

2014 Southeast Hay Convention

Hay Storage Systems



Hay Storage Systems

Southeast Hay Convention
John W. Worley

THE UNIVERSITY OF GEORGIA
COOPERATIVE EXTENSION
Colleges of Agricultural and Environmental Sciences & Family and Consumer Sciences

LOSS ACCUMULATES WITH EACH STEP

It's not unusual to see total losses of 70% or greater

- Field curing 10-25% loss
- Harvesting 7-15% loss
- Storage 5-45% loss
- Feeding 10-30% loss

Slide courtesy of Dennis Hancock

Storage Alternatives

- Curing
 - Field Dry
 - Baleage
- Packaging
 - Round Bales
 - Twine
 - Bale Wrap
 - Square Bales
 - Small
 - Large

Alternatives

- Storage
 - Square Bales - Barn
 - Round Bales
 - Field
 - Tarp
 - Barn

Baleage

- Greater control over harvesting time
- Excellent quality if moisture level right and no leaks
- Reduces Nitrate Levels

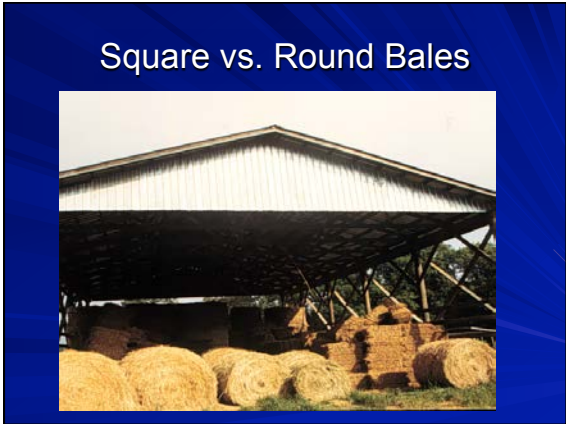
Baleage

- Costs more
- Can get spoilage if ensiling isn't successful
- Disposal of Plastic

Dr. John Worley
Extension Engineer

2014 Southeast Hay Convention

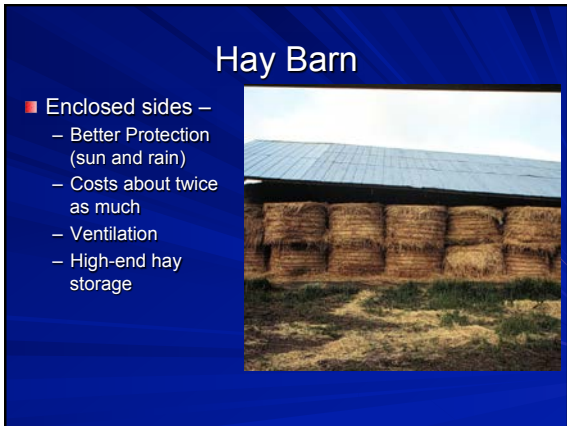
Hay Storage Systems



Hay Storage Research (Kentucky)

Storage Method	Weathered Depth (in.)	DM Loss (%)
Twine	4.4	18.2
Netwrap	2.1	10.6
Solid plastic	0.6	3.6
Shed	<0.5	5.7

Slide courtesy of Dennis Hancock



Dr. John Worley
Extension Engineer


2014 Southeast Hay Convention

Hay Storage Systems



Tarp

- Low-cost alternative
- More Labor
- Decreased losses in case of fire



Uncovered



- Lowest Cost - Greatest Losses - Poorest Quality

Storage Options

- Tarped Stacks
- Hay Sheds
- Hoop Structures




Slide courtesy of Dennis Hancock

Bale Storage Comparisons

Slide courtesy of Dennis Hancock

- \$0.75 + 30-70% Loss
- \$1.50 + 20-40% Loss
- \$3.50 + 4-7% Loss
- \$3.50 + 5-10% Loss
- \$5.00 + 5-10% Loss



Cost of Owning a Building

- 50 by 100 ft building at \$5.00/ square foot (\$25,000) (Roof only)
 - Depreciation \$1250
 - Interest \$1000
 - Tax & Ins. \$750
 - Annual Repairs \$125
- Total Annual Cost \$3125

Benefits of Covered Storage

- Reduced Dry Matter Loss
- Improved Nutritional Value
- Reduced animal refusal
- Barn can be used for other things when not used for hay (equipment storage)

Dr. John Worley
Extension Engineer

2014 Southeast Hay Convention Hay Storage Systems



Dry Matter Losses (%)

Study	Ground Stored	Elevated on Pallets	Elevated & Tarped	Tarped Only	Barn Stored
1	65	38	14	na	4
2	50	32	14	na	4
3	30	na	na	10	0

Size of Bale Affects Losses




- Outer 4 to 6 inches is lost
- Higher percentage of a small bale

Dry Matter Losses (%) As Affected by Bale Size

Bale Diam. (ft.)	Ground Stored	Elevated on Pallets	Elevated & Wrapped	Barn Stored
4	32.4	26.2	14.6	4
5	23.8	17.4	11.4	4
6	19.6	13.4	10.0	4

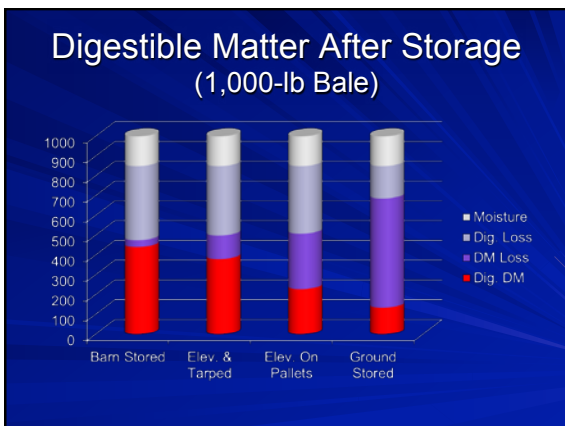
Digestibility and Palatability Also Affected



Nutritional Losses

Start with 1,000-lb bale at 15% moisture

850 lb DM before storage	Ground Stored	Elev. on Pallets	Elev. & Tarped	Barn Stored
DM Loss	65	38	14	4
Digestibility (%)	45	49	52	54
Digestible Matter After Storage	172	258	380	441



Dr. John Worley
Extension Engineer

2014 Southeast Hay Convention

Hay Storage Systems



Annual Savings on Hay Storage

- Assumptions
 - Hay valued at \$75/ton (dry matter)
 - Hay losses reduced by 30%
 - 50 x 100 building (annual cost - \$3125)
 - Storage Capacity - 250 tons (wet basis)
 - Hay stored at 15% moisture

Annual Savings on Hay Storage

- Dry matter saved - 64 tons - - \$4800
- Net Savings - - - \$1675
- What if?
 - If Digestibility Improved by 5% (Total of 42% Savings) Net Savings - - \$3553
 - If Hay worth \$90/ton, Net Savings - - \$4889
 - If dry matter loss improved by 50%, (106 tons) Net Savings - - \$4825

If You Build A Barn

How Much Should You Store in the Barn?

- All that you can fit in existing barns
- All square bales
- 50 to 75% of crop (feed last cutting first and store outside)

Barn Recommendations

- Build to meet Southern Building code (80 mph wind)
- If possible, orient the long axis east and west on open-sided barns
- Hay storage should be open, especially at the gable end for ventilation
- Stack bales on end to increase capacity
- Make sure the eave height (vertical clearance) of barn is sufficient

Rot and Rust on Inside Roof?

Dr. John Worley
Extension Engineer

2014 Southeast Hay Convention

Hay Storage Systems



Enclosed Gable



Water Loss from Curing Hay

- 100 tons of hay stored at 16% moisture
- Dries to 13% moisture
- 3% of 100 tons = 3 tons of water
- = 722 gallons
- Must be removed by ventilation

How much Ventilation? (Enclosed Barn)

- Larger of the following 2 options:
 - 6" continuous ridge vent
 - 2" / 10 ft of width
- For a 50-ft wide building - 10" Ridge vent (83 sq. ft of ridge/gable opening for 100-ft long building)
- Equal area of opening near bottom of walls (Door can serve as part of vent)

Flooring for Square Bales

- Anything that promotes ventilation under the hay is good (Large rock, pallets, etc.)
- Ideal is a raised floor with air underneath (not always practical)
- Bottom layer on edge – primarily to keep twine from rotting, but also helps promote ventilation
- Concrete with vapor barrier underneath and well-drained

If You Store In the Field



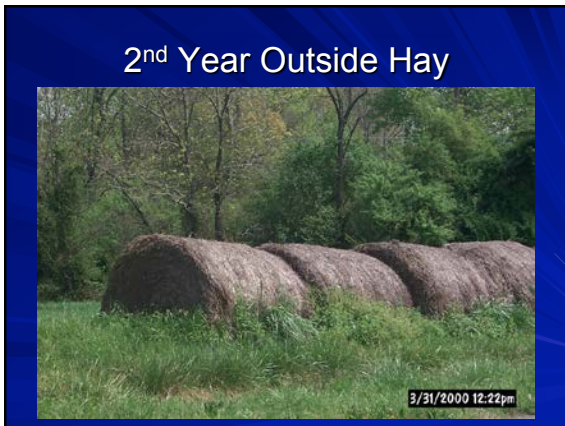
Field Storage Recommendations

- Store on high, well-drained ground
- Store in open, sunny area
- Store in rows with flat edges touching and round edges separated (unless tarped)
- Orient rows North and South
- Orient rows down slope, not across slope

Dr. John Worley
Extension Engineer



2014 Southeast Hay Convention Hay Storage Systems



Controlling Feeding Waste

Losses > 40%

Vs.

Losses < 7%

Slide courtesy of Dennis Hancock

Feeding Losses

Slide courtesy of Dennis Hancock

Method	1 day	7 day
---- % Waste----		
Unrolled	12.3	43.0
Ring	4.9	5.4

Dr. John Worley
Extension Engineer

2014 Southeast Hay Convention

Hay Storage Systems



Slide courtesy of
Dennis Hancock

Feeding Losses

Item	% Waste
Cone	2 - 5
Ring	4 - 7
Trailer	10 - 13
Cradle	15 - 20



Adapted from: Southern Forages (4th ed.) and Buskirk et al., 2003. J. Anim. Sci. 81:109-115



QUESTIONS ?

jworley@uga.edu

Dr. John Worley
Extension Engineer