Feedstuffs

Equine Nutrition #5
Created for Canadian Pony Club
Education
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Feedstuffs

Cereal Grains

- The cereal grains are high in starch
  - This means they are high in energy
- Grains are the most commonly fed high energy source
- Grains contain 50-60% more digestible energy per pound than hay
- The most commonly fed cereal grains are:
  - Oats
  - Corn
  - Barley
- Other grains that are fed to horses include:
  - Rye
  - Sorghum
  - Triticale
  - Spelt
  - Wheat (not recommended)

Nutrient composition of grains

- Digestible energy of cereal grains is relative stable
  - 12-16 MJ per kg
- Protein levels are moderate
  - Approximately 10%
  - But this is a low quality protein
    - Grains are low in lysine
- Grains are low in Ca and high in Ph
- Grains are low in fibre

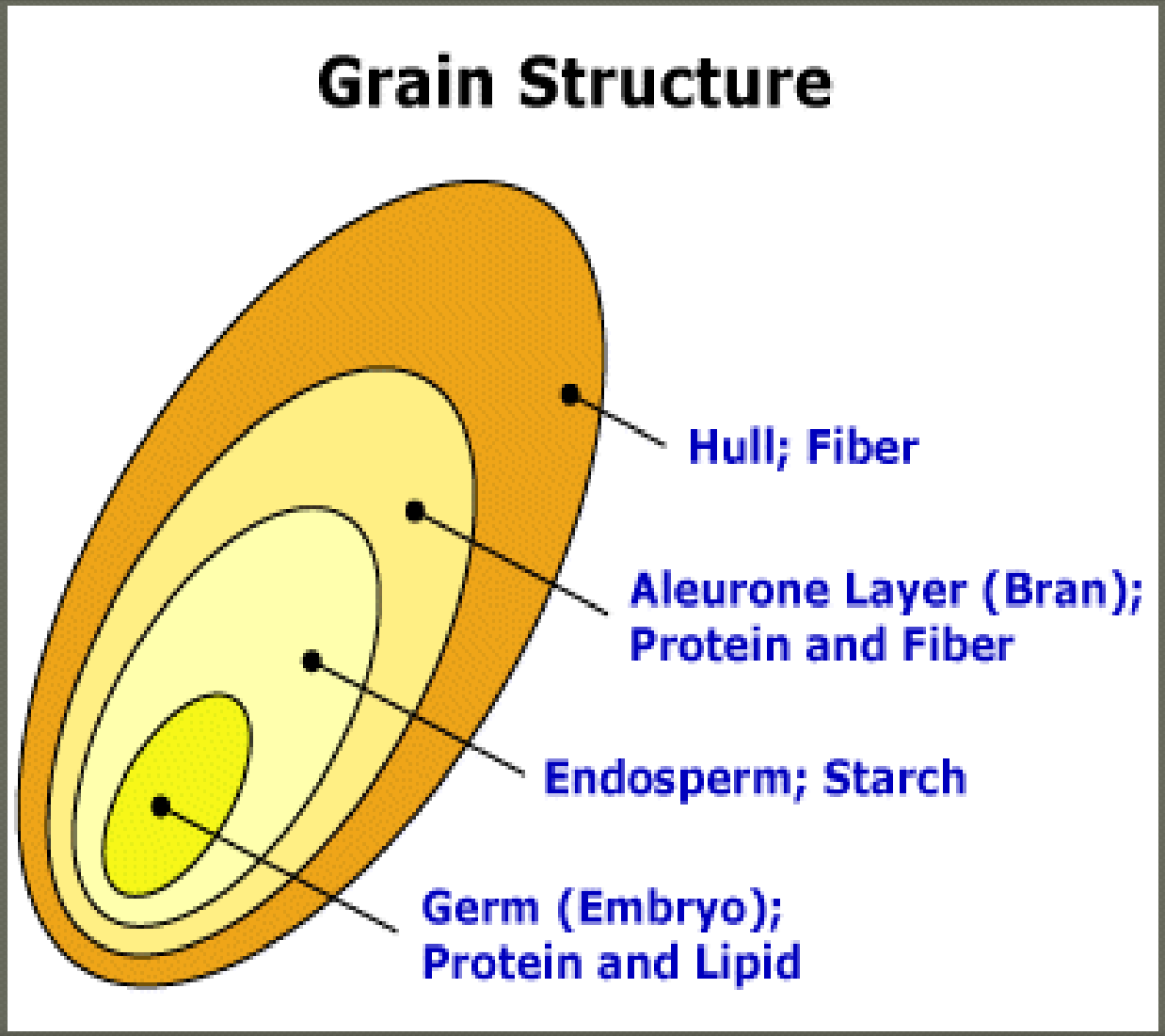
Cereal Grains

Cracked Corn

Crimped Oats

Steam Flaked Barley

Cereal grain structure



Oats

- Oats are the most commonly fed cereal grain
- Oats are considered a 'safe' grain as they are ***less energy dense***
  - This is due to higher levels of fibre in oats (11% crude fibre)
    - Fibre is found in the hull
    - This makes horses consuming them less susceptible to laminitis and colic
- The amount of oats that is digested entirely in the small intestine is relatively high
- Processing oats will increase digestibility
  - Crimping or rolling can improve digestible energy content by 5-7% for horses with sound mouths
  - Processed oats last longer than other grains that are processed
  - Whole oats have a longer shelf life than processed oats
- Oats are highly palatable
- Oats are low in phosphorous
  - They also have too much phosphorous in relation to calcium
- Oats have virtually no carotene, and are a poor source of vitamin B
- If a dietary change is made from an energy dense food to oats, more oats will be required

More about oats

- The energy content of oats is 40% of its dry matter (DM)
- Protein is usually in the range of 10-12%
  - The average is 10%
- The fat content is 5%
- Oats contain 70% Total Digestible Nutrients (TDN)
- If fed alone, can result in vitamin and mineral deficiencies

Oats vs. barley

OATS

BARLEY

Barley

- Barley can be fed in the grain form or as a Brewer's by-product
- Processing of barley will increase digestibility as it is a hard grain to chew whole
- It can be fed:
  - crushed
  - ground (but if fed in this form, should be mixed with another grain to prevent colic),
  - steam rolled
  - as dried brewer's grains
  - brewer's yeast
  - dried distiller's grains
    - Brewer's by-products provide additional digestible energy, protein, minerals and vitamins
      - They are an excellent source of B vitamins, in particular, thiamine
      - They contain 27% protein, 7% fat, and 16% fibre
      - They are used in supplementary form only

More about barley

- Barley has a low percentage of hull which makes it classified as a 'heavy' feed
  - The fibre content is 5-6%
- Barley has too much phosphorous in relation to calcium
- Barley has:
  - 55% DM starch
  - 9-12% protein
    - 9% is the average
  - Digestible energy and protein of barley falls between that of oats and corn

Corn

Corn

- Corn is also referred to as ***maize*** in the UK
- Corn may be fed as:
  - ear corn
  - whole shell corn
  - cracked
  - crushed
  - It should never be fed finely ground as this is very dusty
    - Feeding whole ears increases saliva and therefore digestibility, but increases the chances of choke
    - Horse with dental problems will not do well on ear corn or whole corn
- Digestibility of corn will be improved the more it is processed
  - Of cracking, grinding or steam processing, the latter produces the greater glycemic response
  - Cracked corn can cause excess gas formation leading to colic, due to higher levels of soluble carbohydrates that can be accessed
- Corn is high in carotene, a precursor of vitamin A
- Corn has too much phosphorous in relation to calcium

More about corn

- Corn is:
  - 70% DM starch
    - It has the most energy of all the grains
    - The amount of starch from corn digested in the small intestine is much lower than oats
  - Corn has approximately 7-10% protein
    - The average is 8%
    - This is also a low quality protein as it is deficient in lysine and other essential amino acids
  - Corn is low in fibre:
    - 2%

Other Grains: Wheat

- Ideally wheat is not fed to horses
  - It is very expensive so therefore not economical
  - It should never be fed ground as this can cause colic due to high levels of gluten which will create a doughy mass in the stomach
- Wheat is a 'heavy' food
- Bran is a by-product of wheat
- Wheat contains:
  - 80% digestible energy
  - 2.4% crude fibre
  - 11.4% protein

Other grains: Rye

- Most rye fed to horses are mill by-products, so availability is a big issue
- Rye middlings are the most commonly fed form of rye
  - Middlings are the fine particles of the kernel that is left after the whole grain is milled
  - They have a crude fibre content of 5.2%
  - They contain 72% TDN
  - They contain 16.6% protein

  They contain 3.4% fat

Other grains: Milo

- Milo is a variety of sorghum grain
- These have similar properties to corn
- Milo has:
  - 8-16%
  - 2.6% crude fibre
    - This is low
  - 2.7% fat
  - 75% carbohydrates
    - This is high
  - a TDN of 79.4%
- It is not a good source of vitamins or minerals
  - It contains less carotene than corn

Other grains: Spelt and Triticale

- Spelt
  - Spelt is a relative of wheat
  - Spelt is encased in a large fibrous hull
  - Spelt contains:
    - 9% crude fibre
    - 2% fat
    - 12% protein
- Triticale
  - Triticale is a hybrid of wheat and rye
  - It has the quality of wheat and the hardiness of rye
  - Triticale contains:
    - 4% crude fibre
    - 1% fat
    - 15% crude protein

Prepared Feeds

BALANCED OR COMPLETE FEEDS

- Pellets
- Extruded

BY-PRODUCTS

- Grain by-products:
  - Bran
  - Rice bran
- Fibrous by-products:
  - Beet pulp
- Oil by-products:
  - Linseed meal
  - Soybean meal

Pellets

There are 4 types of pellets

- Single ingredient (e.g., alfalfa meal)
- Mixed grain pellets
- Feed supplements
- Complete feed pellets (grain and hay together)

- They were designed to be a 'balanced' food
- Theoretically, they supply adequate:
  - fibre
  - carbohydrates
  - fats
  - proteins
  - vitamins
  - minerals
- Minerals are balanced and adjusted to soil conditions of the area
- Protein levels can be adjusted to meet requirements of different horses

Extruded Feeds

- Extruded feeds are ground grains that have had pressure and steam applied
  - They are cooked into a kibble form
  - The process preserves protein and vitamin content
- Extruded feeds have a higher digestibility due to its composition
  - One advantage of this is it makes horses eat more slowly
- Formulas can be created to meet the individual needs of each horse, for example:
  - Horses prone to colic or choke
  - Horses that bolt their feed
  - Aged horses and horses with poor teeth
  - Growing horses

Bran

- Bran is the by-product of milling wheat
- It is primarily the outer husk of wheat in flake form
  - Bran is high in organic phosphorous (1.13%) and low in calcium
    - This can cause the calcium phosphorous ratio to invert
  - Bran has 16% protein
    - It is very low quality protein
    - This is because it does not have a broad range of amino acids
- Bran has a surface area that encourages water adhesion
  - a good way to introduce medication or extra water into the diet
- Bran is highly palatable
- Bran contains:
  - 67% TDN
  - 4% fat
  - 10% crude fibre

Some people feel bran is somewhat abrasive to the intestinal tract due to its high fibre content

Beet Pulp

- Beet pulp: the residue remaining after processing sugar beets
- Typically is fed soaked to prevent colic, therefore is also dust-free
- Recent Liverpool University study found a high correlation between large colon torsions and ingestion of beet pulp
- Beet pulp:
  - High in fibre – 18%
    - Considered a 'super fibre'
    - Improves ability to digest other fibres in diet
  - Has moderate levels of protein – 9%
    - Is high in lysine
  - High in calcium, and the Ca:Ph is good
  - High in digestible energy - 30 kJ
    - Energy is diluted when fed soaked
  - Very digestible – 85%
  - Low in starch and sugars (if no molasses added)
  - Helps with hydration as it must be fed soaked
  - Low in B vitamins; no carotene or vitamin D

Other concentrates

- Rice Bran
  - Fed in additive or supplement form only
  - Feed stabilized and fortified versions only
  - High fat (20%), B vitamins, phosphorous, fibre
  - Inverted calcium:phosphorous ratio
  - Good source of starch and protein
  - Contains gamma oryzanol which helps to build and repair muscle
  - Easy to digest
  - Not appropriate for overweight horses
  - Expensive
  - Comes in powdered or pelletted forms

Peas and beans are more commonly fed in the UK

- They are legumes
- They have a high protein content
- They have too much phosphorous in relation to protein

Nutritional additives

Are fed in smaller amounts rather than as the full ration

- Typically higher in protein and/or fats
  - Oils
    - These are an excellent source of energy as they contain 2.25 times more energy than carbohydrates and proteins
    - Oil supplementation should never exceed 10% of the concentrate ratio
    - Corn oil is the most palatable
      - One cup of corn oil is equal to 1.2 pounds of corn
      - One pound of oil is 4000 calories
        - If fed in excess can coat fibre in hindgut, making it inaccessible to digestion
    - Fish oils often provide the most benefit to body condition
    - Other oils include soybean, canola, and blends
  - Linseed and flax
    - Flax is the seed; must be boiled to remove prussic acid
    - Linseed is the meal extract
    - Both have approximately 25% protein and are high in oil

High Protein Concentrates: Oilseed Meals

- Oilseed Meals are the by-products of their respective industries
- They are fed as a protein supplement but should not be fed as a full meal
- They contain 32-50% protein
  - Not all have a good range of amino acids
  - They are low in fibre
- They include:
  - Soybean Meal
  - Cottonseed Meal
  - Linseed Meal
  - Sunflower Meal
  - Rapeseed or Canola Meal
  - Peanut Meal
  - Coconut Meal
  - Safflower Meal

Flax

Supplements

Vitamin and Mineral Supplements

- Vitamin and mineral supplements can either contain many nutrients, or can be comprised of a single nutrient or a small selection of nutrients
- Vitamin and minerals supplements are prepared ingredients designed to:
  - Address nutritional deficiencies
  - Help maintain good health
  - Improve specific problems, such as:
    - Azoturia
    - Nervousness
    - Weak hooves

Other supplements

- In addition to oils, vitamins and minerals, other substances can be added to a horses regular diet as a supplement:
  - Milk replacers
  - Amino acids
  - Live yeast cultures
  - Electrolytes
  - Protein
  - Enzymes
  - Pre-biotics and pro-biotics
    - Pre-biotics feed the bacteria and other organisms in the hindgut
    - Pro-biotics are the actual organisms
    - Should be fed together
    - There is not much nutritional value but great health benefits

Fibre Content (crude fibre %)

Grass	20-30
Hay	30-35
Haylage	30-35
Alfalfa	25
Oats	10
Barley	5
Low Energy Cubes	14-20
Low Energy Mix	10-15
Sugar Beet Pulp	13
Bran	11

Forages

- Forages constitute the largest part of the horse's diet
  - Ideally, 70-100% of the diet
  - Should never drop below 50%
- Chemical composition:
  - Energy – 15-30%
  - Fibre – 20-40%
  - Water soluble carbohydrates – 3-40%
  - Lipids – 3%
- Types of forages:
  - Grass
  - Seed/grass hays (preserved grasses)
  - Legume hays

Factors affecting nutrient composition

- The nutrient composition in forages is highly variable
- If a horse is on a 100% forage diet, pasture and hays should be tested
  - Vitamin and mineral supplementation is advised
- Factors affecting this are:
  - Time of year
  - Species of grasses available
  - Soil type in area
  - Land management
  - Cutting, grazing, fertilization
    - Presence of and type of weeds in the environment
  - Environmental conditions
  - Stage of maturity when hay is cut
  - Curing and storage of hay

Grass

- High in fibre
- High moisture content
- If high availability in field, can help to decrease rate of digestive disturbances
  - Horses kept on pasture have a lower colic risk due to the higher moisture content of grass and constant intake which both lead to increased gut motility
- Can have fluxuating sugar levels on an hourly basis
  - creates a laminitis risk

Grass

THE NUTRITIONAL CONTENT OF GRASS VARIES ACCORDING TO SEASON

Seed hays

Seed hays

- There are many different varieties
- The most common are:
  - Fescue
    - There are 320 varieties of fescue
  - Timothy
  - Rye
  - Orchardgrass
  - Kentucky Bluegrass

Other seed hays

- Other seed hays include:
  - Bahia grass
  - Coastal Bermuda grass
  - Dallis grass
  - Reed Canary grass
  - Smooth Bromegrass
  - Sudan Grass

Timothy

Timothy

- Timothy is considered a safe hay
- It is commonly fed in the BC Lower Mainland area
  - One study showed that the protein content of boot stage timothy was 13% while the mature stage was only 5%
  - Digestibility of protein in the mature stage was only half of that in the boot stage
- Timothy:
  - Is easy to seed and establish
  - Produces well in early spring
  - Can grow in a wide range of soil and climate types

Timothy hay

Other information about seed hays

Boot stage is when the seed head starts to emerge from its sheath

Boot stage is when the protein and energy levels are highest

As the plant matures, energy and protein levels drop as lignin levels rise

There is little danger of colic or laminitis from overfeeding hay

If there are concerns about the sugar level in hays, this can be reduced by soaking it - if you soak hay to reduce the sugar level, DO NOT let the horse drink that water

There are many varieties of hay

Legumes

- Legumes are plants with nitrogen producing nodules in their root systems
- They deposit nitrogen into the soil, thereby making the soil the plant is grown from richer
  - They will produce more nutrients per acre than seed hay
  - When seeded with grass in a field, they will increase the grass yield
- Legumes typically are higher in protein
  - 12-25%
  - They offer a broader range of amino acids
- Legumes have more vitamin A and B than does grass or seed hay

Types of Legumes

- Types of legumes include:
  - Alfalfa aka Lucerne
  - Alsike
  - Birdsfoot trefoil
  - Ladino clover
  - Red clover
  - White clover aka Common or Dutch
- Peas and beans are also a legume, but are not fed as hays

Alfalfa

Alfalfa

- Alfalfa is also known as ***lucerne*** in the UK
- It is considered a very good forage by most, although some people do not like alfalfa
  - It can be very expensive
- Alfalfa is a good energy source
- Alfalfa is high in protein (12-24%)
  - Alfalfa has the broadest range of amino acids
  - Alfalfa is a good source of lysine, the first limiting amino acid
- Alfalfa is a good source of calcium
  - important for balancing the Ca:Ph
- Requires well drained soils with a pH of 6.5-7
- Does not do well as a pasture as it cannot tolerate heavy grazing or traffic, and requires watering

Cautions if feeding alfalfa

- Overfeeding alfalfa can lead to weight problems
  - This is true of any feedstuff, but alfalfa moreso due to its high levels of nutrients
- Alfalfa can be fed in lesser amounts than seed hay due to its high nutritive value
  - But feeding less of a roughage will result in decreased gut fill and motility
- The excess energy in alfalfa can be a contributing factor (but not direct cause) of developmental orthopedic disease
- Some people feel the high protein in alfalfa can be hard on a horse's kidneys
- In areas where enteroliths are a concern, it is theorized that the high calcium, phosphorous and magnesium found in alfalfa plays a role in the development of these obstructions
- If a horse has not had alfalfa in the past recently, the introduction of alfalfa needs to be made very slowly as serious changes in gut flora may result in diarrhea and gas colic

Alfalfa Cubes

Alfalfa cubes

- Alfalfa Cubes is alfalfa hay that has been chopped and made into a dry cube
  - The cubes are non-dusty
  - They are easier to transport than bales if you are travelling
  - They can be hard to eat for horses with dental problems
  - Can be fed wet for horses with dental problems
  - Do not have enough long stem in them to help prevent digestive disturbances
- Have roughly the same amount of protein and other nutrients as alfalfa hay, so is considered a good source of nutrients

QUESTIONS

- 1. List the advantages and disadvantages of feeding oats.
- 2. Compare oats and barley.
- 3. What would be some concerns if you are feeding corn?
- 4. Other than oats, barley and corn, what are some grains that can be fed?
- 5. List some supplements that can be fed.
- 6. Compare and contrast timothy hay and alfalfa.