COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

Nutrition of the Performance Horse

Equine Section, Department of Animal Sciences

In today's industry where seconds mean the difference between 1st and "also ran" at the track, our equine athletes must retain a competitive edge. Renewed interest in research about the performance horse's nutrient needs has allowed horsemen to feed the athletic horse more scientifically than ever before to maintain that edge. Horses can be selected, bred, managed and fed as athletes. However, because knowing the horse's individuality and nutrient needs is very important, the horseman's skill in feeding the horse will never be totally replaced, no matter how precise the feeding recommendations.

Energy

Energy is vital to many of the body's functions, among them muscle contraction, respiration and circulation. It is available from many different sources, most commonly cereal grains (like corn, oats and barley). Milk, soybean meal, excess or unused protein, hay and other forages are less used sources of energy.

Energy is the nutrient influenced by exercise. The exercise's degree and intensity will determine how much energy the horse needs above maintenance.* The additional amount of energy required for exercise depends on several factors: type of work, speed and length of work, condition of the horse, the individual horse, parasite infestation and environmental temperature. For example a 500 kg (1100 lb) horse exercising at a slow-trot for 2 hours a day will increase its energy requirement above maintenance by 5 Mcal of DE or by 30%, whereas walking for 2 hours increases the energy requirement by 2 Mcal or by 12%. The horse needs additional energy even at light work intensities. You can usually meet this need by increasing how much hay you feed or by supplementing a small amount of grain.

How Much Concentrate

The equine athlete's energy requirements are greatest at high work intensities. For instance, horses cantering at 16 mph for 3 miles need 20-30% more DE than that estimated by the NRC.

Table 1 shows the energy requirements for different work intensities as established by the NRC. However, according to recent research, these estimates are low for horses at high work intensities. Even so, the NRC estimates on energy are useful, as long as you remember that these guidelines only give you a starting point. Ultimately, the master's eye determines whether the horse is being fed the correct amount of energy.

In using these guidelines, remember the following:

- If the horse is too fat, reduce the amount of grain and increase the hay.
- If the horse is too thin, increase the grain. The optimum body condition for optimum performance is not yet clearly defined. Further, horses are individuals and what might be the optimum body condition for one horse might not be the same for the next. Therefore, knowing the feeding and individuality of horses is extremely important.

Table 1. *Energy Requirements of Horses Used in Various Activities.*

Type of Work	Digestible Energy (Mcal)	Digestible Energy Concentration Mcal/lb
Light Work[a]	21.89	1.0
Medium Work[b]	28.69	1.2
Heavy Work[c]	34.00	1.25

[a] *Western pleasure, bridle path, hack equitation, etc.*
[b] *Ranch work, roping, cutting, barrel racing, jumping, etc.*
[c] *Race training, polo, cross country riding, 3-Day eventing, etc.*

What Concentrate to Use

Grains have higher energy density (energy content/unit wt.) than do hays. Hay is not a good source of energy for horses performing at high work intensities, because they cannot consume enough hay with their limited gastro-intestinal tract capacity. For such horses, then, consider concentrate supplementation. Therefore, by replacing some of the hay with grain, you can meet the energy requirement.

**Maintenance is defined as the amount of nutrients required to maintain an animal's body weight with zero weight gain or loss. A mature light horse requires approximately 3.4 megacalories (Mcal) of DE/100 kg of body weight according to the National Research Council (NRC); therefore a horse weighing 500 kg or 1100 lb needs 16.4 Mcal of DE daily for maintenance.*

What types of grain should you feed to provide for optimum performance? In a survey where 65 trainers were interviewed at 6 tracks, only one fed corn as the primary grain. All but one fed some corn or sweet feed which contained corn in addition to oats. Many of the trainers did not feed corn because they felt it was "too hot." However, research has shown that diets containing 60% corn or solely corn and alfalfa can be fed with no adverse affects.

Since corn contains almost twice as much energy as oats per volume, it is easier to overfeed corn than oats. Therefore, better feeding management is required. Corn can be fed as the primary grain source if it is economically feasible and if you take proper precautions. If you feed a certain volume of oats, do not feed corn at the same volume or the horse may get digestive upsets and metabolic problems.

Using Fat for Energy

Using fat in rations for performance horses has recently received much attention. Feeding high levels of fat during training has two purposes:

1. to condition the horse to more efficiently utilize fat stores and
2. to adapt the enzymes involved to more efficient fat metabolism. Fat is most likely to be the horse's primary energy source during long bouts of exercise. Maybe if horses are adapted to using fat, they can use fat stores more efficiently.

Research has shown that horses fed diets higher in fat have higher blood glucose levels after exercising than those on low fat diets. Maintaining blood glucose levels will likely improve performance over long distances. Horses can be fed high fat diets (corn oil) with no loss in body condition or performance although they will consume less feed because of the higher energy content of their diets. Therefore, their energy needs will be met by less feed.

Protein

Some protein is present in most ingredients in horse diets. Oats and corn are the most commonly used cereal grains but are not particularly good sources of protein.[1] Protein is made up of amino acids, which are required for protein synthesis and are the building blocks of all body tissue. To raise the protein content of diets to the required level, use a protein supplement. The most commonly used protein source in horse diets is soybean meal. Protein quality, the balance and amount of essential amino acids present in the protein source, is important when you choose any protein source.

The performance horse's protein needs are not any greater than those for maintenance. The exercising horse should be fed a diet containing about 10% crude protein (CP), according to NRC. Although the horse loses some protein via sweat and by muscle catabolism during exercise, the additional feed provided to meet energy requirements meets the horse's protein needs as well. For example, if a horse in heavy race training receives 12 lb of a 12% protein feed plus 12 lb of hay split equally between timothy, 8% protein, and alfalfa, 15% protein, he gets the following protein intake:

Concentrate	12 lb	=	5.45	Kg x .12 prot.	=	.65 Kg
Timothy	6 lb	=	2.7	Kg x .08 prot.	=	.21 Kg
Alfalfa	6 lb	=	2.7	Kg x .15 prot.	=	.40 Kg
				Total protein	=	1.26 Kg
						or
						1260 g
				Requirement		- 700 g
				Extra Protein		**= 560 g**

As the above example shows, even using protein sources considered very conservative gives the racehorse more than adequate protein intake. This example also provides further evidence that the racehorse does not need high protein supplements.

If horses get more protein than they need, the protein is deaminated and used for energy. This excess protein neither harms nor helps the horse. However, if a high protein diet is fed, water must be supplied ad libitum because it is needed for the excretion of nitrogen.

Vitamins

Exact requirements for many of the vitamins have not been strictly established and the value of vitamin supplements is still being debated. We do know that the fat soluble vitamins (A, D, E and K) are required at the tissue level as are many of the water soluble vitamins (B vitamins). The fat soluble vitamins are stored in body tissues so that reserves may be built up for future use, while the water soluble vitamins are not stored by body tissues to any substantial degree.

Beta-Carotene is the naturally occurring precursor of Vitamin A and is found in green leafy plants and properly cured hays. **Vitamin A** is needed to maintain epithelial cells, hooves and night vision. It is believed that heavy exercise increases the need for Vitamin A.

Vitamin D is found in sun-cured hay and is synthesized by a normal reaction in the skin with sunlight as the catalyst. Vitamin D's primary function is to absorb, metabolize and transport calcium. There is a tendency to overfeed Vitamin D because of its role in calcium metabolism. However, excess Vitamin D can lead to calcification of soft tissues like skeletal muscle, arteries and cardiac muscle.

Wheat germ oil, properly cured hay and cereal grains are excellent source of **Vitamin E** and usually contains enough to meet the horse's need. Vitamin E's function in reproduction and muscle metabolism is still unclear, but symptoms of muscle degeneration, myositis and muscular dystrophy in foals have responded to Vitamin E therapy.

B vitamins are primarily involved in energy metabolism and are synthesized by microbial flora of the cecum in amounts adequate to meet the horse's needs. However,

[1]Protein is made up of amino acids, which are required for protein synthesis and are the building blocks of all body tissue.

horses in hard race training may have an increased requirement for B vitamins, because of the B vitamins' involvement in energy metabolism. Thiamin deficiency has been suggested as a factor in roaring, because roarers have lower blood thiamin levels than non-roarers. Thiamin functions as a coenzyme in energy metabolism.

Avoid giving excess supplements of any vitamin. Feed an appropriate vitamin premix to meet the horse's need for Vitamin A, D and E and for thiamin, riboflavin, pantothenic acid and Vitamin B12. Table 2 gives an example premix.

Minerals

Calcium, phosphorus, sodium and chlorine are the primary minerals of concern for the performance horse. **Calcium** and **phosphorus** are involved in many body functions (i.e. proper formation and maintenance of bone, nerve conductivity, muscle contraction, energy metabolism, etc.). Even though an exercising horse could need more calcium and phosphorus, either because of losses in sweat or exercise, the increased requirement can easily be met by the increased intake needed to supply energy. Growing horses in hard training have a higher requirement for calcium and phosphorus than older horses in training. A growing horse that is working is more susceptible to mineral deficiency than one not working.

Table 2. *Vitamin Premix for Horses*

		Amt/lb feed when ---- premix added at: ----	
Vitamin	**Per lb Premix**	**2 lb/Ton**	**1 lb/Ton**
Vitamin A	1,000,000 I.U.	1000 I.U.	500 I.U.
Vitamin D	100,000 I.U.	100 I.U.	50 I.U.
Vitamin E	10,000 I.U.	10 I.U.	5 I.U.
Thiamine	1.2 g	1.2 mg	0.6 mg
Riboflavin	800 mg	0.8 mg	0.4 mg
Pantothenic Acid	800 mg	0.8 mg	0.4 mg
Vitamin B12	5 mg	5.0 mcg	2.5 mcg

When you formulate a concentrate mix for any class of horse, never use more phosphorus than calcium. Generally, forages are good sources of calcium and cereal grains are good sources of phosphorus. This is very important for performance horses, as they generally consume significant amounts of grain while they are in training to meet their energy needs (see Energy section, above). Therefore, supplement high grain diets with a calcium source to keep more calcium than phosphorus in the diet.

Sodium and **chlorine** are important because they help maintain osmotic and acid base balance in the performance horse. During strenuous exercise horses may lose as much as 1/5 lb of salt via sweat. They must compensate for these losses by having salt in the ration and trace mineralized salt free choice. As long as enough fresh clean water is available, horses should have no problem with toxicity in regard to salt.

Horses need certain **trace minerals** and generally these requirements can be met by allowing them free access to a trace mineralized salt block. Toxicity problems have been associated with some of the major trace minerals, notably selenium and iodine.

Selenium is a mineral of concern because it is required for muscle integrity. It has been used to treat exertional myopathy but has not always been effective and has been reported that Thoroughbred horses exhibiting less than expected performance had lower serum selenium levels than horses who had good performances. The amount of selenium required by the horse is quite low and in many areas of the country adequate selenium exists in naturally fed dietary ingredients. If selenium is inadequate or marginal, it is recommended to add .1 ppm or .05 mg of selenium/lb of diet. Avoid indiscriminant addition of selenium to the diet since the margin between selenium requirements and toxicity is quite small.

Iodine toxicity and deficiency results in goiterous conditions. Iodine functions as part of the hormone, Thyroxine, which is produced by the thyroid gland and regulates metabolic rate. Iodine is also deficient in some areas of the country and adequate in others. Iodine requirements can be met by using iodized salt in the feed mix, by feeding trace mineralized salt block or loose trace mineral salt free choice.

Other trace minerals needed by the performance horse can be met by including trace mineralized salt in the concentrate mix at ½ of 1%.

Recommendations for Feeding the Exercising Horse

The most important thing to remember in feeding the performance horse is that as activity or exercise increases, you need to increase only the amount of energy fed. The horse in training has no more need for an increase in the concentrate or percentage of other nutrients in the diet than does a horse of the same class that is not being worked. Activity of the horse is categorized as light, moderate and intense work. As Table 3 shows, increasing work load requires no increase in percent protein but does call for an increase in energy. Any nitrogen loss as a result of work should be met by the increased intake of feed required to meet horses' energy needs. Table 4 gives sample rations for performance horses.

As a rule of thumb to meet the working horse's energy need, provide ¾ - 1½ lb of grain/100 lb of body weight in addition to liberal amounts of good quality hay. The horse needs long stem forage. The fiber content of the roughage aids in normal gastro-intestinal function. Ideally, rations should contain at least 50% of forage intake. This can be adhered to fairly easily for maintenance, light work and moderate work levels but is somewhat more difficult for horses performing intense work. The energy needs of horses at high work intensities cannot be met by feeding 50% hay.

Thus, the concentrate must be fed at more than 50% of the diet. Typically, performance horses fed low forage, high grain diets with forage accounting for less than 50% of the diet, exhibit a higher incidence of colic. Horses consuming less than .5 lb of forage/100 lb of body weight do not get enough fiber intake and are considered high colic risks. Therefore, when formulating diets for horses at high work intensities, include wheat bran to help ensure adequate fiber intake for normal digestive function. Remember, horses receiving large amounts of concentrates require extremely good management.

Remember that horses are individuals and vary greatly in their requirements for feed. Some horses become over weight when fed according to the guidelines while others lose weight. Therefore, monitor each individual horse's condition constantly and feed each one accordingly. Here again, remember that these are guidelines. It is our responsibility as horsemen to make sure our horses receive adequate feed to meet their needs.

Table 3. *Nutrient Concentrations for Horse Diets*

	D.E. (Mcal/lb)	% Crude Protein	% Ca.	% Phos.	I.U./lb Vit. A.
2 yr. old	1.25	12	.4	.3	800
Mature working horses					
Light work	1.0	10	.27	.18	650
Medium work	1.2	10	.27	.18	650
Heavy work	1.25	10	.27	.18	650

Table 4. *Sample Grain Mixtures[a] for Performance Horses*

	1		2	
	%	lb/Ton	%	lb/Ton
Rolled Oats	48.0	960	38.0	761
Cracked Corn	25.0	500	25.0	500
Wheat Bran	10.0	200	10.0	200
Soybean Meal	7.0	140	7.0	140
Molasses	7.0	140	7.0	140
Dicalcium Phosphate	1.0	20	1.4	30
Ground Limestone	1.0	20	1.0	20
T.M. Salt	.5	10	.5	10
Vitamin Premixb	.5	10	.5	200
Fats or Oils	—	—	10.0	200
	100.0	2000	100.0	2000
CP, %	13.5		12.0	
Calcium, %	.80		.70	
Phosphorus, %	.60		.60	

[a] *Fed with hay or pasture.*
[b] *See Table 2.*

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, C. Oran Little, Director of Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, and Kentucky State University, Frankfort.
Issued 7-88, 10000 copies