STORAGE STRATEGIES:
FEED AND FORAGE STORAGE

2015 Stateline Equine Conference
Determining Storage Needs

- What is being fed?
  - Hay, grain, supplements
- Who is being fed what?
- How many are being fed?
- Other items
  - Bedding, equipment, medicines, pesticides, etc.

- Determining Storage Needs
  - Purchased feed materials
  - Required amount of each ingredient
  - Delivered volume?
  - Bulk, bags, pallets, liquid?
TOPICS

• Hay Storage
  • Indoors
  • Outdoors
  • Safety concerns
    • Pests
    • Fire
    • Quality

• Feed Storage
  • Containers
  • Safety concerns

• Medicine Storage
  • Safety concerns
  • Records

• Pesticides
  • Safety concerns
  • Records
Hay storage

• Goal is to keep stored hay as fresh and palatable as possible
  • Prevent heating and possible combustion
  • Preserve nutrient content
  • Prevent mold development
How much hay?

1100-pound riding horse

• = eats 2% body weight/day as forage - 9 months
• = 3 T of hay = 600 cubic feet of storage
• = 10 foot by 10 foot stall that is 7 feet high

• Density
  • 10 pounds per cubic foot for hay
  • 26 pounds per cubic foot for grain

• Space considerations
  • provide at least 25 percent more space than the required amount you calculate
Purchase by the ton, not bale

<table>
<thead>
<tr>
<th>Price - per bale</th>
<th>Per ton</th>
<th>Per ton</th>
<th>Per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.00</td>
<td>$250</td>
<td>$166.5</td>
<td>$125</td>
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<tr>
<td>4.50</td>
<td>$225</td>
<td>$150</td>
<td>$113</td>
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<tr>
<td>4.00</td>
<td>$200</td>
<td>$133</td>
<td>$100</td>
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<tr>
<td>3.50</td>
<td>$175</td>
<td>$117</td>
<td>$88</td>
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<tr>
<td>3.00</td>
<td>$150</td>
<td>$100</td>
<td>$75</td>
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</table>

Bale Weight, lb.
### Weekly Hay Price Summary (2-13-15)

**Hay Price Summary**

<table>
<thead>
<tr>
<th>Hay Grade</th>
<th>Bale type</th>
<th>Price ($/ton)</th>
<th>Average</th>
<th>Minimum</th>
<th>Maximum</th>
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</thead>
<tbody>
<tr>
<td>Prime (&gt; 151 RFV/RFQ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Small Square</td>
<td>260.00</td>
<td>240.00</td>
<td></td>
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<td>280.00</td>
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<tr>
<td>Large Square</td>
<td>191.30</td>
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<td>272.50</td>
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<tr>
<td>Large Round</td>
<td>126.75</td>
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<td></td>
<td>180.00</td>
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<tr>
<td>Grade 1 (125 to 150 RFV/RFQ)</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Small Square</td>
<td>152.80</td>
<td>90.00</td>
<td></td>
<td></td>
<td>215.00</td>
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<tr>
<td>Large Square</td>
<td>155.20</td>
<td>120.00</td>
<td></td>
<td></td>
<td>200.00</td>
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<tr>
<td>Large Round</td>
<td>111.25</td>
<td>75.00</td>
<td></td>
<td></td>
<td>150.00</td>
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<tr>
<td>Grade 2 (103 to 124 RFV/RFQ)</td>
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<td></td>
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<td></td>
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<tr>
<td>Small Square</td>
<td>No reported sales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large Square</td>
<td>97.35</td>
<td>70.00</td>
<td></td>
<td></td>
<td>125.00</td>
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<tr>
<td>Large Round</td>
<td>83.55</td>
<td>50.00</td>
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<td></td>
<td>125.00</td>
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<tr>
<td>Grade 3 (87 to 102 RFV/RFQ)</td>
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<tr>
<td>Small Square</td>
<td>73.00</td>
<td>50.00</td>
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<td></td>
<td>96.00</td>
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<tr>
<td>Large Square</td>
<td>77.50</td>
<td>70.00</td>
<td></td>
<td></td>
<td>90.00</td>
</tr>
<tr>
<td>Large Round</td>
<td>75.80</td>
<td>70.00</td>
<td></td>
<td></td>
<td>90.00</td>
</tr>
</tbody>
</table>

* http://fyi.uwex.edu/forage
“Long-term” storage needed

- Year long storage
  - Guaranteeing hay delivered from the same lot of hay
  - Lower cost
  - Consistent quality

Monthly storage
- Less hay
- Higher cost per bale
- Transitioning between lots of hay
Hay storage

- Hay is highly combustible
  - don’t store in same barn that animals are housed in
- Insurance companies
  - often charge higher rates if > 1 week’s hay is stored in the barn
Store hay at proper moisture content

• **When cut**, around 80% moisture

• **Storage moisture** is around 16-20% moisture
  • Higher – microbial activity generates heat, and reduces hay quality both through reduced DMD and spore caused respiratory problems

• **Hay heated to 150-175°F** may spontaneously combust
Bale Condition

- Depends on type of hay
  - grass hay is looser
- Difficult to move
- May not stack well
Hay storage considerations

- Good Ventilation
  - Always place bales in the direction of prevailing winds
  - Use a minimum of 3 feet between bale rows for air circulation. The more space the better.
  - If bales are stored side by side, leave > 24” between bales

- Alternate stacking with strings up and strings to the side to increase ventilation

- Stack with cut side up to increase evaporation

- Leave space between stacks
Hay storage considerations

- Don’t stack bales higher than can be safely moved
- Stack new inventory behind the old or separate different types/ lots of hay
  - Helps transitioning horses from one type of forage to another
- Use barns for high quality forage
- Hay stacked on bare ground or on concrete will wick moisture
- Limit access by critters
Your back! Your energy!

- Cart/ wheelbarrow/ tractor access
- Height vs. lifting
- Distance to where it will be used
Consider Large Bales

- Larger door openings
- Equipment needs
Bale Size and Storage

- Small bales
  - Easiest to move and feed
  - Most expensive
- Large bales are less expensive per ton, but
  - Require equipment to move
  - Large round bales should be fed in a feeder to avoid waste
Hay storage outside?

• Store inside if possible
  • Sunlight bleaches hay
  • Loss of vitamin A and proteins
Large bale considerations for storage outside

- Store on twine or wrapped side
- Tractor or skid loader necessary to move
- Cover with tarp or other thick material if possible
  - Loss can be prevented up to 10 % by covering
- Slope the tarp so that water can run off smoothly
- Proper feeders to minimize loss
- Bales not touching to avoid pooling of water between bales
Storage time vs. quality

- Losses after 12 to 18 months can be twice as great as losses after nine months of storage. (Oklahoma State University)
- As hay is stored it loses both dry matter and moisture
- Fibrous carbohydrates increase
- Protein decreases at a slower rate than carbohydrates
# Longevity of Stored Hay

<table>
<thead>
<tr>
<th>Hay Storage Options</th>
<th>Storage Longevity (Years)</th>
<th>Dry Matter Loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Shed</td>
<td>20</td>
<td>4 to 7</td>
</tr>
<tr>
<td>Tarped on Pallet</td>
<td>5</td>
<td>4 to 7</td>
</tr>
<tr>
<td>Net Wrap on Ground</td>
<td>1</td>
<td>15 to 25</td>
</tr>
<tr>
<td>Twine on Ground</td>
<td>1</td>
<td>25 to 35</td>
</tr>
</tbody>
</table>

[www.extension.umn.edu/agriculture/horse/nutrition/selecting-and-storing-horse-hay](http://www.extension.umn.edu/agriculture/horse/nutrition/selecting-and-storing-horse-hay)
Hay Storage Concerns

- Black Patch Mold
  - second-cutting red clover
  - sometimes other legumes
  - toxin that stimulates the salivary glands, the lacrimal glands.

- Hay Mold, dust

- EPM - Equine Protozoal Myeloencephalitis
  - Opposum
Mold in Hay

- Heavily molded hay
  - put up moist
  - possible heat damage

- Presence of mold
  - does not necessarily mean that the feed quality is lower
  - lower palatability

- Testing is possible

- Hay preservative
  - Hay desiccants
  - Mower conditioners
  - Bacterial inoculants
  - May reduce palatability
  - Hard on equipment (acidity)
Birds

- Can consume feed, contaminate feed and water with feces, damage equipment

Some Considerations:
- Keeping them out of the barn, while providing good ventilation
- Clean up any spilled grain
- Consider covered feeders
- Water levels
- Most bird species are protected
  - But not pigeons, starlings, house sparrows
- You are liable if you kill nontarget species
Think F-E-E-D-S **

- **Flexibility**
  - changes; expansion

- **Economy**
  - low cost; effective; minimal waste

- **Ease of operation**
  - Feeding steps; mechanization

- **Dependability**
  - Simple is best

- **Safety**

  **Dan F. McFarland, M.S., Agricultural Engineering Educator, Penn State**
Feed Storage

- Containers with lids
- Labeling/ Dates
- Keeping rats/ mice out
- Monitoring traps for rodents
Bagged Feed

- Convenient but costly
- Makes transport and storage easy
- Timely purchasing to minimize feed from going stale
- Can buy bags by the ton for a volume discount
- Do not store on concrete
- Not rodent proof
Medicines

- SAFETY! Recordkeeping
- *Separate measuring tools from feed*
- Refrigeration?
- Locked cabinet
- Cleanliness
- Discard outdated veterinary supplies
Pesticide Storage

- SAFETY! Recordkeeping
- Do not store in same area as feed and forage
- Insecticide Sprays – don’t spray by feed/ forage
- Locked cabinet, especially with children present
- Clean equipment immediately to minimize exposure to others
- Worker Protection – everyone should be aware of safety concerns
SUMMARY

• Hay Storage
  • Indoors
  • Outdoors
  • Safety concerns: Pests, Fire, Quality

• Feed Storage
  • Containers
  • Safety concerns

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Questions?

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