The Need for and Production of Quality Forage Feeds

Peter HUNTINGTON * and Junling SUN **

**Kentucky Equine Research, Mulgrave, Australia*

***Beijing Baolin Horse Industry Company, Shunyi, China*

Summary

Horses have evolved over millions of years as roaming grazing animals, with specialised digestive tracts adapted to digest and utilize diets containing high levels of plant fibre. They are capable of eating and processing large quantities of forage to meet their nutrient demands. In an attempt to maximise growth or productivity, horses are often fed diets that also contain high levels of grains and supplements. Unfortunately, this type of grain supplementation often overshadows the significant contribution that forages make in supplying the horse's nutrient demands and can lead to serious gastrointestinal, metabolic and behavioural disturbances. In China, few horses have access to pasture and so rely on hay for their forage intake. When forage is grazed as pasture, its nutrient quality is almost always higher than when it is harvested as hay, unless the pasture is the dead remnant left from the previous growing season. Hay production is limited to Northern China and Inner Mongolia and grass hay is cut too late and is usually of lower quality than that grown in many countries. Poor transport conditions and storage often leads to further deterioration in quality. Many horses are not fed enough hay or are fed hay of inferior quality leading to health, productivity and welfare issues such poor growth, condition, performance, stable vices and digestive disturbances.

Digestive function

Horses are classified anatomically as nonruminant herbivores or hindgut fermenters. The large intestine of the horse houses billions of bacteria and protozoa that produce enzymes which ferment plant fibre. These microbes are absolutely essential to the health and welfare of the horse. The by-products of this microbial fermentation provide the horse with a source of energy and micronutrients. The equine digestive tract is designed in this fashion to allow the horse to ingest large quantities of forage in a continuous fashion. The small capacity of the upper part of the tract is not well-suited for large single meals, a fact that is often ignored by horsemen. Large single meals of grain overwhelm the digestive capacity of the stomach and small intestine, resulting in rapid fermentation of the carbohydrates by the microflora in the hindgut. This fermentation may result in a wide range of problems including colic, laminitis, stable vices and behavioural disturbances.

Forage should remain the foundation of a horse's feeding program, regardless of where it is raised or how it is used. Additional grains or protein and mineral supplements should be used only to supply essential nutrients not contained in the forage. This is the most logical and economical way to approach feeding horses, because it eliminates the needless duplication or dangerous excess of fortification. The problem with this method of ration balancing is that the quantity and quality of forage eaten by most horses is not precisely known. Horsemen pay close attention to a difference of a few percentage points of protein in a grain mix, but rarely assay hay or pasture for nutrient content. To compound the problem, intakes of hay are often not recorded and pasture intakes are impossible to measure. Daily intake of forage should be at least 1% of body weight on a dry matter basis, but 1.5% is more beneficial. Horses can consume up to 3% of their body weight in forage daily if given free choice access to hay and/ or pasture

Forage composition

Forages are composed of two components, cell contents and cell walls. Cell contents contain most of the protein and all of the starch, sugars, lipids, organic acids, and soluble ash found in the plant. These components are degraded by enzymes produced by the horse and are highly digestible. The cell wall contains the fibrous portion of the plant, which is resistant to digestive enzymes produced by the horse. The primary components of the cell wall are cellulose, hemicellulose and lignin. The nutritive value of forages is determined by two factors: 1) Fibre content (the proportion of the plant that is composed of cell wall) and 2) Fibre quality (the degree of lignification). These factors are important because the horse can digest practically all of the cell contents contained in forages, but bacterial fermentation can digest only 50% or less of most plant cell wall. The degree to which plant cell wall is digestible is largely dependent on the amount of lignin that it contains. Many factors affect the quality of forage. Most important of these are the species of plant,

stage of maturity, location where the plant was grown, and content of inhibitory substances. All of these factors should be considered when assessing the suitability of a particular forage for horses.

Most plants that serve as forages for horses can be divided into two different categories, grasses and legumes. Grasses contain much structural matter in their leaves and leaf, and this can be as important as the stem in holding the plant erect. Legumes, on the other hand, tend to be treelike on a miniature scale. Their leaves have very little structural function and tend to be on the ends of woody stems. The primary legumes used as horse forage are alfalfa (lucerne) and clover. At a similar stage of maturity, legumes tend to be higher in protein, energy and calcium than grasses. The fibre that is in legumes tends to be less digestible than the fibre in grasses, largely because legumes tend to have higher lignin content per unit of total fibre. This means that the digestible fibre content of grasses is much higher than it is in legumes of similar maturity. Grasses tend to have higher sugar content than legumes. Cereals such as Oats and what can make high quality hay when cut early at the milk stage for hay, but when cut late they are akin to straw which is cut after harvest. Straw is less palatable, less digestible and has lower energy and protein content that proper cereal hay

Because of the factors mentioned above, legumes contain 15-25% more digestible energy than grasses at the same maturity. In certain instances, the amount of legume hay fed may need to be limited so that the horse doesn't get too fat. This can result in intakes of digestible fibre that are below optimal levels, particularly in extremely high-quality hays. Generally, as plants mature they become less digestible. Legumes tend to mature by decreasing leafiness and increasing the stem-to-leaf ratio. As grasses mature, the leaves become more lignified and less digestible. Palatability and digestibility varies between varieties of grasses and native grasses tend to be lower digestibility than improved grasses. The time of cutting grass for hay is critical to ensuring the highest possible protein and energy content. If cut too early you get less hay and the grass doesn't dry properly and can go mouldy. Hay should be cut before it goes to seed, but government regulations limit this practice, which means that most Chinese hay is cut too late. This means its palatability, energy and protein content is lower and its fibre content is higher (Table 1).

Table 1: Nutrient content of average Chinese grown grass hay compared to US grass hay

Nutrient Content DM basis	Protein %	Dig. Energy MJ/kg	ND Fibre %	Lignin %	Calcium %	Phos. %	Iron mg/kg	Zinc mg/kg
China Hay	7.3	1.81	68.7	6.8	0.35	0.13	277	20
US Hay	10.8	2.0	62.5	5.7	0.49	0.24	195	31
Difference	- 33%	-10%	+10%	+20%	-29%	+45%	+42%	-35%

Chinese hay also tends to be lower in minerals and fat soluble vitamins with the exception of Iron. This means that concentrate feeds and supplements need to be fortified with higher levels of protein, amino acids, minerals and vitamins than would be the case if they are designed for use in Europe, Australia or the USA. Hay can be imported to China and horse owners can use imported timothy, Bermuda and alfalfa hay from Nth America or locally grown grass, oaten or alfalfa hay. In general, imported hay is higher quality than locally made hay, however Chinese made alfalfa hay will have a higher protein content than imported grass hays.

Transport and Storage

The quality of hay fed to horses in China is often reduced by poor transport and storage conditions after harvest. When being transported south, hay can get wet so that nutrients may be leached out and hay can go mouldy. Some hay is stored outside without protection from sun, rain and airborne pollutants. This leads to major loss of quality. Hay that is sun bleached will lose moisture and palatability and also the fat soluble vitamins A and E. Water damaged hay will lose sugars, energy, some minerals and often starts to go mouldy. Provision of indoor hay storage would be a major factor in improvement in the quality of hay fed to horses in China. Some indoor storage is not ventilated and when hay is kept over several years, old hay can lead to mould in new hay. Small black spots of mould are tell tale signs and may indicate the presence of toxic mycotoxins. Mouldy hay will tend to be more dusty which can be damaging to the respiratory tract. Hay with major areas of mould should not be fed to horses as it can contain toxic mycotoxins.

Alternative Forages to Hay

Alterative forage sources to pasture and hay include chaff, hay pellets and cubes, haylage or super fibres such as soybean hulls or beet pulp which can be added to the feed bin to provide forage and slow concentrate intake. Chaff is chopped hay but is very light. Hay cubes and pellets are easy to transport and store and can provide a good alternative forage. Haylage for horses is a popular feed in Asia and provides a consistent, dust free, palatable and digestible forage for horses, but has a high water content and is susceptible to mould.