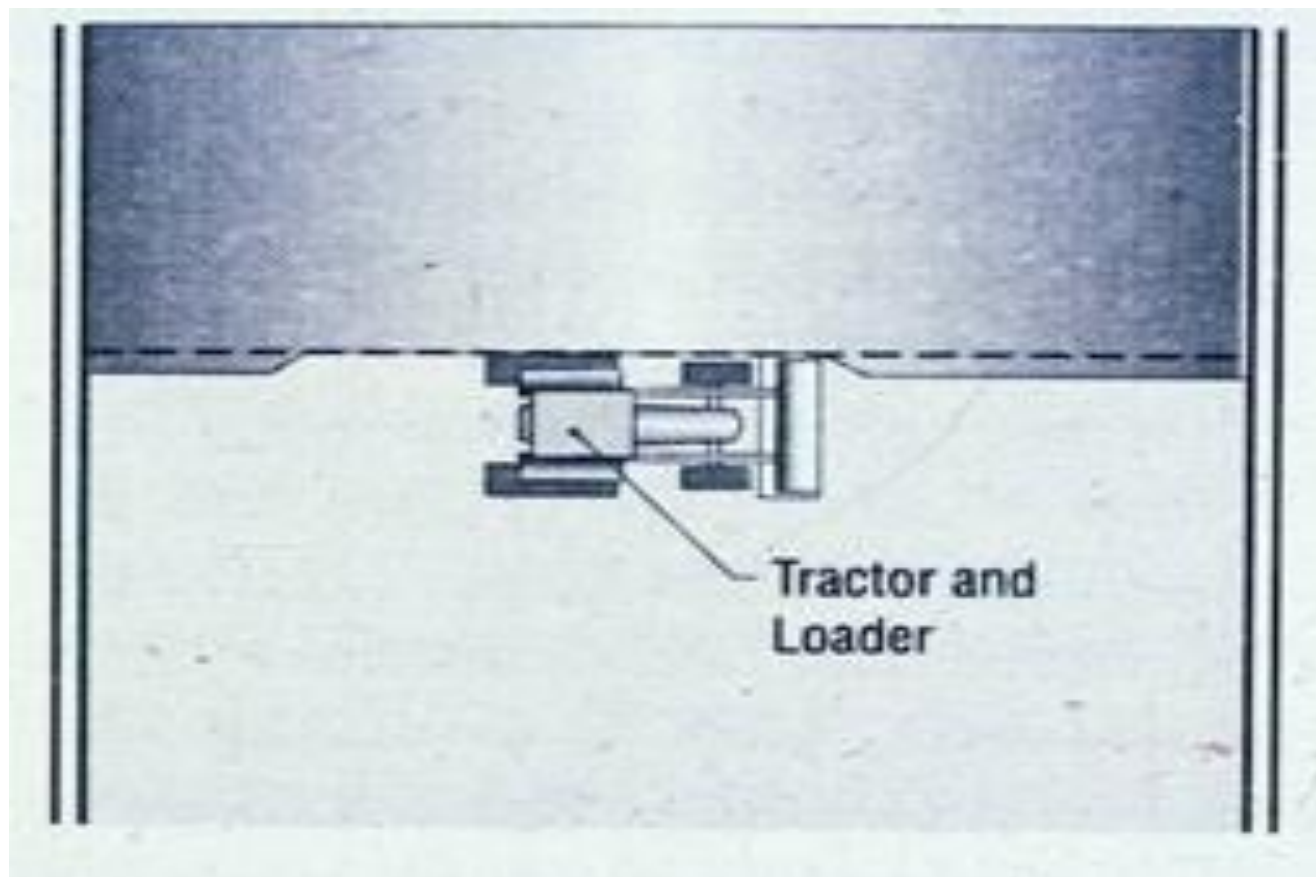






Dairy 2





Dairy 3



Mechanical device to extract silage

PROS

- Reduces the surface area of silage (9% corn, 26% alfalfa)
- May result in up to 3% less DM losses

CONS

- Equipment cost
- Increase feeding time



Discard Spoiled Silage

We don't want to **fed spoiled forage** to COWS:

- Decreases intake and digestibility
- Destroys rumen mattress

We don't want to **remove spoiled forage**:

- Safety issues
- Worker's time



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- Place enough weight, especially where the plastic layers overlap

Silage Sitting Before Feeding



Silage exposed
to oxygen and
sun

\$\$\$

Silage Sitting Before Feeding

- Remove silage prior to feeding. Consider doing it several times a day.
- Once removed, make a pile to minimize the exposure to oxygen, sun or rain.
- Remove only what is needed for that day.
- Leftovers from the previous day should be fed to low production cows, dry cows, or heifers.

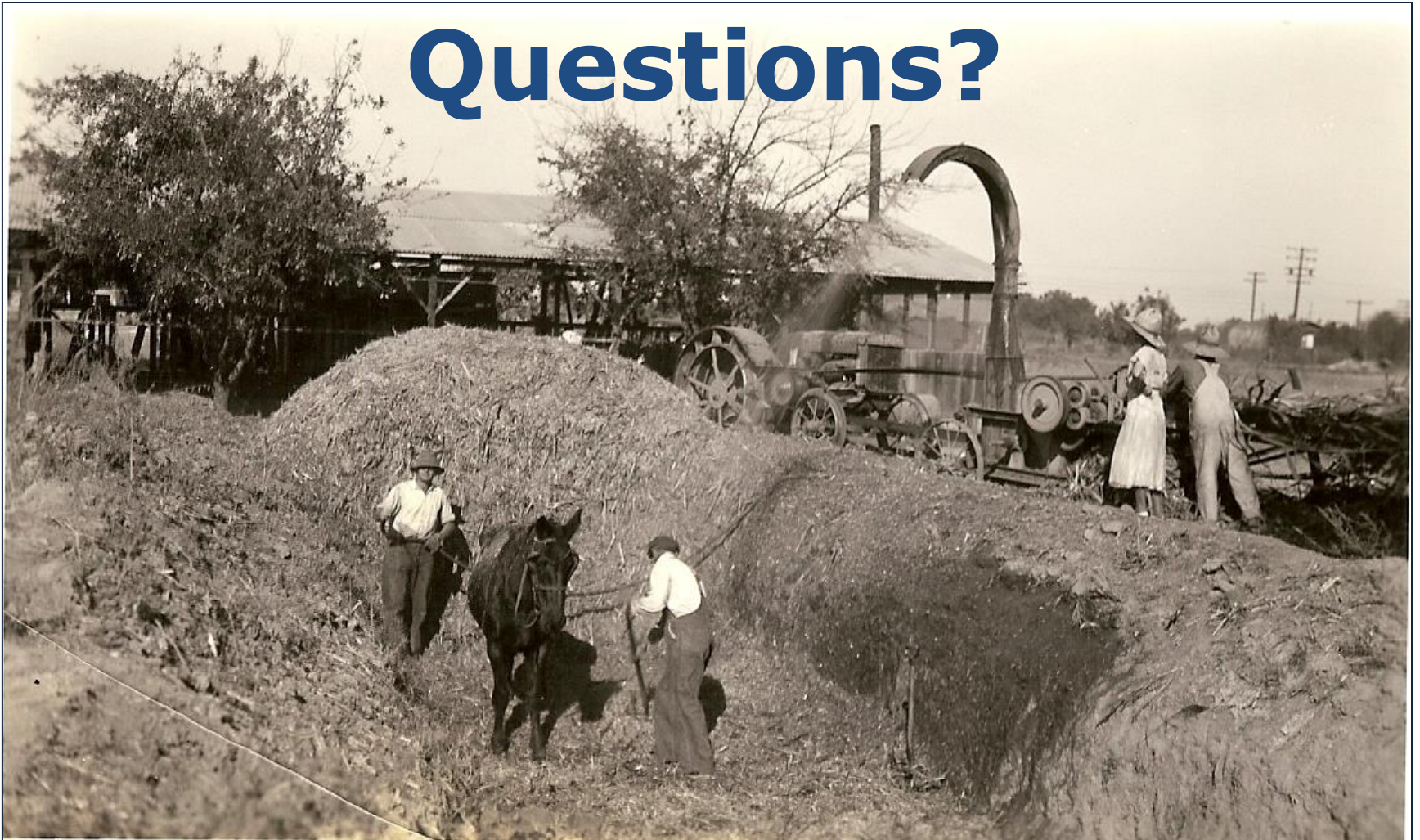
In Summary

Minimize oxygen exposure by implementing BMP at:

- Harvesting
- Packing
- Covering
- Feeding

Think **\$\$\$\$** when your silage is exposed to oxygen.

Questions?



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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