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

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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

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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**

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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

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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.

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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

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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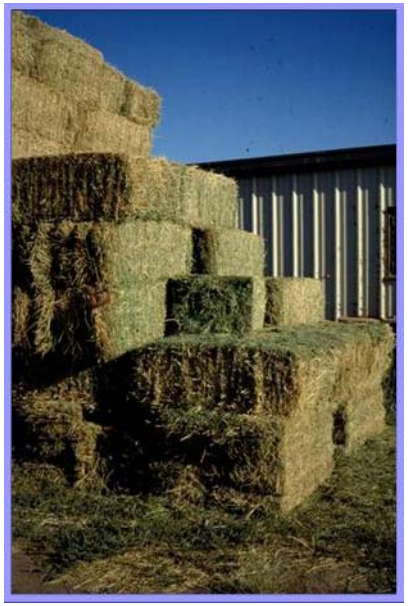

Measurements of carbohydrate content of hay

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, ie simple sugars that are absorbed as glucose into circulation.

* **Water soluble carbohydrate (WSC)**: Mono-, di- and polysaccarides 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

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Carbohydrate content of different hay types

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

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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)

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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.

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