Optimizing Different Hay Types for Horses: What have we learned?

Anne Rodiek
California State University, Fresno
New discoveries in equine nutrition in the last 20 to 30 years that has led to better understanding of the role of nutrition in:

* Growth and skeletal development
* Various metabolic diseases
* Colic and laminitis
In the discovery of new knowledge, old knowledge is often “rediscovered”:

- The importance of a natural approach to horse management and nutrition
  - The importance of social interaction with other horses, freedom of movement, good air quality
  - Frequent, small meals
  - Need for adequate fiber in the diet for gut health, immunity, and even behavior
  - The importance of good quality forage as the cornerstone of healthy rations.
    - More natural
    - More healthful
    - More economical
Good quality forage is the basis of all horse rations

- Adult, healthy horses in maintenance condition or light work can be maintained on a diet comprised solely of good quality forage, either legume or grass
- On average, horses eat 2% of their body weight daily of air dry feed.
- 1100 lb. horse will eat about 22 lbs. of hay/day
The Queen of Forages

- Despite much bad press, alfalfa hay is unsurpassed to provide energy, protein, lysine and calcium (in forage form) to pregnant and lactating mares and growing horses.
- It is palatable, available, and usually uniform.
- It is low in sugars, starch and fructans, important for horses predisposed to laminitis.
- Its energy and protein content, in combination with low carbohydrate content is the best hay for refeeding starving horses.
Sugars, starch and fructans

- Different types of carbohydrate manufactured by plants
- Impart energy to forages for growth and production
- Are metabolized by different pathways
- Are implicated in metabolic diseases in some horses
Sugars, starch and fructans: A link between carbohydrates and laminitis

- Complex mechanisms, not completely understood.
- Older, sedentary, obese horses of certain breeds appear to be predisposed to laminitis.
- Dietary triggers to laminitis occurs when large amounts of starch escape small intestine digestion, and/or
- Large amounts of microbially fermentable carbohydrate (primarily fructans from grass pasture or hay)
- reach large intestine, and provide substrate for “furious fermentation” by microbes.
Link between carbohydrates and laminitis

- Creating large amounts of acids that decrease large intestine pH, kill several types of bacteria, damage intestinal lining and allow escape of toxins or other compounds into the general circulation.
- At level of hooves, compounds cause inflammation or otherwise decrease circulation to living tissues of hoof.
- Death of living tissues allows hoof to lose its attachment to leg – acute laminitis.
Link between carbohydrates and laminitis

- Fast growing or stressed cool season grasses, grazed as pasture or harvested as hay, are most often implicated as contributory to onset of laminitis.
- This includes winter grown crops that experience bright sunny days and cold nights.
- It also includes stressed plants that accumulate sugars and fructans through photosynthesis but do not utilize the stored energy for growth because of other nutrient deficiency, drought or cold stress.
Link between carbohydrates and laminitis

- This can lead owners of laminitic horses to seek forages low in carbohydrate compounds.
- However, these plants may also be low in other nutrients needed for adequate nutrition.
- A balance must be achieved between desire for low carbohydrate forage and general malnutrition.
Cereal hays: wheat, oat, barley

- Excellent source of fiber and energy for horses with moderate protein requirements.
- Fibrous stems provide bulk in the ration, give fat horses more to eat with fewer calories,
- Although it can be quite high in starch in the grain component and sugars and fructans in the leaves and stems
- Generally good, although sometimes variable palpability, it’s excellent for healthy, adult horses not predisposed to laminitis.
Warm season grasses: Bermuda and Teff

- Warm season grasses accumulate fructans in particular and carbohydrates in general to a lesser degree than cool season grasses.
- As such, warm season grasses are lower in energy than cool season grasses and provide less carbohydrate to the horse, either as enzymatically or microbially digestible compounds.
- Warm season hays have received much attention lately as appropriate feeds for obese or laminitis horses.
Alfalfa hay

- Generally low in carbohydrate, but relatively high in energy due to high content of protein.
- May be used as a ration “balancer” to supply needed nutrients to horses fed warm season grasses.
Measurements of carbohydrate content of hay

Commercial laboratories run different analyses of carbohydrate content of hays:

* **Starch** – such as is often found in grain, including in cereal hays

* **Ethanol soluble carbohydrate (ESC):** mono- and disaccharides digested mainly in the small intestine, i.e., simple sugars that are absorbed as glucose into circulation.

* **Water soluble carbohydrate (WSC):** Mono-, di- and polysaccharides mainly fermented in the large intestine (primarily fructans)

* **Non-fiber carbohydrate (NFC):** non-cell wall carbohydrates that include starch, sugar, pectins, fructans, other fermentable compounds. Calculated as 100% – (CP% + NDF% + Fat% + Ash%)

Some/all can be used to assess carbohydrate content of hay.
Carbohydrate content of different hay types

<table>
<thead>
<tr>
<th>Nutrient content of hay</th>
<th>Legume hay</th>
<th>Oat hay</th>
<th>Wheat hay (cool season)</th>
<th>Grass hay</th>
<th>Bermuda grass hay</th>
<th>Teff hay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digestible Energy (Mcals)</td>
<td>1.2</td>
<td>.9</td>
<td>.9</td>
<td>.9</td>
<td>.9</td>
<td>.8</td>
</tr>
<tr>
<td>Starch (%)*</td>
<td>1.9</td>
<td>5.1</td>
<td>4.3</td>
<td>2.3</td>
<td>5.8</td>
<td>.8</td>
</tr>
<tr>
<td>Ethanol soluble carbohydrate (%)</td>
<td>7.4</td>
<td>11.9</td>
<td>12.5</td>
<td>7.5</td>
<td>7.4</td>
<td>4.3</td>
</tr>
<tr>
<td>Water soluble carbohydrate (%)</td>
<td>9.1</td>
<td>16.8</td>
<td>16.5</td>
<td>10.9</td>
<td>7.4</td>
<td>6.1</td>
</tr>
<tr>
<td>Non-fiber carbohydrate (%)</td>
<td>11.0</td>
<td>22.0</td>
<td>17.6</td>
<td>12.0</td>
<td>13.2</td>
<td>14.0</td>
</tr>
</tbody>
</table>

from equi-analytical.com
Selling hay based on carbohydrate content?

- What kinds of analysis should horse owners want to see for hay?
  - Protein (%)
  - Digestible energy (calculated, Mcal/lb)
  - Some measure of carbohydrate content (likely ESC, WSC, NFC, %).
  - Perhaps ADF (% which is related to DE)
What do horse owners really want?

- The same things as before:
  - Uniform, green, soft, weed-free, undamaged hay

- Information/Education
  - Working with a hay supplier that understand horses
  - And knows a bit about how different hays can best be used for different types of horses, at least in three different categories:
    - **Alfalfa hay** – young, growing, late pregnant, lactating, starving
    - **Cereal hay** – healthy, working, not obese or laminitc
    - **Warm season hays** – overweight, laminitic
  - No one hay does everything. A balance of all three types if likely the best for balanced nutrition.