

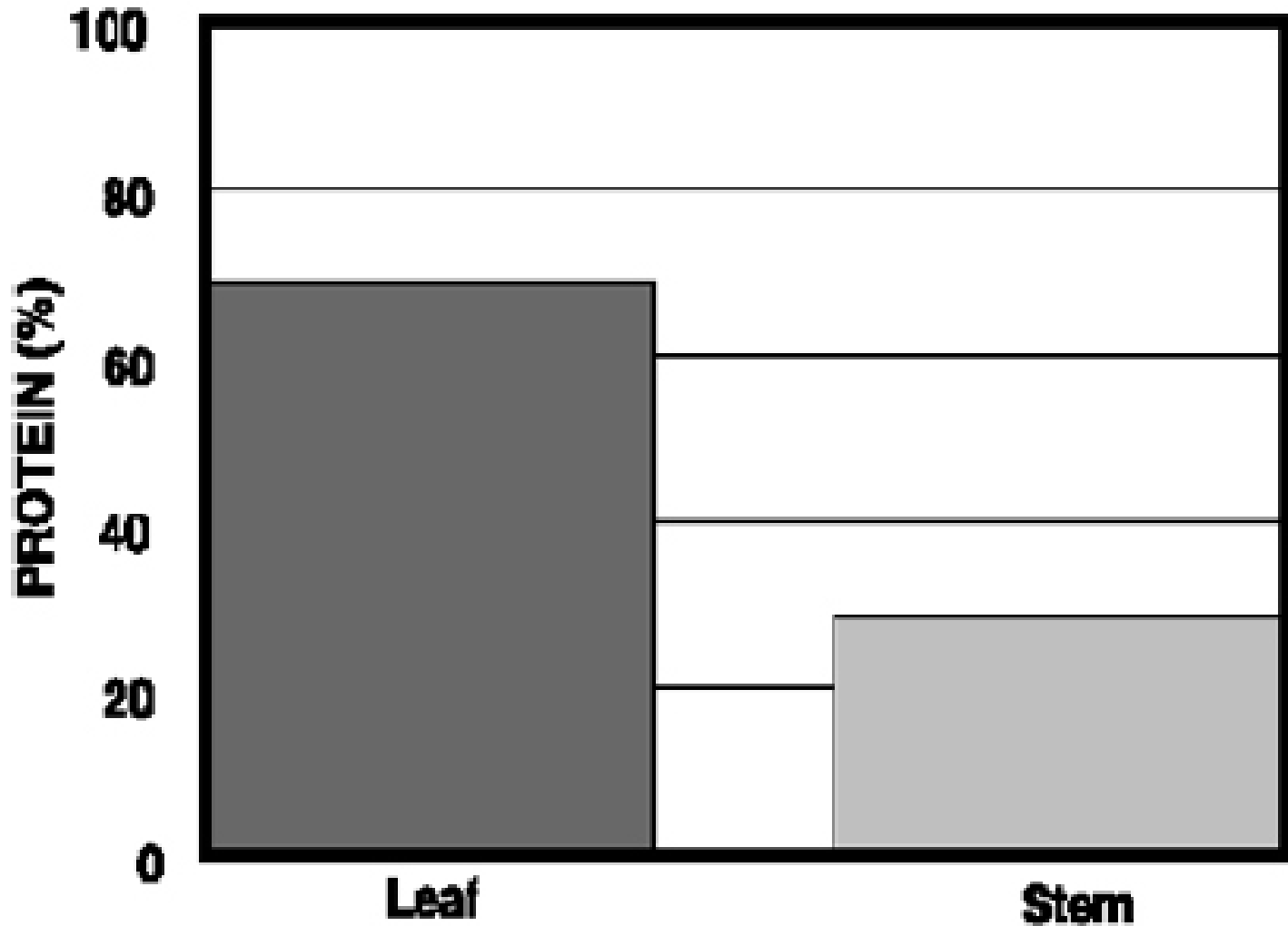
Making Dry Hay & Baleage

Aaron Gabriel, Cornell Cooperative Extension



Just Trying To Preserve Forage Quality

Leaf retention is critical for quality hay



Something Can Be Managed At Each Step

- **Mowing**
- **Conditioning**
- **Tedding**
- **Raking**
- **Baling**
- **Wrapping for baleage**
- **Transporting**
- **Storage**

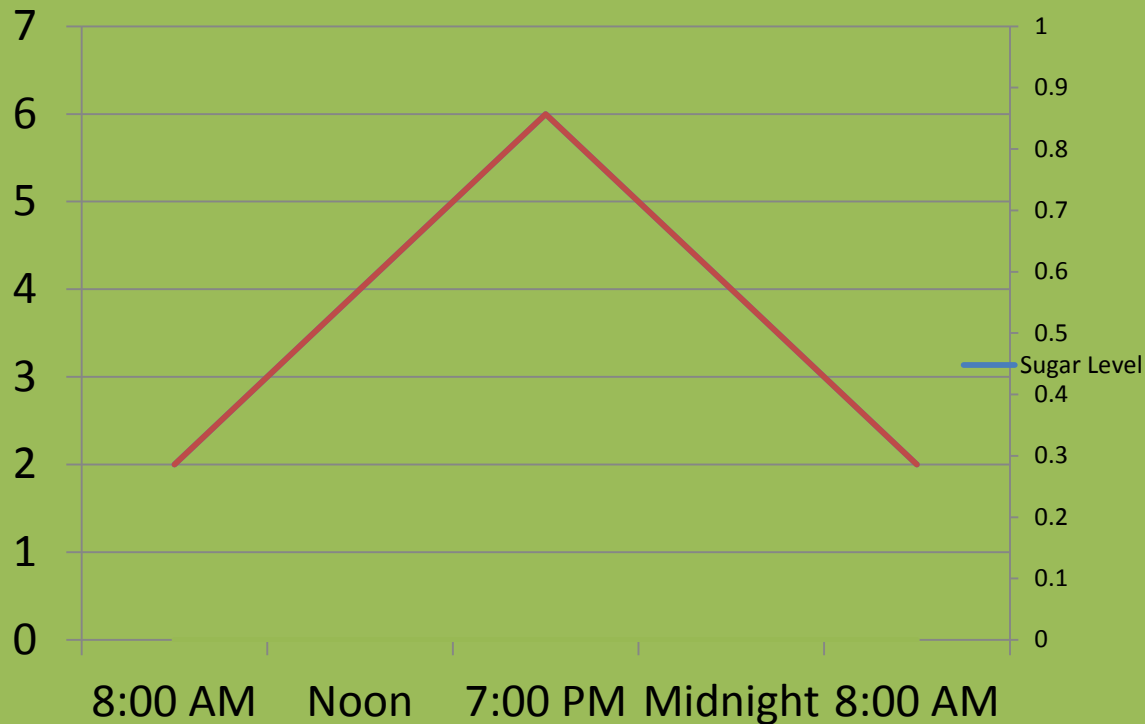
Drying= Sunshine + Humidity + Temperature + Wind



Morning or Afternoon mowing makes no difference in the northeast 90% of the time

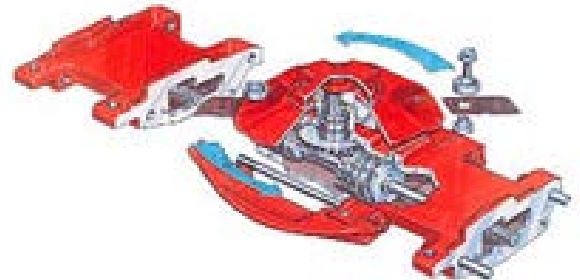
(Plant respiration stops at ~40% moisture)

Estimated gm sugar/Kg grass DM

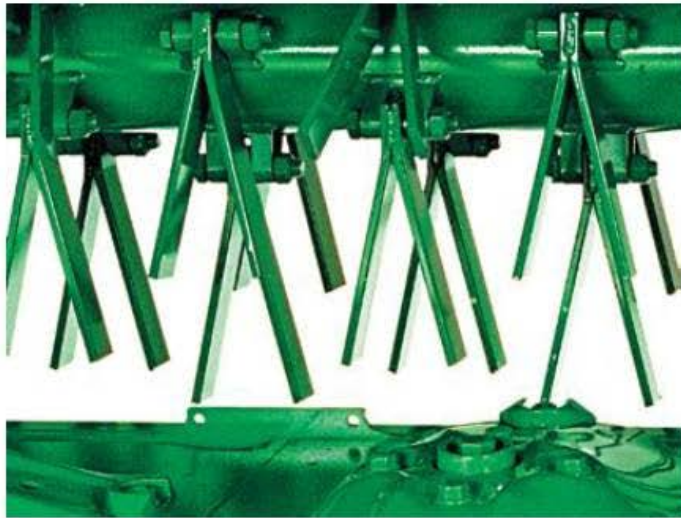


Discbines

- can travel 5 – 10 mph
 - do not plug like sickle mowers
 - Cut a lodged crop better
- * easier to replace knives



Conditioning is essential for dry hay, but not for baleage



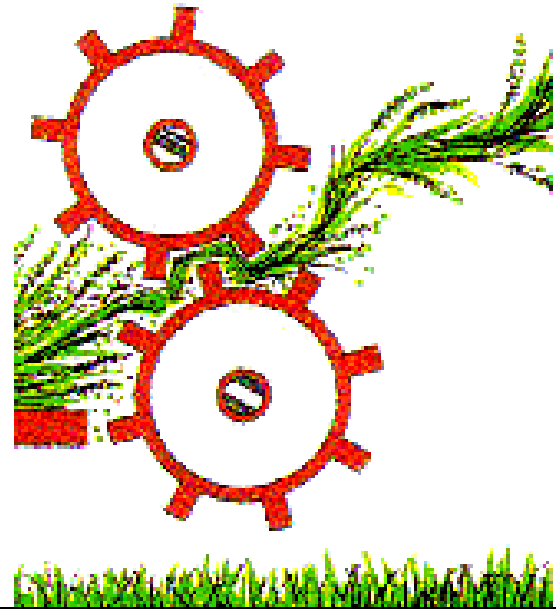
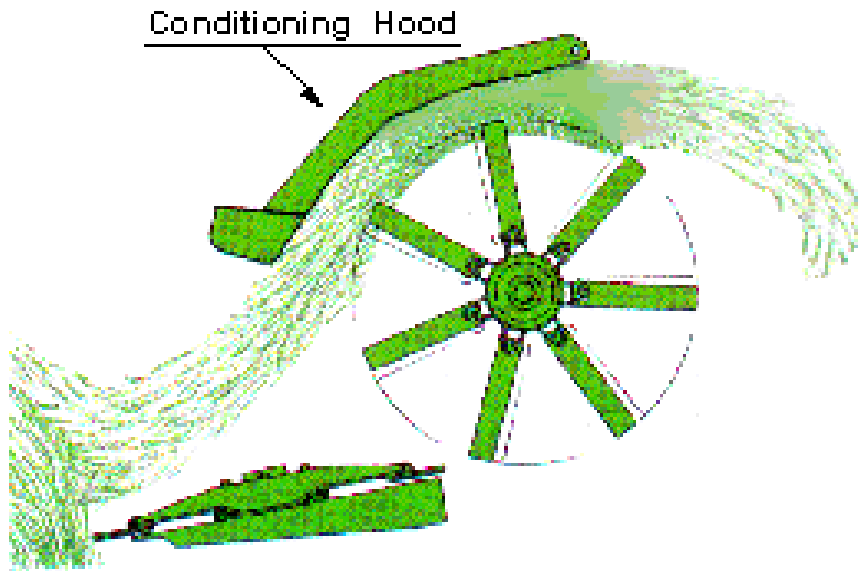
Flail Conditioner



Roll Conditioner

Rubbing wax off leaves vs crimping stems

- 2-4% more alfalfa leaf loss with tines, but can be adjusted
- Tines work best on grass
- Rolls are good for alfalfa, wear out in the middle fastest



Tine or Finger Conditioner

tines may swing on some brands



Macerator (ReCon 400)

reduce drying time from 0 to 24 hours





**Rubber rolls in front
hold forage firmly.**



**Steel rolls behind spin
at different speeds to
nick and scrape wax
off grass leaves and
alfalfa stems**





Teddar

ted hay soon after mowing



Teddar with horizontal long & short tines



Hay Fluffer flips windrow in place (old Grimm tedder).



<http://www.baumanmfg.com/img/tedder/tedder.gif>



Hay Rakes

- rake at >35% moisture



[http://www.dyersold.com/equipment_for_sale/New%20holland%20hay%20rake%20\\$%201,850.00.jpg](http://www.dyersold.com/equipment_for_sale/New%20holland%20hay%20rake%20$%201,850.00.jpg)

Roping

Gentle,
roping



<http://tractortoolsdirect.com/wp-content/uploads/2013/12/Galfre-5-wheel-hay-rake.jpg>



Fluff for good
drying,
Set PTO to
wheel speed,
high repairs

No roping,
high repairs;
need full
windrows



http://www.progressivedairy.com/features/full_photos/2008/0108/0108hg_shinners_2_full.jpg

http://www.progressivedairy.com/features/full_photos/2008/0108/0108hg_shinners_1_full.jpg

Keep Soil Out of Hay

< 10% ash on soil test

- **Mow at a decent height (4" grass, 3" alfalfa)**
- **Properly adjust tedder**
- **Properly adjust the rake**
- **Properly adjust pick-up on baler**
- **Plow & fit fields well so they are smooth**

Baling



Baler adjustments & tractor operation affect bale shape and density.

Moisture Testing

- 1) “Dish rag” test. – Wring out moisture when above the 65%
- 2) Commercially available testers poor at <40% moisture
- 3) Koster moisture testers - heated, forced-air dryers, takes longer than a microwave moisture test.
- 4) **Best Method** - microwave moisture test
 - Measure 100 grams forage, chopped 1”
 - Place a cup of water in the microwave
 - Microwave 1 minute at a time at first, weigh when it feels dry
 - Microwave 30 seconds or less and weigh each time (avoid burning it)
 - When it stops losing weight, it is dry (~99% dry)
 - Starting weight – final weight = % moisture (water was removed)

Critical Temperatures and Action Steps to Prevent Spontaneous Combustion

Temperature (°F)

Condition and Action

125

No action needed.

150

Hay is entering the danger zone. Check temperature twice daily. Disassemble stacked hay bales to promote air circulation to cool the hay.

160

Hay has reached the danger zone. Check hay temperature every couple of hours. Disassemble stacked hay bales to promote air circulation to cool the hay.

175

Hot spots or fire pockets are likely. Alert fire services to the possible hay fire incident. Stop all air movement around the hay.

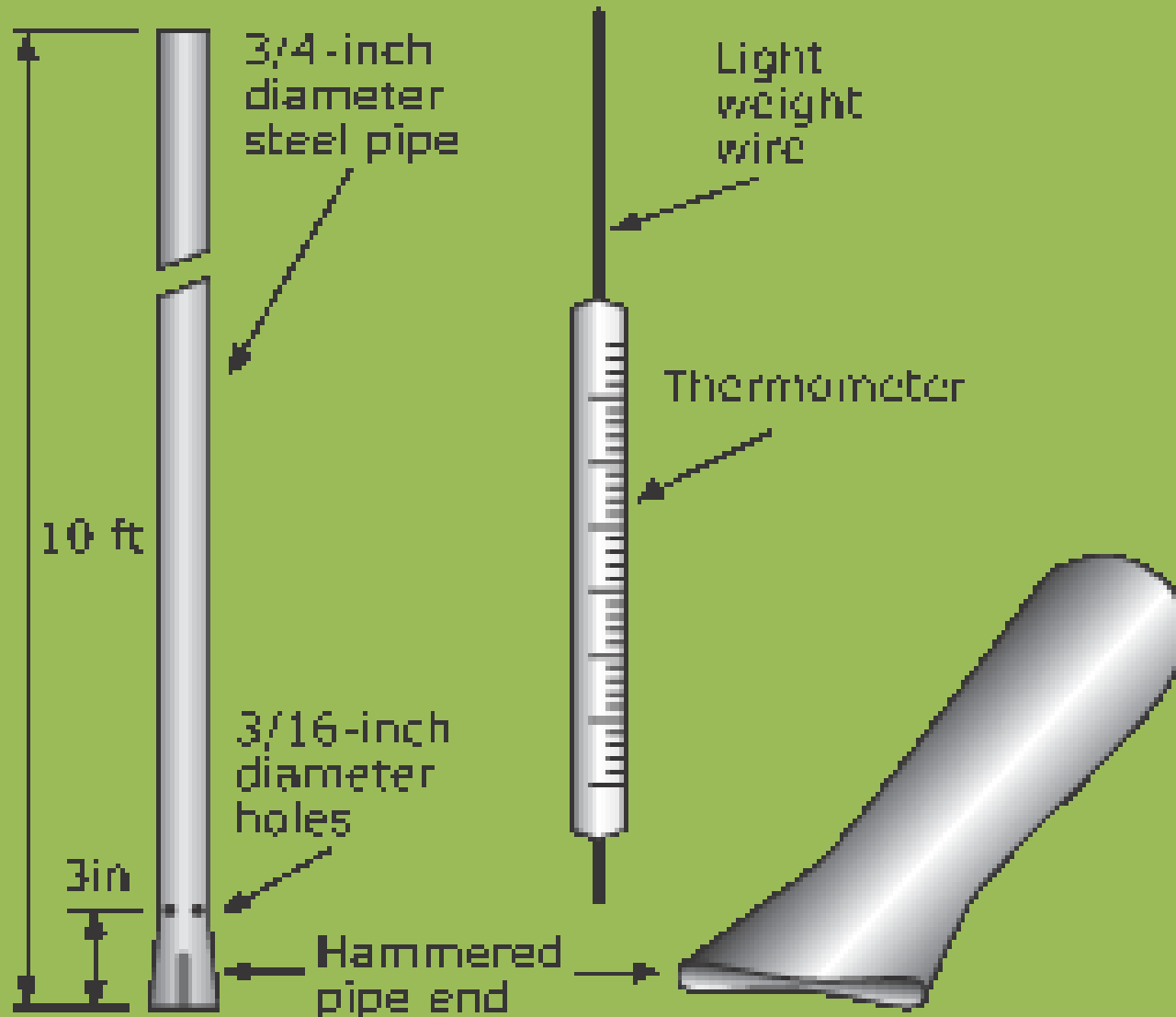
190

With the assistance of the fire service, remove hot hay. Be aware that hay could burst into flames.

200 or higher

With the assistance of the fire service, remove hot hay. Most likely, a fire will occur. Be aware that hay could burst into flames.

Figure 1. Homemade hay temperature probe with thermometer.



Leaf loss in grass during round baling – moisture effect

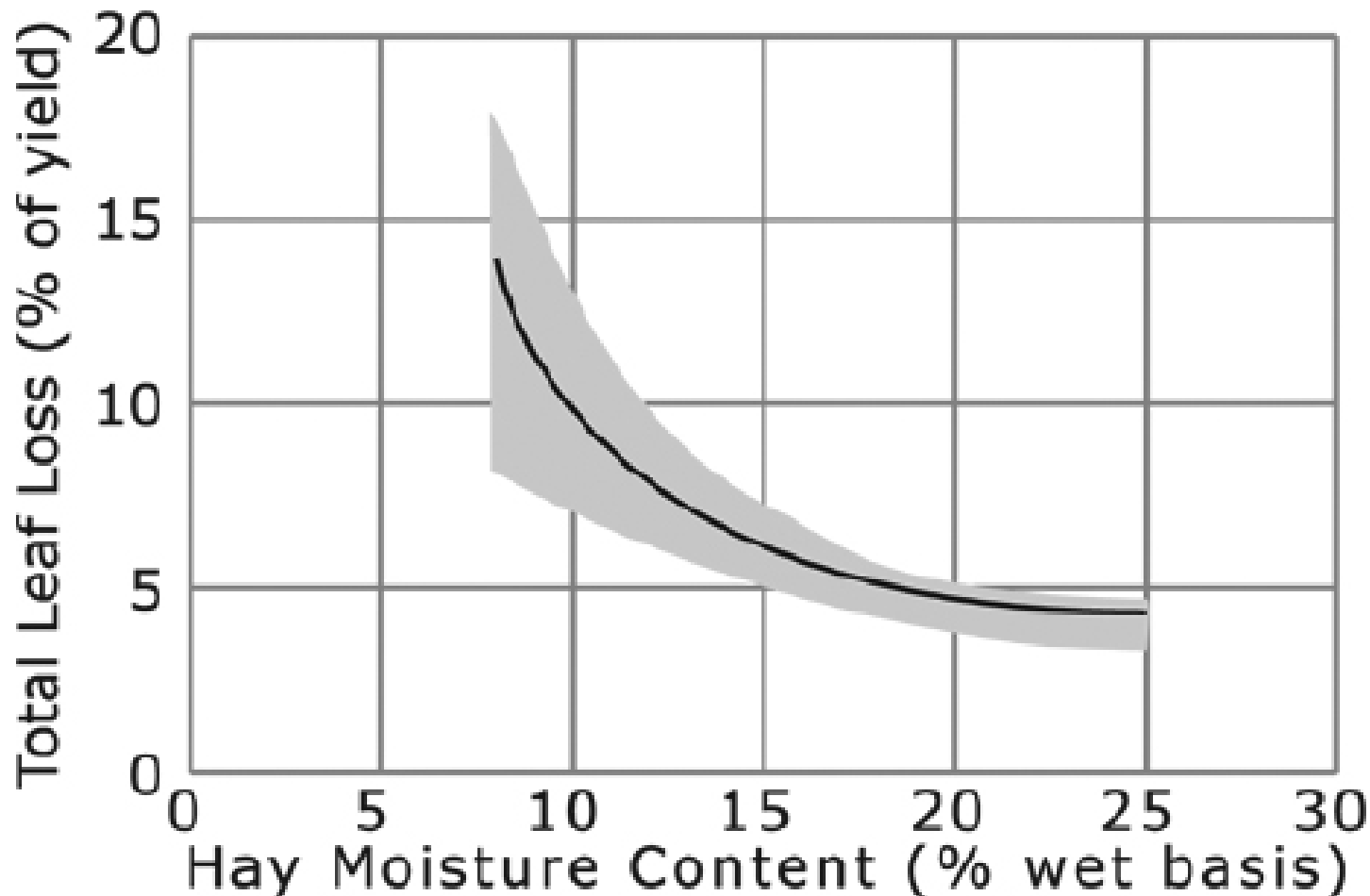


Figure 1. Leaf loss during baler operation. Accumulation of data for several large round balers over a range of hay moisture contents in fields of mixed alfalfa, crested wheatgrass and brome grass. Data source: Prairie Agricultural Machinery Institute.

Preservatives – liquid & granular propionate



- Bale at 5% more moisture
- Better leaf retention
- Beat the weather
- May be necessary for large squares
- ~\$15/ton
- Excellent coverage is necessary



<http://www.nuhnbiotech.ca/assets/uploads/pages/image/granularapplicator5.jpg>

Preservatives Can Maintain Quality

Table 1. Storage losses and composition of alfalfa hay baled at 32% moisture and treated with different rates of propionic acid at baling. 1 Hay at harvest was 70.5% IVDDM (In vitro dry matter digestibility)

Source: Knapp, Holt and Lechtenberg, 1976.

Treatment	Max. Storage Temperature, °F	Dry Weight Loss, %	Digestibility, %	Total Carbohydrates, %
Control	124	15.1	60.5	3.4
Propionic Acid Rate				
0.02%	127	16.7	61.8	3.1
0.2%	115	13.2	62.2	3.9
0.5%	104	11.7	61.0	4.1
1.0%	84	7.6	65.0	6.5

Recommended rates for applying organic preservatives to hay.

Hay Moisture Level, %	Rate, % (dry wt basis)	lb/ton
20-25	0.5	10
25-30	1.0	20
30-35	1.5	30

Variable Chamber Baler

Tractor should be heavier than the baler plus bale



Variable Chamber Round Baler





Fixed Chamber Baler

Less than perfect conditions for round baling

Baling short, dry and slick material such as straw from a rotary combine can be a challenge. The baler may continually plug or starting the bale may be difficult.

Make decent-sized windrows

Bale in late evening or early morning to take advantage of moisture

Reduce bale density settings

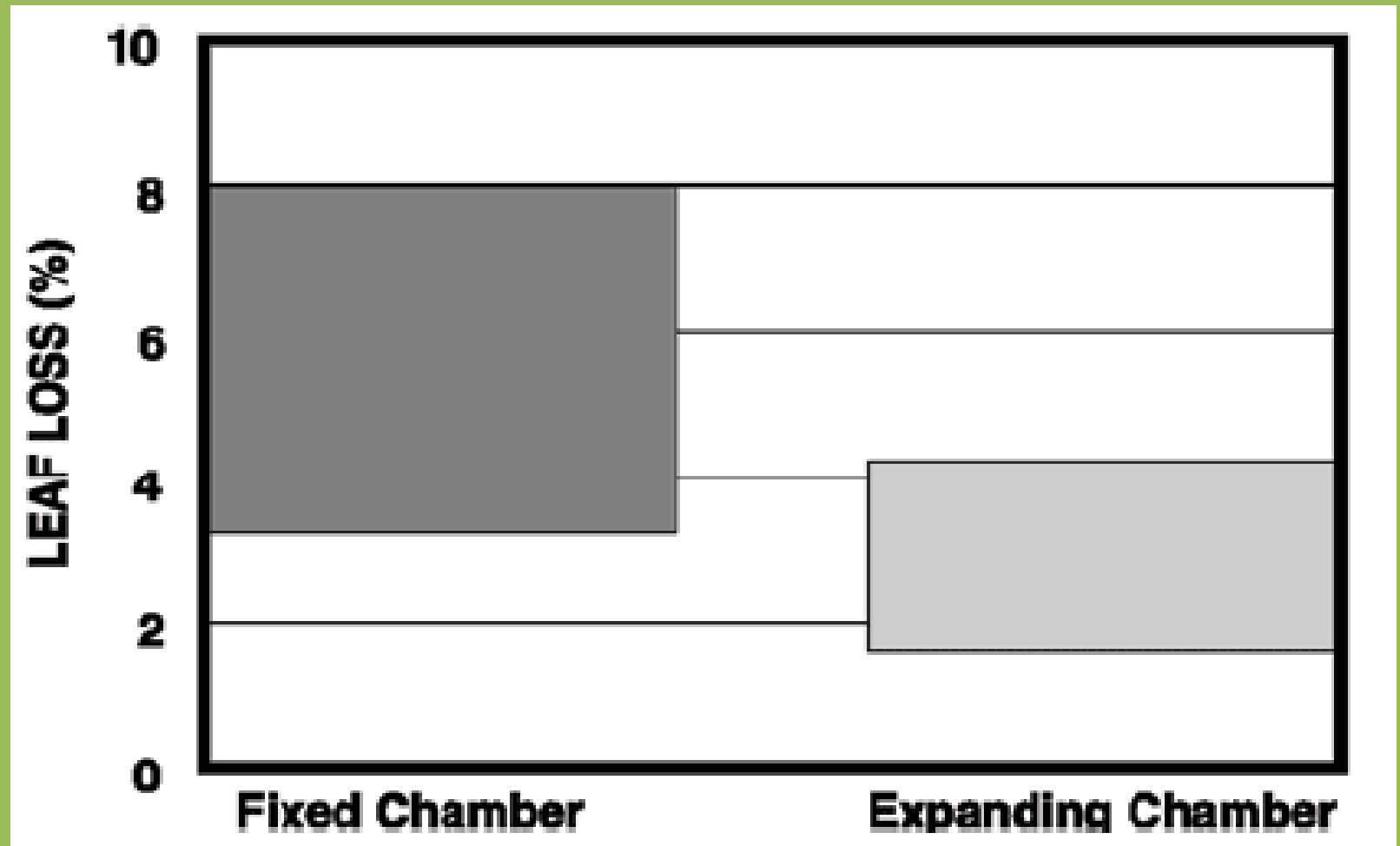
Make smaller bales

Decrease the PTO speed while maintaining normal ground speeds

If possible, adjust the distance from the twine to the end of the bales as wide as possible so the twine doesn't slip off the end of the bale

Use a close twine spacing across the bale

Round Baler Leaf Loss in Chamber



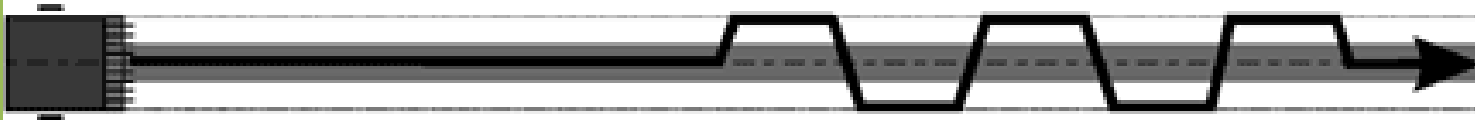
Round Baler Drive Pattern for Good Bale Shape

WEAVING PATTERNS

Expanding Chamber (Hard Core) Baler- Right



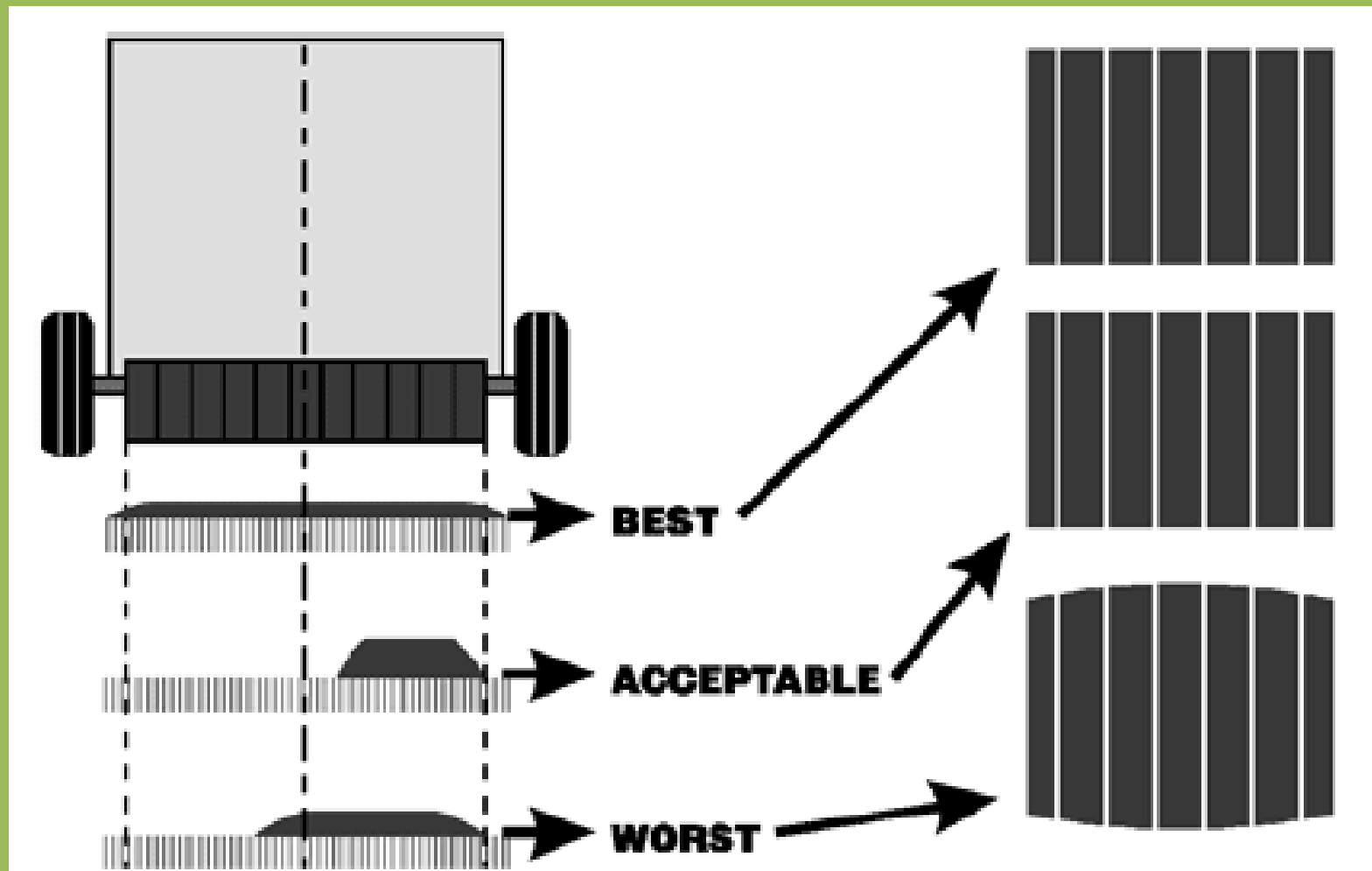
Fixed Chamber (Soft Core) Baler- Right



Wrong



Windrow Size – full or $< \frac{1}{2}$ pick-up width for good bale shape



Variable vs Fixed Chamber Round Balers

COMPARISON	Variable	Fixed
Power Req.	Less	More
Purchase Price	More	Less
Maintenance Cost	More (belts)	Less
Bale Size	Adjustable	One size
Bale Pressure	Adjustable	Slightly adjustable
Leaf loss	2 – 4%	3 – 8%
Baleage	Yes	Yes

Management Areas for Leaf Retention

- Ted and Rake at Proper moisture, no less than 35 or 40%
- Ted and Rake at a gentle speed
- Bale at proper moisture: 18-20% sm sq. / 16-18% Round / 15-16% lg sq
- Baler pick-up speed, same as forward speed.
- Baler forward speed, do not pull or push forage into the baler
- Windrows full of hay
- Round balers should turn no more than necessary to form the bale; square bale plunger should plunge a chamber full of hay
- Square bales partially on thrower belt lose leaves
- Handle bales as few times as possible

John Deere B-Wrap for Dry Hay

- Sheds rain and snow
- Lets moisture escape, so bales can cure
- Protects bales from ground moisture



http://www.deere.com/en_US/media/corporate_images/releases/b_wrap_eject_large.jpg

Baleage balers

- heavy duty bearings & rollers
- scrapers to keep gum off belts and rollers



Table Wrapper

- Either place bale on table with tractor or it will have an arm to lift bales onto table
- 20 – 30 bales / hour



In-line (tootsie roll) bale wrapper

40 – 50 bales/hr

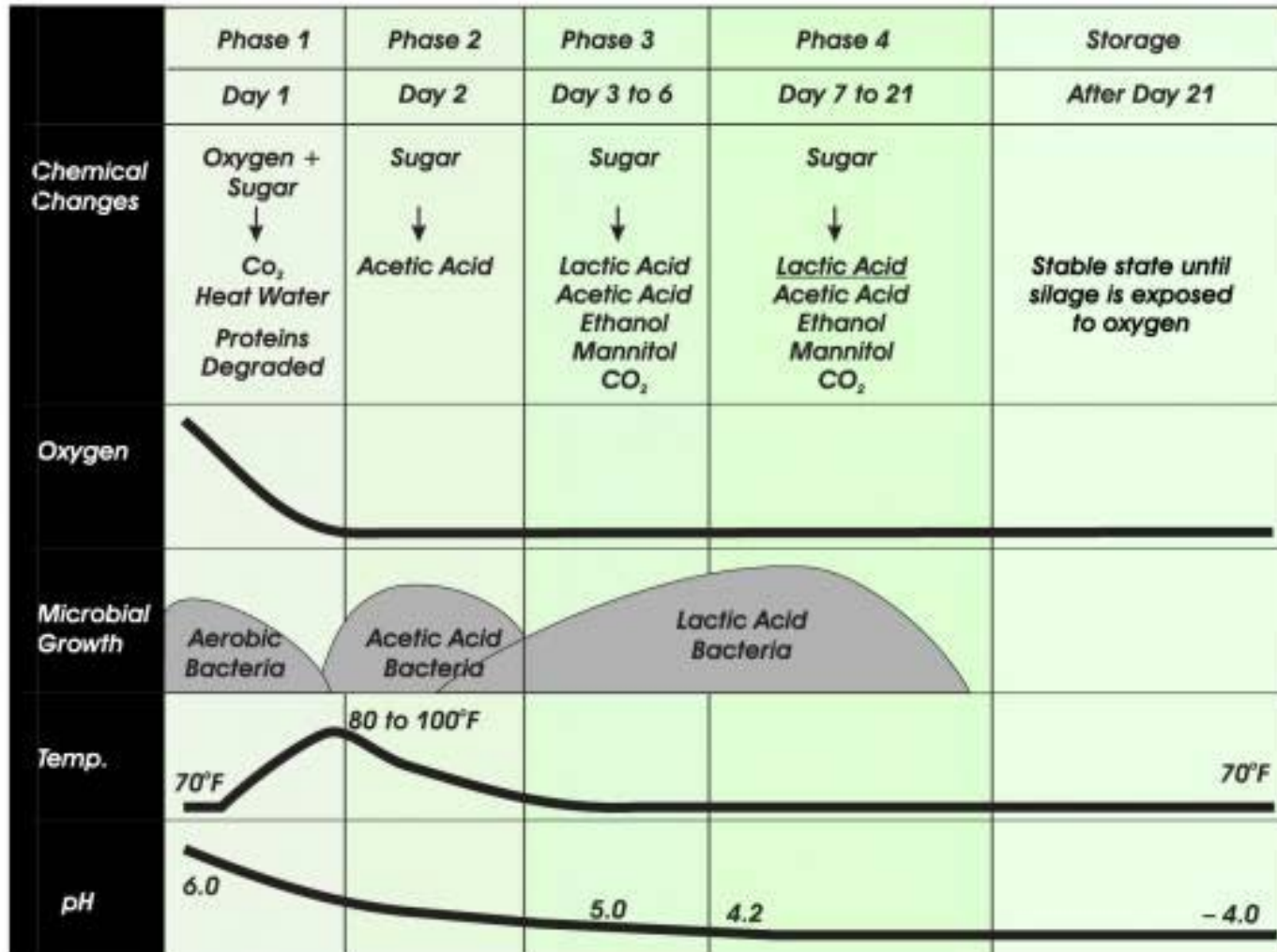


Inline Wrapper



Silage Fermentation

wilt forage to 40 – 60% moisture



Baleage Tips

- 1. Use good quality forage, no rain damage**
- 2. Make dense bales: driving slowly; full windrow**
- 3. Wilt to 40 -60% moisture**
- 4. Wrap with 6 mil (6 layers) of plastic. Do not stretch plastic too much.**
- 5. Wrap ASAP, w/in 2 hr on a hot day, w/in 12 hr on cool days**
- 6. Wrap in a area free of puncture hazards**
- 7. Store in area of low temperature fluctuation**
- 8. Check bales weekly, repair with polyethylene tape**

Vough, L.R., and I. Glick. 1993. Round bale silage. pp. 117-123. *Silage Production*, Proceedings, National Silage Production Conference, February 23-25, 1993. Syracuse, N.Y.

Table 1. Temperature (°F) in silage bales bagged immediately, after 8 hours, and after 24 hours.

	Interval Between Baling and Bagging (hours)		
Days After Ensiling	0	8	24
1	118	129	125
2	111	140	135
3	113	127	132

Source: University of Missouri, 1983 Research Reports.



CLAAS

DANGER

ROLLANT
Roto Cut

UNWRAP

Bale Grabber

handle bales as little as possible to keep sealed



<http://kts.se/NT/images/multigrip7.jpg>

Any questions so far about making hay or baleage?

???



<http://infinitepool.net/blog/wp-content/uploads/2013/12/Winnie-the-Pooh-think-think-think.jpg>

Labor Saving Machinery

- **There is a lot of different bale handling equipment**
- **Youtube has many videos**

Bale throwers are safer than kickers



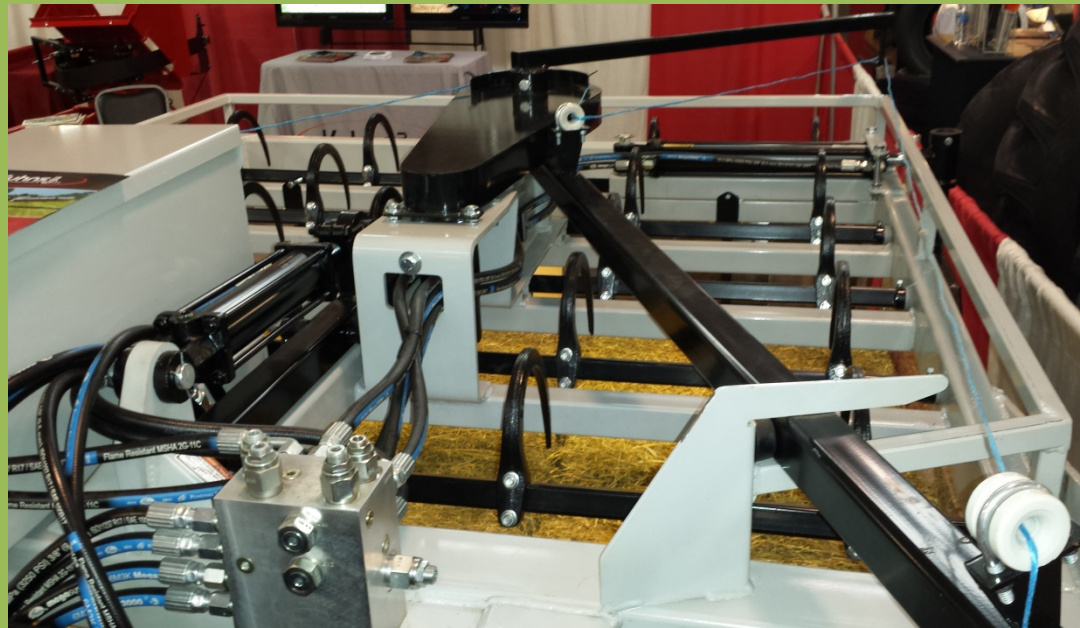
Bale table accumulates bales, places them on the field for later pickup by a grabber



Very few moving parts
Works on hills according to the dealer



<http://ak3.picdn.net/shutterstock/videos/215389/preview/stock-footage-farmer-square-baling-hay.jpg>



Bale grabber has hydraulically operated hooks



Tractor pulled bale wagon



Bale wagons work well when you stack bales in sheds



**There are many types of bale accumulators.
Youtube has lots of videos**



<http://www.rciengineering.com/pics/BaleAccumulator.jpg>

**This accumulator picks up bales in the field.
Some are designed to not tear baleage plastic**



http://hayandforage.com/site-files/hayandforage.com/files/imagecache/galleryformatter_slide_penton/gallery_images/63proag900-Hay-Hikerroundbalecarrier.jpg

Round Bale Unroller



<http://www.ibiblio.org/farming-connection/grazing/forgey/images/unroll.gif>

Questions?



http://i.dailymail.co.uk/i/pix/2011/06/15/article-0-0C920C0E00000578-144_634x579.jpg

© Wales News Service

Storing hay

Lessons from a hay grower

By: Kevin Ganoë, CCE – Central NY Dairy & Field Crops Team

Horse customers
want dust free hay



Keep hay off the floor to prevent moisture from contacting the bale



Use chaff to build a layer

Even the tightest buildings seem to
allow snow through



Dealers want bales
stacked cut side up



Lessons from a hay grower

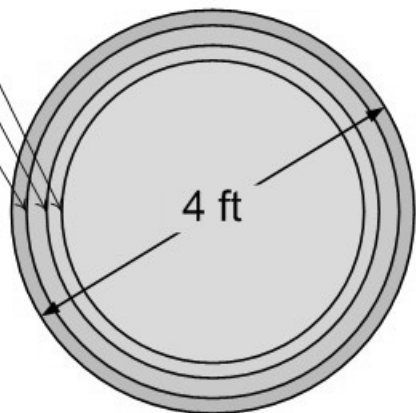
- When baling don't allow bales to spend any time on the ground to draw moisture
- If you have hay that is not fully dry:
 - Do not put damp bales on the bottom; moisture works its way up and ruins more bales
 - Don't stack damp bales tight against the next bale
- Don't allow bales to set on a wagon over night
 - Will draw moisture
 - If not stacked will be misshapen by the next day

Lessons from a hay grower

- Pest problems:
 - Rodents
 - Hay mites
- Know what your customer wants



6" deep: 44% loss
4" deep: 31% loss
2 " deep: 16% loss



6" deep: 31% loss
4" deep: 21% loss
2 " deep: 11% loss

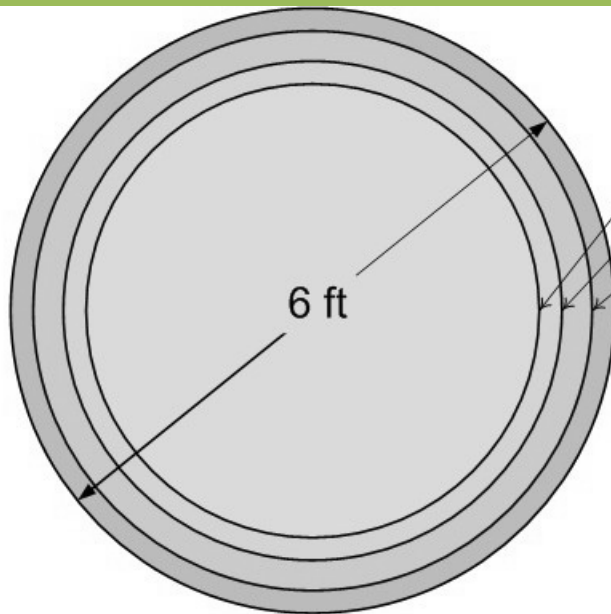


Table 2: Typical ranges in storage losses for various hay storage methods.

	% of dry weight	
Storage methods	Twine	Net wrap
Pole barn	2-5%	2-5%
Hoop structure	2-5%	2-5%
Tarp	5-10%	5-8%
Stack pad,		
covered stack	5-10%	5-8%
uncovered stack	15-40%	10-30%
Plastic wrap	5-10%	N/A
Outside on ground,		
well-drained	20-40%	15-40%
poor drainage/shaded	30-60%	30-45%

Table 3: Value of hay lost

	<i>Value of Hay (\$/dry ton)</i>			
% Loss	\$75	\$100	\$125	\$150
10	\$8	\$10	\$13	\$15
20	\$15	\$20	\$25	\$30
30	\$23	\$30	\$38	\$45
40	\$30	\$40	\$50	\$60
50	\$38	\$50	\$63	\$75
60	\$45	\$60	\$75	\$90

<http://www.uwex.edu/ces/crops/uwforage/storage.htm>

<http://www.uwex.edu/ces/crops/uwforage/BaleStorage5-7-04.xls>

HAY STORAGE METHODS FOR KEEPING COSTS LOW

February 2010 Georgia Cattleman

Dennis Hancock, Forage Extension Specialist

The University of Georgia

“Hay storage is not cheap, regardless of the method used. However, I often remind folks that if you are storing hay outside on the ground, you likely are paying for a barn whether you want to or not.”

To Bale or Not To Bale?

Sandy Buxton & Steve Hadcock
Capital Ag & Hort Program

When you are producing feed,
whether for sale or for on-farm
consumption, you need to know
what it costs you.

Do you receive top price for your forage?

- If Yes – Great!!
 - You can afford to invest in your land and equipment which will help you improve yield, quality and long term profit.

If No – you are not receiving top dollar.

- Then what is holding you back?
 - Poor Quality
 - Inconsistent quality
 - Too little of the good stuff
 - Inability to harvest on time
 - Inability to invest money into fields/equipment
 - Too many break downs
 - Bad weather slows down harvest

How to Figure Costs?

- Enterprise budgeting
 - Variable costs
 - Fixed costs
 - Breakeven cost
 - Breakeven yield

Crop cycle length

- Remember the impact a crop cycle can have on your needed returns.
- Total Cost to establish Hay ground \$411.80/ac
- Crop length Needed return
 - 3 years \$137.27
 - 4 years \$102.95
 - 5 years \$ 82.36

At some point, you will need to add value again.

Break Even Price

– Production	Orchardgrass	Timothy
• @ 1.5 T/ac	\$417.77	\$332.69
• @ 3.0 T/ac	\$208.90	\$166.34
• @ 4.5 T/ac	\$156.67	\$124.76
• What price could you get? Or afford to pay?		

Breakeven Yield

- Price/T Orchardgrass Timothy
- @ \$200/T 3.1 T/ac 2.5 T/ac
- @\$240/T 2.6 T/ac 2.1 T/ac
- Lower yields result in greater expense amounts being spread across fewer tons.

Andrew's Article

- \$150/T cost equals \$3/small square bale before storage and handling.
- Think about and track YOUR numbers.
- They may look more like these than you can imagine!

Questions?

