



Selecting Appropriate Hay for Horses

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Unique demands of the horse industry....



GETTY IMAGES

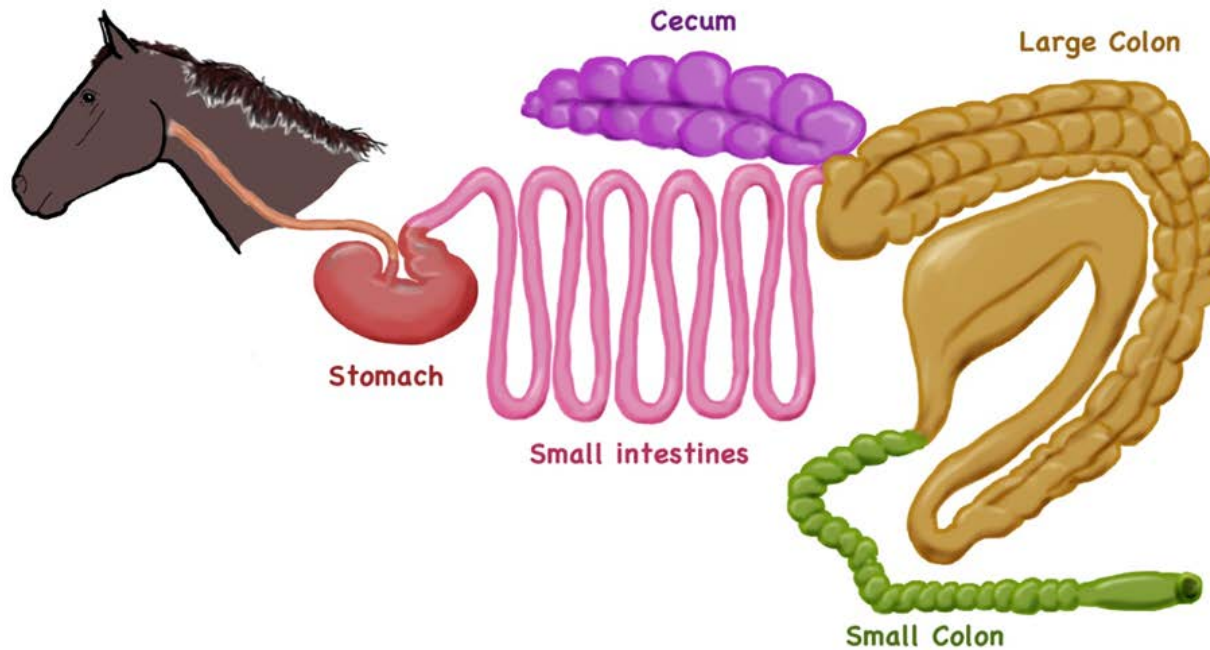


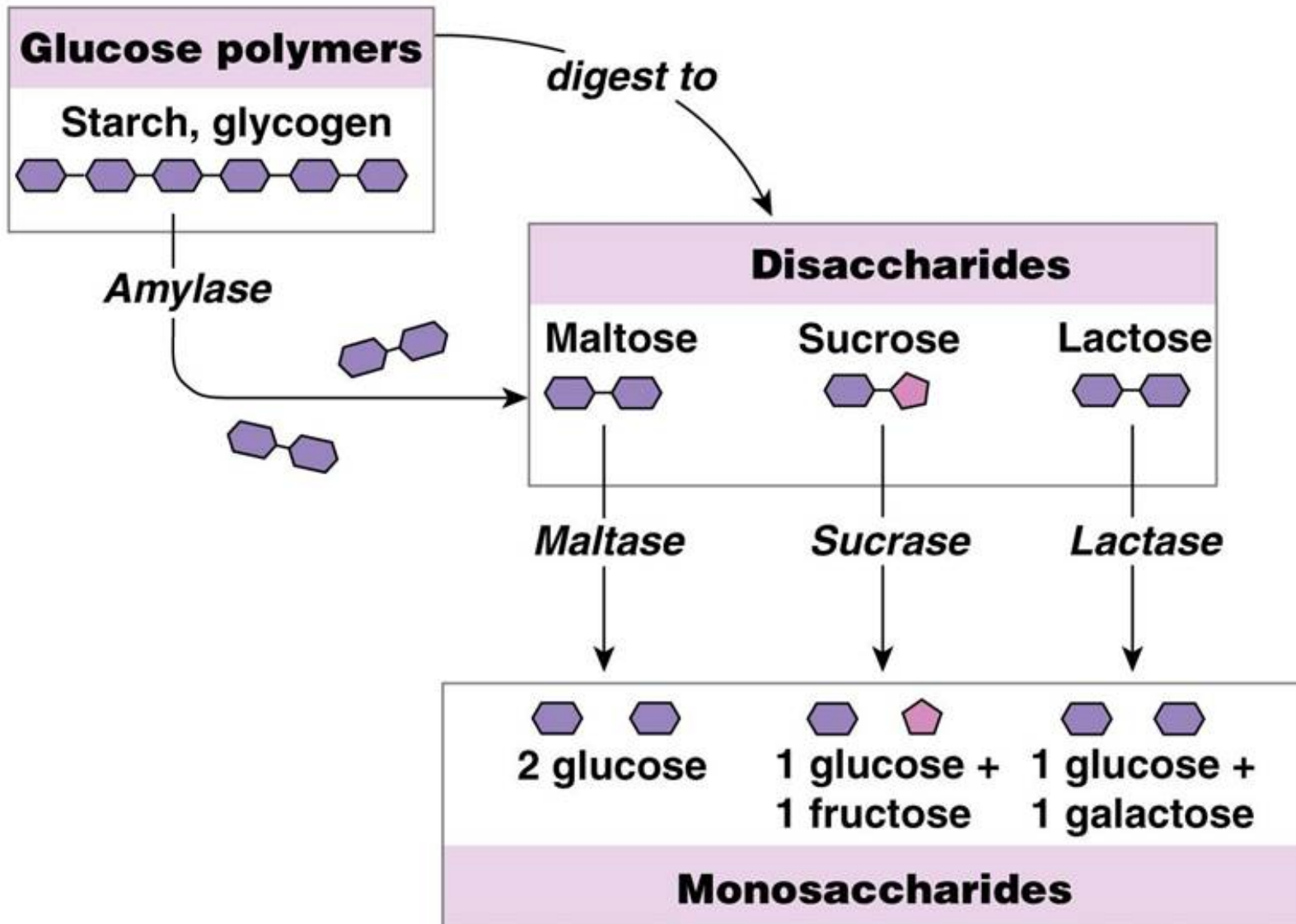
Know what your clientele wants!

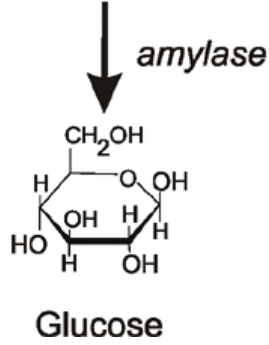
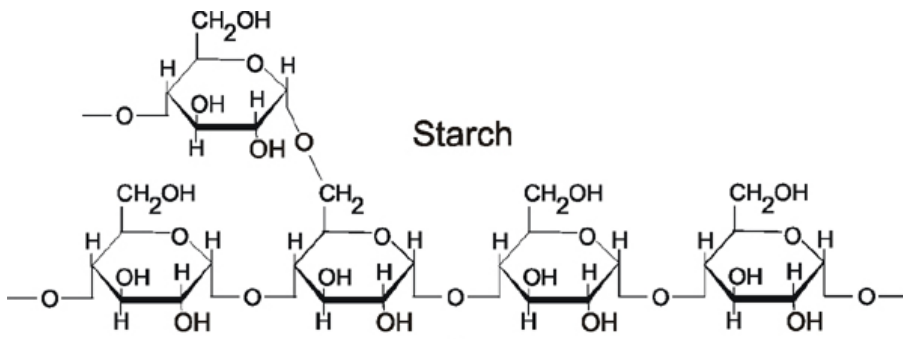
- ▶ What types of hay do they feed?
- ▶ Square vs. Round bales
- ▶ Forage test
- ▶ Sensory properties
- ▶ Delivery and storage
- ▶ Cost



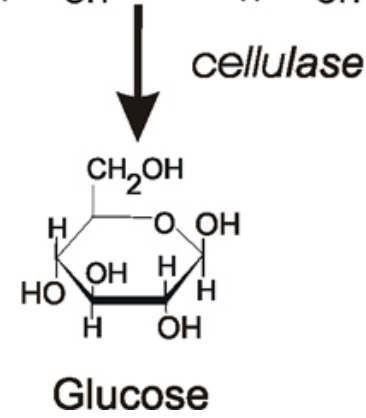
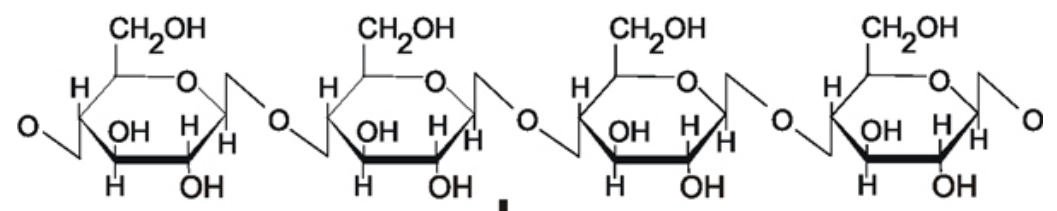
Horse GI anatomy



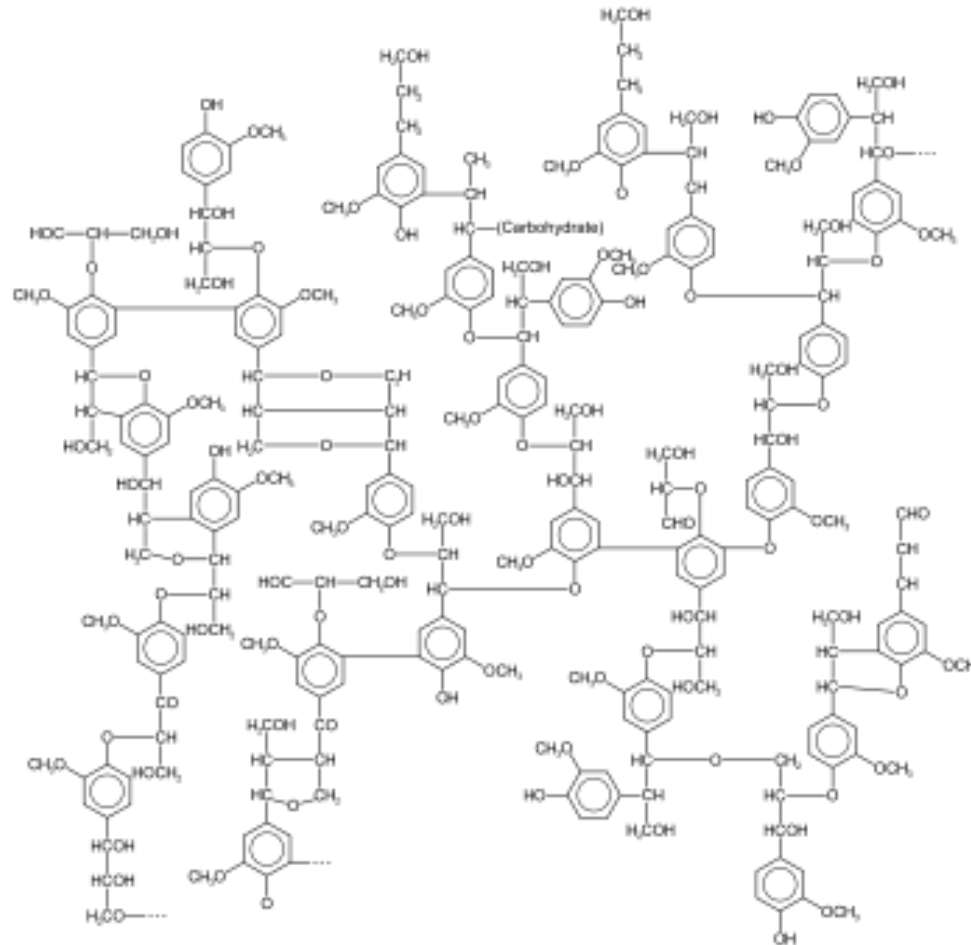




Cellulose



An example of a lignin structure...



Forage Quality Determined by:

- ▶ Digestibility
 - Maturity—stage when harvested
 - Moisture content
 - Stem to leaf ratio (more leaves=better quality)
- ▶ Free of dust, weeds, mold
- ▶ Storage for horses



What goes wrong with performance horses??



Colic



Ulcers

What do horse owners feed?

- ▶ Grass hay
 - Bermudagrass
 - Coastal vs. other hybrids
 - The colic dilemma
 - Timothy, Orchardgrass
 - Tall fescue—endophyte contamination
 - Ryegrass—problematic for sugar sensitive horses
- ▶ Legumes
 - Alfalfa
 - Perennial peanut
 - Red clover—slobbers
 - Lespedeza

Comparison of bermudagrass hybrids

Table 1a.

Summary of the characteristics of the primary vegetatively propagated (sprigged) bermudagrasses in Georgia.

Variety	Overall Rating	Yield*	Digestibility**	Winter Hardiness	Persistence	Leaf Spot Resistance
Alicia (Alecia)	★★↓	100	P	G	P	P
Coastal	★★★★↓	100	F	G	G	E
Coastcross II	★★★★↓	135	E	G	ND	ND
Russell	★★★★↓	130	G	E	E	G
Tifton 44	★★★★	90	G	E	G	E
Tifton 78	★★★	120	E	F	F	E
Tifton 85	★★★★★	135	E	F	E	E

Ratings: E = Excellent, G = Good, F = Fair, P = Poor.

* Yields are expressed as a percent of yields from Coastal.

** Based on *in vitro* dry matter digestibility.

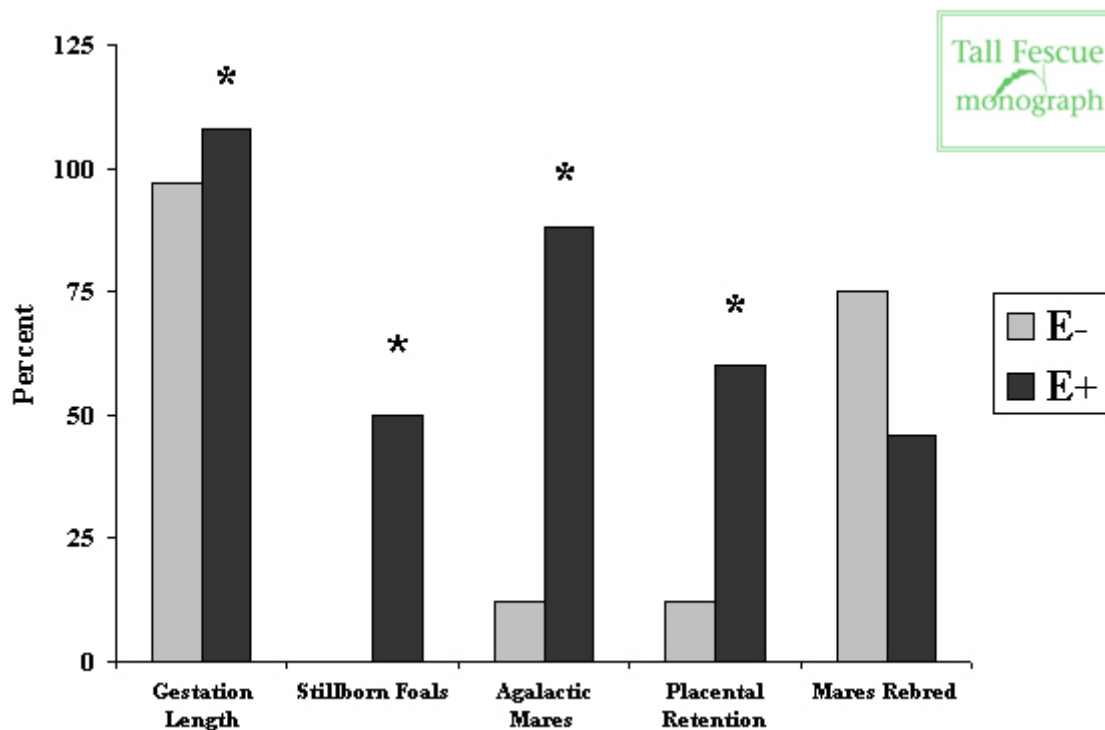
ND Insufficient data exists to accurately estimate these parameters. Coastcross II remains a relatively new variety and has not yet been evaluated as rigorously as other hybrids.

Selecting a forage bermudagrass variety. UGA Cooperative Extension. Dennis W. Hancock, Norman R. Edwards, T. Wade Green, Deron M. Rehberg.

Molds and fungi in forages

- ▶ Horses can be very sensitive to molds
 - Storage is very important
- ▶ Tall fescue
 - Endophyte produces ergovaline—reproductive problems
- ▶ Sweet clover
 - Moldy plants produce dicumerol
- ▶ Red clover
 - *Rhizoctonia leguminicola*
 - Slaframine

Fescue Toxicosis



Comparison of the effects of E+ and E- tall fescues on gestation length, foal mortality, agalactia, incidence of placental retention, and rebreeding response in mares (adapted from Monroe et al., 1988). Stars indicate significant difference between treatments ($P < 0.05$).

Other forage contaminants

- ▶ Blister beetles
 - Cantharidin
 - Alfalfa
 - 1/4" X 3/4"
 - Cutting of hay

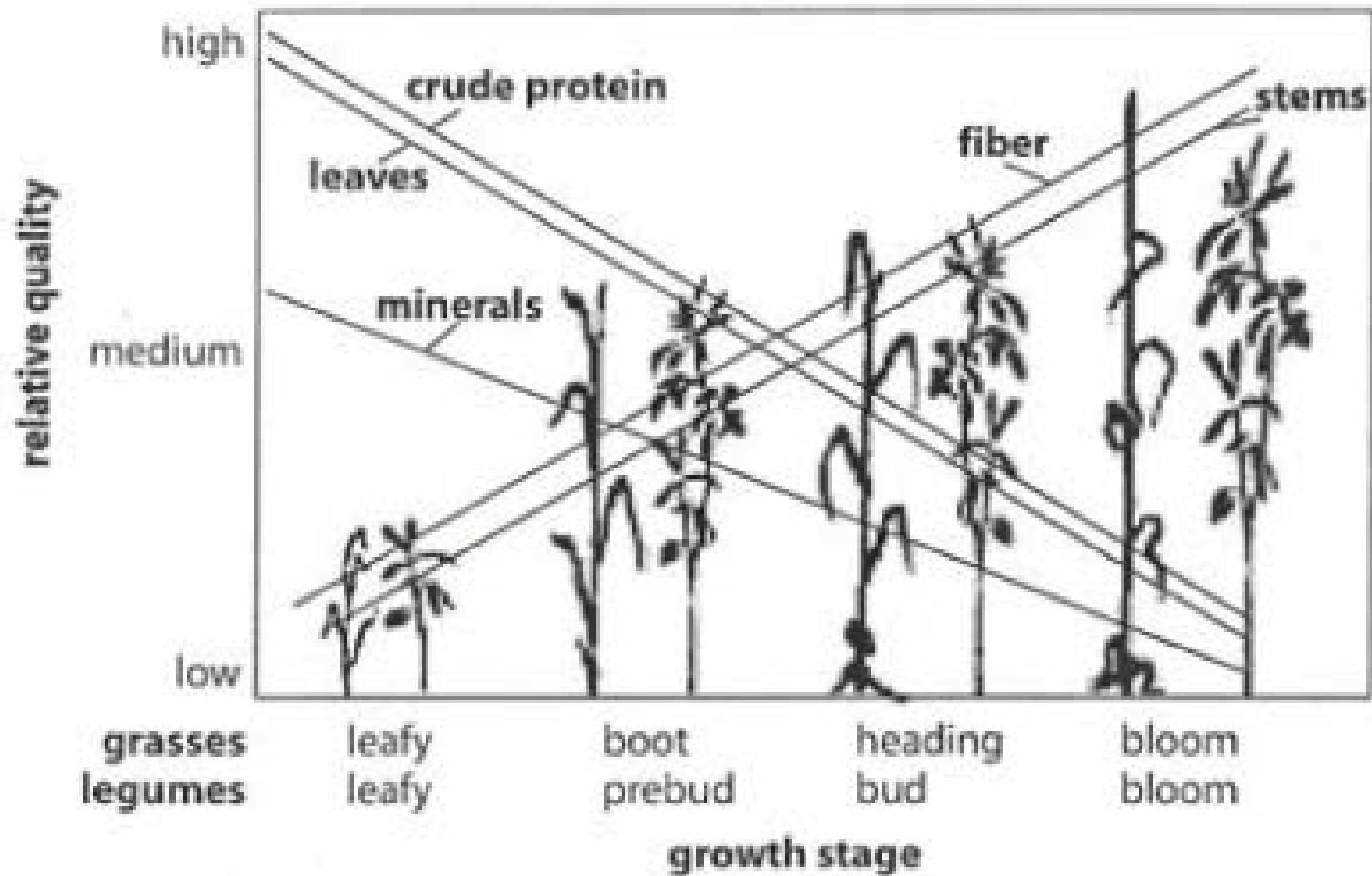


Nitrate Toxicity

- ▶ Urea
 - NPN
 - Digestion in rumen vs. stomach/small intestine
 - Conversion to CO_2 and ammonia
 - Toxicity: 0.3–0.5 g/ lethal 1–1.5 g/kg; horses 4 g/kg
- ▶ Forage nitrate accumulation
 - Sudan grasses, Johnsongrass, Bermudagrass, Tall Fescue, Ryegrass, Pearl Millet, Crabgrass
 - Higher concentration following heavy fertilization
 - <4500 ppm dry forage safe
 - Horses may tolerate closer to 10,000 ppm

Forage analysis to determine hay quality!

- ▶ DE most important; ADF, NDF
- ▶ Protein
 - Good quality grasses: 10–16% CP on DM basis
 - Good quality legumes: 18–22% CP on DM basis
- ▶ Also should include % moisture
 - No less than 10% (leaf shattering)
 - No more than 15–18% (mold, combustion)
- ▶ Minerals, esp. Ca, P



Hay Market Task Force Classifications

Quality Standard	Crude Protein	ADF (Acid Detergent Fiber)	NDF (Neutral Detergent Fiber)	RFV (Relative Feed Value)
Prime	>19%	<31%	<40%	>151
1	17-19%	31-35%	40-46%	151-125
2	14-16%	36-40%	47-53%	124-103
3	11-13%	41-42%	54-60%	102-87
4	8-10%	43-45%	61-65%	86-75
5	<8%	>45%	>65%	<75

Additional considerations:

DE less than 0.75 Mcal/lb are not suitable for horses
ADF greater than 45% are not very digestible to horses
NDF greater than 65% are not readily eaten by horses

ADF less than 31% considered excellent
NDF less than 40% considered excellent

How do different hays rank?

Table 1: Typical nutrient content of hays fed to horses (as-fed basis)*

Hay Variety	Digestible Energy (Mcal/lb)	Acid Detergent Fiber (%)	Crude Protein (%)	Calcium (%)	Phosphorus (%)
Alfalfa	0.8 to 1.1	24 to 34	15 to 22	0.9 to 1.5	0.2 to 0.3
Perennial peanut	0.8 to 1.0	28 to 38	10 to 15	0.9 to 1.5	0.2 to 0.3
Orchardgrass	0.7 to 1.0	30 to 40	7 to 11	0.3 to 0.5	0.2 to 0.3
Timothy	0.6 to 1.0	30 to 40	6 to 11	0.3 to 0.5	0.2 to 0.3
Bermudagrass	0.7 to 1.0	28 to 38	6 to 11	0.3 to 0.5	0.15 to 0.3
Grass/legume mix hay	0.8 to 1.0	27 to 36	12 to 18	0.8 to 1.2	0.2 to 0.3

*Source: Dairy One, Feed Composition Laboratory

Different hays for different horses?

Table 3: Guidelines for Matching Hay to the Horse

Horse	Type of Hay	Visual Characteristics*	Laboratory Characteristics	
			Crude Protein	ADF
Weanlings Lactating mares	Early- to Mid- Maturity Legume hays or Grass/legume Mix hays	Leafy Fine stemmed Few seed heads/flowers	> 14%	< 34%
Performance Yearlings 2-year-olds	Mid- Maturity Grass or Legume hays or Grass/legume Mix hays	Leafy Medium-fine stems Small, soft seed heads, small flowers on legumes	12 – 16 %	30 – 36%
Recreation use or idle horses	Mid- to Late-Maturity Grass hays Late- Maturity Grass/legume Mix	Medium stems Large, soft seed heads, flowers on legumes	8 – 12%	37 – 40 %
Overweight	Late- Maturity Grass hays	Thick, coarse stems Large, brittle seed heads	7 – 10%	> 40%

**All hay should be clean-smelling and free from molds, weeds and trash; avoid excessive rain damaged hay.*

How to estimate digestible energy...

- ▶ $DE \text{ (kcal/kg DM)} = 2,118 + 12.18 \text{ (CP\%)} - 9.37 \text{ (ADF \%)} - 3.83 \text{ (hemicellulose \%)} + 47.18 \text{ (fat \%)} + 20.35 \text{ (NSC)} - 26.3 \text{ (ash \%)}$
- ▶ $DE(\text{kcal/kg}) = 255 + 3660 \times \text{TDN}$

How to determine value?

- ▶ Need to determine:
 - Cost of hay/pound
 - Mcal of DE/\$
- ▶ **Example 1**
 - 50 lb bale of bermudagrass that costs \$5.00
 - $\$5.00/50 \text{ lbs} = \$0.10/\text{lb}$
- ▶ If that bale of hay had 0.80 Mcal DE/lb
 - $.80 \text{ Mcal DE/lb} \times 1 \text{ lb}/\$0.10 = 8 \text{ Mcal DE}/\1.00
- ▶ **Example 2**
 - What about a bale of alfalfa that costs \$10.00/bale and has 1.00 Mcal DE?
 - $\$10.00/50 \text{ lbs} = \$0.20/\text{lb}$
 - $1 \text{ Mcal DE/lb} \times 1 \text{ lb}/\$0.20 = 5 \text{ Mcal DE}/ \1.00



Carbohydrate testing

- ▶ NSC vs ESC vs WSC
- ▶ WSC
 - Simple sugars, disaccharides, oligosaccharides, and some polysaccharides
 - Includes fructans
 - Glycemic response depends on % of fructans
- ▶ ESC
 - Subset of WSC
 - Includes sugars, disaccharides, oligosaccharides and some fructans
 - Typically induces high glycemic response
- ▶ NSC
 - WSC+starch

Average sugar, starch, and non-structural CHO

FEEDSTUFF	SUGAR	STARCH	NSC
Oat hay	16.0%	6.3%	22.3%
Alfalfa hay	8.9%	2.5%	11.4%
Bermudagrass hay	7.5%	6.1%	13.6%
Grass hay	11.1%	2.9%	13.8%
Beet pulp	10.7%	1.4%	12.1%
Oats	6.3%	44.4%	50.7%
Corn	3.7%	70.3%	74.0%
Wheat middlings	10.1%	26.2%	36.3%
Soybean meal	14.3%	2.1%	16.4%

Additional References

- ▶ http://www.caes.uga.edu/applications/publications/files/pdf/B%201224_2.PDF
- ▶ <http://www.ker.com/library/equine/v9n2/v9n210.pdf>
- ▶ <http://www.agry.purdue.edu/ext/forages/publications/ID-190.htm>
- ▶ <http://animal.ifas.ufl.edu/extension/equine/documents/2006EquineInstit/SelectingHay.pdf>
- ▶ <http://www2.ca.uky.edu/agc/pubs/id/id146/id146.htm>
- ▶ <http://animalscience.tamu.edu/files/2012/04/equine-selection-usage-hay-processed-roughage11.pdf>

Questions?

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