Drive Over Pile vs. Bag vs. Bunk Storage

Pros & Cons

A Large Dairy Case Study

NWWNY Dairy, Livestock & Field Crops Team
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Storage Systems for Fermented Feed

- Drive Over Pile
- Ag Bags
- Bunk Silo with Walls
- Upright Silo
- Baleage

All systems provide the *opportunity* to put up high quality forage, for any quantity and any size dairy.
What’s right for your operation?

Ensiling Process
- Packing Weight
- Labor
- Footprint

Feed Management
- Animal Grouping
- Rate of Feedout
- Carryover
S.W.O.T. Analysis

- Strength
- Threat
- Opportunity
- Weakness
S.W.O.T. Analysis

All storage facilities have an *opportunity* and a *threat* in common:

**Opportunity**: high quality forage in combination with lower shrink

**Threat**: compromised forage quality with higher shrink
Drive Over Pile

**Strengths**
- Segregate Forages
- Adapt space to Ag Bag pad or bunk with walls
- Flexibility

**Weaknesses**
- Large footprint
- Packing weight and labor requirements to achieve adequate density
- Runoff Collection - CAFO
- Exposed Face
- Managing varying delivery rate
## Ag Bags

**Strengths**
- Minimal storage losses
- Minimal runoff concerns
- Handles wide range of forage delivery rates
- Segregate Forages
- Good Quality can be achieved even with limited equipment and labor

**Weaknesses**
- Cost
- Matching bagger to herd size
- Large changes in forage through bag
- Site selection
- Recycling of plastic
- More time at feed out
Bunk with Walls

**Strengths**
- Contained Footprint
- Segregate Forages
- Control Face Size

**Weaknesses**
- Bury older forage
- Cost of Walls
- Matching space b/t walls and tractors needed for packing weight
- Runoff Collection - CAFO
- OSHA
- Managing varying delivery rate
- Packing weight and labor requirements to achieve adequate density
- Inflexible if repurposing of space is needed
Why we focused on Bunk Density

2009 - Down turn in dairy economy
  • Looking for opportunity costs
  • This is what we saw !!!
Let's Improve Bunker Management
Great Silage Makes Profitability Possible
Hands-on Short Course  (really, only 1.5 hrs)

Who: For those who drive and pack and wonder why

Why: *Great Silage Makes Profitability Possible.*
- You cannot do that with forages that are harvested at the wrong dry matter, poorly packed and not protected from air and water infiltration.
- Hands-on course intended for those on the farm in the driver’s seat (literally) We will help you understand, apply and excel in the following topics:
  - Safety
  - Siting
  - Harvest Timing
  - Filling
  - Packing! Packing! Packing!
  - Covering
  - Feed out
  - Safety

- Plus: Easy to use Management and Decision Making Tools
Match forage delivery rate to packing weight

- Silage Delivery: _____ tons per hour
- Total Tractor(s) Weight
- Packing Time____ hours per day (Blading tractor 50% time)
- Silage Layer Thickness: <6 inches

<table>
<thead>
<tr>
<th>Challenger (caterpillar) 27,730# (13.86ton)</th>
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<tbody>
<tr>
<td>• 16x100# weight on front,</td>
</tr>
<tr>
<td>• R. Duals,</td>
</tr>
<tr>
<td>• 1800#block</td>
</tr>
<tr>
<td>• Weight evenly distributed front/back</td>
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</table>

<table>
<thead>
<tr>
<th>John Deere 7810 22,030# (11.01 ton)</th>
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<tbody>
<tr>
<td>• Pushing blade,</td>
</tr>
<tr>
<td>• Rear duals,</td>
</tr>
<tr>
<td>• 1800# block</td>
</tr>
<tr>
<td>• 38% weight on front axle</td>
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<table>
<thead>
<tr>
<th>John Deere 8760 33410# (16.70 ton)</th>
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<tbody>
<tr>
<td>• Pushing blade</td>
</tr>
<tr>
<td>• Front and rear duals</td>
</tr>
<tr>
<td>• 74% weight on front axle.</td>
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</table>
Developing a Real Time Tool for Measuring Bunk Density

“New” Method
• Core from top of bunk during filling instead of the face at feed out.

Goals
• Safety
• Immediate feedback to bunk crew on how well bunk is being packed
  They take great pride in their job!
• Quick and Reliable
• Ability to compare two methods of packing side by side
Guidelines for Success:

Send all employees home to their families safe everyday.

- Proper siting & construction.
- Harvest at correct moisture.
- Fill bunk quickly.*
  *Match forage deliver rate to packing weight (see charts).
- Fill in thin layers (≤ 6 inches) and pack each layer thoroughly.
- Covering immediately after filling.
- Proper feed out management.
Why we focused on Bunk Density

2014

• Milk prices were at record-high levels
  • Farms that had improved forage storage captured larger share of profits

2015

• New economic pressures on dairy farmers.
  • Farms that had improved forage storage were able to withstand slump in profitability
This is why we focused on Bunk Density

2009

2014
Definitions

• Bunk Density
  • forage mass per unit volume. It is, essentially, a measurement of how tightly matter is crammed together
    • Excludes oxygen resulting in an environment (anaerobic) that reduces dry matter (DM) loss (SHRINK)
    • Amount of forage in a defined space

• Shrink
  • to contract or lessen in size
    • loss of the commodity from harvesting until delivery

• Lost capital
  • Expense that doesn’t add value to your farm
Obtaining a high forage density in any forage storage facility is important for two reasons:

1a: Reduction in crop losses during storage.
   Lessens the amount of spoilage and maintains feed value.

1b: Increases the capacity of the silo.
   Cuts the annual cost of storage per ton of crop.
What does shrink look like?

Some estimates of worse case bunker silo losses approach 30% and even 50%!

• Disappearing forage
• Dumping milk
• Profit and Loss
What does shrink look like?

- Some estimates of worse case bunker silo losses approach 30%.
  - now 70 acres
What does shrink look like?

• Some estimates of worse case bunker silo losses approach 30%
• Milk: 100 cows

Dumping milk from 30 cows
What does shrink look like?

• Some estimates of worse case bunker silo losses approach 30%.
Drive Over Pile vs. Bag vs. Bunk Storage -

Pros & Cons

- **Commonality with case farms was the need to change forage storage facility due to:**
  1a: Unacceptable forage losses credited to shrink
    - Shrink ranged from 24 to 36% in old facilities.
  1b: Too much forage for existing footprint
    - The need to increase forage inventory & carryover

- **Additional common factors:**
  2. Excellent record keeping of forage stored and fed
  3. Understood the expense of shrink
  4. Bunk crews understand importance of achieving high bunk density
  5. Adapted equipment
  6. Chose storage type after considering both site and capital expense
North Harbor Dairy; Sackett's Harbor, NY
North Harbor Dairy; Sackett’s Harbor, NY

Background:
- Herd Expansion 600 cows in 2009 to 1100 cows in 2017
- Forage needed would not fit on footprint of drive over pile
  - Pile too high and ramps too steep.
  - Most of shrink occurred on slopes.
  - Could not get thin layer.
  - Blading and Packing tractors continue to spin moving forage.

Shrink:
- Was 24%. Goal was to achieve 18% shrink by 2013.
  - Achieved goal but still unacceptable for management
North Harbor Dairy; Sackett's Harbor, NY

Choice: 2015 Bunk Silo with Walls

Smaller footprint with contained space

- Did not want to move to another site because of truck and mixer traffic on the road
- Plus threat of theft from grain bins located at feed center off-site

Less amount of oxygen limiting cover

Less tires

Shrink: 8%-11%
North Harbor Dairy; Sackett's Harbor, NY
North Harbor Dairy; Sackett’s Harbor, NY

Labor and equipment

- Bunk with walls very efficient for filling and feed out
- Use of smaller single tire tractors to pack near walls
North Harbor Dairy; Sackett’s Harbor, NY

- Use asphalt instead of concrete—cheaper at the time.
  - Would suggest top sealer coat
- Epoxy on bunk walls for smooth surface—less oxygen trapped
- Bunk designed with total # head capacity
- Cow numbers match facility
Murcrest Farms; Copenhagen, NY
Murcrest Farms; Copenhagen, NY

  • Bunk silo was sized for 300 cows
  • To fit forage into existing structure
    • “bread loafed” high over the walls.
    • Made temporary drive over piles on soil
  • Located near creek -CAFO issues

Shrink:
  • Huge amounts of shrink, >35% forage loss through poor fermentation and mold
Murcrest Farms; Copenhagen, NY

Choice: Drive Over Pile
- New site: Forced by CAFO regulations.
- NRCS had cost share for leachate collection.
- Farm paid for pad
- Input from visiting other farms, extension, nutritionist, veterinarian, SWCD

Shrink: Currently 12%
• Size pile correctly for face management.
• Roughly size footprint, start near middle and grow pile
• Pack in thin layers!
  • Push tractor controls delivery from chopper
Flexible -
• Can make any size pile needed to match yield and delivery
• Fine tune for milk production or cow numbers
• Adjust acres harvested and acres available for planting
• More option with land for new seeding's, BMR corn silage, HMSC, dry corn, soybeans, wheat
Murcest Farms; Copenhagen, NY

Less capital using drive over pile

- Building vertical very pricy-forms, rebar, labor, engineering
  - Building any forage structure with cement is lost capital.
- Can put up walls later if more capacity is needed-
  - if they expanded footprint would have to upgrade leachate collection
- Single day pour cement.
- More plastic, more tires, more labor to put on oxygen limiting barrier.
  - 1.5 days to cover corn silage.
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY
Background: 1300 cows at Locust Hill. (2010)
Expansion at Maple Ridge. (2016)
Currently milking 2800 cows combined.
4000 cow goal.

• Outgrew foot print of corn silage drive over pile
• Safety on top of pile and base growing concern
• Increasing CAFO regulations for leachate
• 5 hours per week pitching spoiled corn silage

Shrink: 24%-34%
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY

Choice: AG-bags for corn silage storage in 2013
• Farm had always stored haylage and HMEC in bags
• No CAFO regulations
• Safety

Shrink: Now 5%
Calculated Shrink:

- 2016 Bagged 25,225 tons of corn silage
  - every chopped load is weighed at scales on farm
  - fed out 24,000 tons.

- Digi-Star TMR tracker feed management system

- 4.85% shrink during storage
  - harvesting and feed out other sources of shrink

- Drive over pile shrink 2012 year before bags avg. 24%
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY

On farm experiments:
  • inoculants/hybrids/shredlage
Fine tune TMR
  • forage samples taken as each bag is filled
Feed out face area 155 sq. ft. vs. 3000+ sq. ft.
with drive over pile
Quality proved itself by contributing to a 5-
pound-per-cow gain in milk production in 2014.
Eventually would desire central feed center for both dairies
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY

• Unload 8-9 tons per minute. No need for choppers to slow down.
• Less labor—one person can “dump, blade, pack, and cover”
• Flexibility with acres for chopping, etc.
  • Already had bagger. Purchased another
• Built pad with asphalt reclaimed from I-81 construction
• Fence for deer control
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY
Determining Value of Improved Silage Management

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Professor and Extension Specialist,
  • Biological Systems Engineering Dept.
University of Wisconsin Extension
• bjholmes@wisc.edu
• http://www.uwex.edu/ces/crops/uwforage/storage.htm.
Move From Not So Good Management to Good Management
Locust Hill Farm

<table>
<thead>
<tr>
<th>Herd</th>
<th>Silage DM</th>
<th>Hay Ratio (Lbs DM/animal/day)</th>
<th>in the ration (%)</th>
<th>Total Forage Must Equal</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Milking Cows</td>
<td>1300</td>
<td>15</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Dry Cows</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
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<tr>
<td>Heifers Eating Silage</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
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</table>

| Herd Hay Silage Consumed (Lbs DM/day) | 0 |
| Herd Corn Silage Consumed (Lbs DM/day) | 19,500 |
| Herd Daily Total DMI (lbs/day) | 19,500 |

| Hay Value ($/T DM) | 174 |
| Corn Silage ($/T DM) | 130 |

<table>
<thead>
<tr>
<th>Good Management</th>
<th>Not So Good Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unavailable TDN (%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Price of Corn ($/Bu)</td>
<td>3.78</td>
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<tr>
<td>Value of TDN ($/lb DM)</td>
<td>9.979</td>
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<tr>
<td>Value of Unavailable TDN per</td>
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<tr>
<td>Ton of Forage Dry Matter ($/T DM)</td>
<td>1.40</td>
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<table>
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<tr>
<th>Herd Annual Consumption (T DM/yr)</th>
<th>Feeding Loss</th>
<th>Storage Feed Out Loss</th>
<th>Storage Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>3.559</td>
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# Move From Not So Good Management to Good Management

## Locust Hill Farm

<table>
<thead>
<tr>
<th>Operation</th>
<th>Quantity (T DM/yr)</th>
<th>Value ($/yr)</th>
<th>Quantity (T DM/yr)</th>
<th>Value ($/yr)</th>
<th>Quantity (T DM/yr)</th>
<th>Value ($/yr)</th>
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</thead>
<tbody>
<tr>
<td>Hay Silage</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Feeding Loss</td>
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<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
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<tr>
<td>Storage Feed Out Loss</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
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<td>0.0</td>
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<tr>
<td>Storage Loss</td>
<td>5</td>
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<td>0.0</td>
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<tr>
<td>Feeding Loss</td>
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<tr>
<td>Harvest Loss</td>
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</table>

**Total Loss ($/yr): $179,058**
### Move From Not So Good Management to Good Management

**Locust Hill Farm**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Quantity (%)</th>
<th>Quantity (T DM/yr)</th>
<th>Value ($/yr)</th>
<th>Quantity (%)</th>
<th>Quantity (T DM/yr)</th>
<th>Value ($/yr)</th>
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<tr>
<td>Feeding Loss</td>
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<td>0.0</td>
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<tr>
<td>Storage Feed Out Loss</td>
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<td>Storage Loss</td>
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<td>Filling Loss</td>
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</tr>
<tr>
<td>Harvest Loss</td>
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<td>0.0</td>
<td>0.0</td>
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**Total Loss**

- **Sum of Individual Losses**: $29,318
- **Cumulative Losses, %**: 5.00%

Total Loss: $29,318
Move From Not So Good Management to Good Management
Locust Hill Farm

Total Reduction of Value Lost ($/yr)

149,740 /yr
Locust Hill Dairy; Mannsville, NY
Maple Ridge Dairy; Lacona, NY

***expansion from 1300 cows to 2800 cows (115% more cows)
*** additional corn silage acres 600 to 1260 acres (110% more acres)

• Plan for 400 day inventory (2 months carryover)
  • Drive over pile  308 day inventory
  • Silage bag 380 day inventory (4540 more tons CS)

• Require an additional 227 acres to account for shrink difference

  $ Purchase or rental cost per acre
  $ Taxes
  $ Planting expense
  $ Harvesting expense
  $ Labor
  $ Distance from fields to feed center
Different approach's have all lead to better overall forage management

As simple as adding weight to existing tractors

+ Cover bunks
+ Oxygen limiting covers
+ Cut sidewall tires
Different approach's have all lead to better overall forage management

- Increased footprint/apron of drive over piles and bunk silos
- Decrease ramp height.
- Much of shrink we see is from steep ramps

Custom harvesters
- Harvest in timely fashion
- Free up equipment
- Proper sized equipment
- Concentrate on packing bunks correctly
Different approach's have all lead to better overall forage management

Poorly constructed drive over piles – make switch to bags

• One person can store forage.
  • Drive over pile took 3-4 people with tractors. Neither were available.

• More forage preserved.
• Less need to rent marginal acres for additional forage
• Will have extra inventory and corn silage carryover for first time.
Different approach's have all lead to better overall forage management

Dairy in Expansion mode - need to monitor capital expenses

• Will stay with bags now as it has worked out well for them.

• Invest in larger bagger and larger unloading wagons.

• CAFO - NO!
Different approach's have all lead to better overall forage management

Existing Bunk silos - Not enough storage
• Below average density.
• Choice between building new bunks
  • OR
• More forage in same footprint
  • increasing bunk density
  • using/buying/renting heavier tractors.
fyi.uwex.edu/forage

- Cost of Forage Storage - Spreadsheet
- Bunker Silo Density Calculator – Spreadsheet
- Bunker Silo Sizing - Spreadsheet
- Silage Pile Capacity Calculator – Spreadsheet
- Forage Feed out Losses for Various Storage Systems
- Choosing Forage Storage Facilities
- Bunker Silo Cover Alternatives
- Factors Affecting Bunker Silo Density
- Management of Bunker Silos and Silage Piles
- Capital Costs of Pads for Bunkers, Piles and Bag Silos
- Silage Bag Capacity
- How to Store Silage with Increased Profitability and Safety
- Drive-over Silage Pile Construction
What's right for your operation?

Drive Over Pile?
Ag Bags?
Bunk Silo with

All systems provide you the opportunity to put up high quality forage in any quantity for any size dairy.
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