



# Horse Feeding Management

## Nutrient Requirements for Horses

*In Nutrient Requirements of Horses (1989), the National Research Council (NRC) helped horse owners and feed companies develop more effective diets for their animals. Although NRC recommendations have often been used to establish minimum nutrient requirements, more recent research indicates that some of those requirements should be increased for specific production situations. In addition to outlining NRC recommendations, this fact sheet will help you make those increases and thus better meet your horse's nutrient needs.*

The following factors affect equine nutrient requirements: age, weight, environment, individual variation, and use or production stage.

### Age

When horses reach nutritional maturity at age three, their growth rates slow and their nutrient requirements decrease. Tables 1 to 5 present nutrient requirements for mature horses and for horses at various growth stages. Prior to nutritional maturity, horses pass the following stages:

- **Suckling**—birth through three to six months of age, when the animal still nurses from the mare.
- **Weanling**—4 through 11 months of age, when the foal receives no milk, only supplemental feeds.
- **Short yearling**—12 through 17 months of age.
- **Long yearling**—18 through 23 months of age.

- **Two-year-old**—24 through 36 months of age.

*Moderate growth or rapid growth* categories may be selected for weanlings and yearlings. *In-training* and *Not-in-training* categories may be selected for long yearlings and two-year-olds.

### Weight

As horses grow, the amount of nutrients required to maintain body weight increases. Tables 1 and 2 provide maintenance requirements for a mature horse weighing 1,100 pounds (500 kg). Table 3 presents vitamin and mineral requirements. Table 4 provides feed-consumption ranges, which are calculated as a percentage of the horse's body weight.

### Environment

Environmental temperature affects energy requirements. When temperatures are low, horses require additional

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**Table 1. Summarized nutrient requirements (dry matter basis)<sup>a</sup>**

Animal	Weight <sup>b</sup> (lb)	Daily gain (lb)	DE <sup>c</sup> (Mcal)	Crude protein (g)	Lysine (g)	Ca <sup>d</sup> (g)	P (g)	Mg (g)	K (g)	Vitamin A <sup>e</sup> (10 <sup>3</sup> ) IU
<b>Mature horses</b>										
Maintenance	1,100		16.4	656	23	20	14	7.4	25.0	30
Stallions, breeding season	1,100		20.5	820	29	25	18	9.4	31.2	40
Pregnant mares										
9 months	1,100		18.2	801	28	35	26	8.7	29.1	50
10 months	1,100		18.5	815	29	35	27	8.9	29.7	50
11 months	1,100		19.7	866	30	37	28	9.4	31.5	50
Lactating mares										
Foaling to 3 months	1,100		32.2	1,427	50	56	36	10.9	46.0	50
3 months to weaning	1,100		28.3	1,048	37	36	22	8.6	33.0	50
<b>Working horses</b>										
Light work <sup>f</sup>	1,100		22.0	820	29	25	18	9.4	31.2	40
Moderate work <sup>g</sup>	1,100		27.0	984	34	30	21	11.3	37.4	40
Intense work <sup>h</sup>	1,100		35.0	1,312	46	40	29	15.1	49.9	40
<b>Growing horses</b>										
Weanling, 4–5 months	385	1.87	14.4	720	30	34	19	3.7	11.3	14
Weanling, 6–11 months										
Moderate growth	473	1.43	15.0	750	32	29	16	4.0	12.7	17
Rapid growth	473	1.87	17.2	860	36	36	20	4.3	13.3	17
Short yearling, 12–17 months										
Moderate growth	715	1.10	18.9	851	36	29	16	5.5	17.8	25
Rapid growth	715	1.43	21.3	956	40	34	19	5.7	18.2	25
Long yearling, 18–23 months										
Not in training	880	0.77	19.8	893	38	27	15	6.4	21.1	30
In training	880	0.77	26.5	1,195	50	36	20	8.6	28.2	30
Two-year-old, 24–36 months										
Not in training	990	0.44	18.8	800	32	24	13	7.0	23.1	33
In training	990	0.44	26.3	1,117	45	34	19	9.8	32.2	33

<sup>a</sup> Adapted from the National Research Council's *Nutrient Requirements of Horses* (1989). The data has been adjusted based on research from 1989 to 1995.

<sup>b</sup> Examples include recreational riding and show horse riding (pleasure and equitation classes).

<sup>c</sup> Examples include ranch work (roping, cutting), barrel racing, and jumping.

<sup>d</sup> Examples include race training, polo, and endurance trail riding.

<sup>e</sup> 2.2 pounds = 1 kilogram; 1,100 pounds/2.2 = 500 kg.

<sup>f</sup> Digestible energy, measured in megacalories (Mcal).

<sup>g</sup> Ca = calcium, P = phosphorus, Mg = magnesium, K = potassium.

<sup>h</sup> Vitamin A (1,000 x International Units).

energy to maintain their internal body temperature. These energy requirements decrease during warm weather. Current recommendations do not address the effect of environmental changes

on nutrient needs. Horse owners should be aware, however, that slight seasonal modifications in diet may be necessary to account for changes in environmental temperature.

### Individual Variation

Horses vary in their ability to digest nutrients: some horses are "easy keepers"; others are "hard keepers." These differences can be caused by stress.

**Table 2. Minimum nutrient concentration in total horse and pony diets (dry matter basis)<sup>a</sup>**

Animal	Digestible energy		Dietary proportions		Crude protein (%)	Lysine (%)	Ca (%)	P (%)	Mg (%)	K (%)	Vitamin A <sup>‡</sup>	
	(Mcal/kg)	(Mcal/lb)	Concentrate (%)	Hay (%)							(IU/kg)	(IU/lb)
<b>Mature horses</b>												
Maintenance	2.00	0.90	0	100	8.0	0.28	0.24	0.17	0.09	0.30	3660	1660
Stallions, breeding season	2.40	1.10	30	70	9.6	0.34	0.29	0.21	0.11	0.36	4805	2184
<b>Pregnant mares</b>												
9 months	2.25	1.00	20	80	10.0	0.35	0.43	0.32	0.10	0.35	6195	2806
10 months	2.25	1.00	20	80	10.0	0.35	0.43	0.32	0.10	0.36	6095	2772
11 months	2.40	1.10	30	70	10.6	0.37	0.45	0.34	0.11	0.38	6095	2772
<b>Lactating mares</b>												
<b>Foaling to 3 months</b>												
3 months to weaning	2.96 <sup>§</sup>	1.37 <sup>§</sup>	50	50	13.2	0.46	0.52	0.34	0.10	0.42	4592	2088
<b>Working horses</b>												
<b>Light work<sup>b</sup></b>												
Moderate work <sup>c</sup>	2.70 <sup>§</sup>	1.26 <sup>§</sup>	35	65	9.8	0.35	0.30	0.22	0.11	0.37	4896	2220
Intense work <sup>d</sup>	2.91 <sup>§</sup>	1.32 <sup>§</sup>	50	50	10.4	0.37	0.31	0.23	0.12	0.39	4404	2002
	3.14 <sup>§</sup>	1.43 <sup>§</sup>	65	35	11.4	0.40	0.35	0.25	0.13	0.43	3549	1620
<b>Growing horses</b>												
<b>Weanling, 4–5 months</b>												
Weanling, 6–11 months	2.90	1.40	70	30	14.5	0.60	0.60	0.38	0.08	0.30	2639	1202
<b>Moderate growth</b>												
Rapid growth	2.90	1.40	70	30	14.5	0.61	0.56	0.31	0.08	0.30	3123	1420
<b>Short yearling, 12–17 months</b>												
Moderate growth	2.80	1.30	60	40	12.6	0.53	0.43	0.24	0.08	0.30	3607	1637
Rapid growth	2.80	1.30	60	40	12.6	0.53	0.45	0.25	0.08	0.30	3206	1453
<b>Long yearling, 18–23 months</b>												
Not in training	2.50	1.15	45	55	11.3	0.48	0.34	0.19	0.08	0.30	3791	1720
In training	2.65	1.20	50	50	12.0	0.50	0.36	0.20	0.09	0.30	3006	1369
<b>Two-year-old, 24–36 months</b>												
Not in training	2.45	1.15	35	65	10.4	0.42	0.31	0.17	0.09	0.30	4409	2000
In training	2.65	1.20	50	50	11.3	0.45	0.34	0.20	0.10	0.32	3407	1553

<sup>a</sup> Adapted from the National Research Council's *Nutrient Requirements of Horses* (1989).

<sup>b</sup> Examples include recreational riding and show horse riding (pleasure and equitation classes).

<sup>c</sup> Examples include ranch work (roping, cutting), barrel racing, and jumping.

<sup>d</sup> Examples include race training, polo, and endurance trail riding.

<sup>§</sup> Adjusted for current research, 1989 to 1995.

They can also be caused by varying levels of digestive enzymes and by parasite damage to the intestinal-tract lining. In Table 4, levels of feed consumption are presented as ranges so that horse owners can make adjustments for easy or hard keepers.

### Use or Production Stage

In the accompanying tables, horses are classified into nutritional groups based on use or activity level. The most important of these groups are as follows: maintenance, work, gestation (pregnancy), lactation, breeding (stallions), and growth.

### • Maintenance

This group consists of non-working mature horses.

### • Work

This group is subdivided to account for horses involved in (1) *light work*, which involves little physical exertion and

**Table 3. Mineral and vitamin requirements for horses and ponies (dry matter basis)<sup>a</sup>**

	Adequate concentrations in total rations				
	Maintenance	Pregnant and lactating mares	Growing horses	Working horses	Maximum tolerance levels
<b>Minerals</b>					
Sodium (%)	0.10	0.10	0.10	0.30	3 <sup>b</sup>
Sulfur (%)	0.15	0.15	0.15	0.15	1.25
Iron (%)	40	50	50	40	1,000
Manganese (mg/kg)	40	40	40	40	1,000
Copper (mg/kg) <sup>c</sup>	15	35	50	15	800
Zinc (mg/kg) <sup>c</sup>	60	140	200	60	500
Selenium (mg/kg)	0.1	0.1	0.1	0.1	2.0
Iodine (mg/kg)	0.1	0.1	0.1	0.1	5.0
Cobalt (mg/kg)	0.1	0.1	0.1	0.1	10
<b>Vitamins</b>					
Vitamin A (IU/kg) <sup>d</sup>	3,000	6,000	3,000	4,000	16,000
Vitamin D (IU/kg) <sup>d</sup>	300	600	800	300	2,200
Vitamin E (IU/kg)	50	80	80	80	1,000
Vitamin K (mg/kg) <sup>e</sup>					
Thiamin (mg/kg)	3	3	3	5	3,000
Riboflavin (mg/kg)	2	2	2	2	
Niacin (mg/kg) <sup>e</sup>					
Pantothenic acid (mg/kg)					
Pyridoxine (mg/kg)					
Biotin (mg/kg)					
Folacin (mg/kg)					
Vitamin B12 (µg/kg)					
Ascorbic acid (mg/kg)					
Choline (mg/kg)					

<sup>a</sup> Adapted from the National Research Council's *Nutrient Requirements of Horses* (1989).

<sup>b</sup> As sodium chloride.

<sup>c</sup> Adjusted for current research, 1989 to 1995.

<sup>d</sup> Recommendations for horses not exposed to sunlight or artificial light with an emission spectrum of 280 to 315 nanometers.

<sup>e</sup> Blank spaces indicate that data are insufficient to determine a requirement or maximum tolerable level.

Note: Major minerals (i.e., macro-minerals) include calcium, phosphorus, sodium, sulfur, chlorine, potassium, and magnesium.

Trace minerals (i.e., micro-minerals) include iodine, manganese, molybdenum, fluorine, iron, copper, zinc, selenium, silicon, chromium, and cobalt.

includes recreational pleasure horses, as well as show horses used in pleasure and equitation classes; (2) *medium work*, which involves moderate exercise at varying degrees of intensity and includes ranch work such as roping and cutting, as well as barrel racing, jumping, and hunting; and (3) *heavy work*, which involves prolonged intense exercise such as that demanded of polo ponies,

endurance or competitive trail horses, and race horses.

#### • Gestation (pregnancy)

During the first eight months of pregnancy, nutrient requirements are similar to those for the maintenance group. During the last four months, nutrient requirements are elevated due to rapid fetal development.

#### • Lactation

During the first three months after foaling, lactating mares

have the highest nutrient requirement of any mature horse. During the second three months, milk production decreases, resulting in a lower nutrient requirement.

#### • Breeding (stallions)

If stallions are not exercised during the non-breeding season, their diets should be the same as horses in the maintenance group. Ideally, however, the non-breeding

**Table 4. Expected feed consumption by horses<sup>a</sup>**

	Forage	Concentrate <sup>b</sup>	Total
<b>Mature horses</b>			
Maintenance	1.5 to 2.0	0 to 0.5	1.5 to 2.0
Mares, late gestation	1.0 to 1.5	0.5 to 1.0	1.5 to 2.0
Mares, early lactation	1.0 to 2.0	1.0 to 2.0	2.0 to 3.0
Mares, late lactation	1.0 to 2.0	0.5 to 1.5	2.0 to 2.5
<b>Working</b>			
Light	1.0 to 2.0	0.5 to 1.0	1.5 to 2.5
Moderate	1.0 to 2.0	0.75 to 1.5	1.75 to 2.5
Intense	0.75 to 1.5	1.0 to 2.0	2.0 to 2.5
<b>Young horses</b>			
Nursing foal (0–3 months)	0	1.0 to 2.0	2.5 to 3.5
Weanling foal (4–11 months)	0.5 to 1.0	1.5 to 3.0	2.0 to 3.5
Short yearling (12–17 months)	1.0 to 1.5	1.0 to 2.0	2.0 to 3.0
Long yearling (18–23 months)	1.0 to 1.5	1.0 to 1.5	2.0 to 2.5
Two-year-old (24–36 months)	1.0 to 1.5	1.0 to 1.5	2.0 to 2.5

<sup>a</sup> Air dry feed (about 90 percent dry matter). Adapted from the National Research Council's *Nutrient Requirements of Horses* (1989).

<sup>b</sup> Grain mix.

#### Example

- A 1,100 pound mare in late gestation fed at a rate of 2 percent of her weight.
- 1,100 pounds x 2 percent = 22 pounds of total feed intake.
- 50 percent grain mix x 22 pounds per day = 11 pounds of grain mix.
- 50 percent hay x 22 pounds per day = 11 pounds of forage.

stallion should receive routine forced exercise to condition him prior to the breeding season. Stallions undergoing a conditioning program should be fed the same diet as horses at light work. Nutrient requirements for a stallion during the breeding season are described in Tables 1 and 2.

#### • Growth

The principal growth stages are described above.

#### References

National Research Council. 1989. *Nutrient Requirements of Horses* (fifth edition). Washington, D.C.: National Academy Press.

**Table 5. Crude protein level of grain mixes for horses fed grass or legume forages<sup>a</sup>**

	Grass <sup>b</sup>	Legume <sup>c</sup>
Suckling (creep feed)	18	16
Weanling	16	14
Yearling	14	12
Mature horse	10	8
Pregnant mare (late gestation)	14	12
Lactating mare	16	14

<sup>a</sup> Air dry feed (about 90 percent dry matter).

<sup>b</sup> Values assume a grass hay containing 10 percent crude protein fed at an intake level described in Table 4.

<sup>c</sup> Values assume a legume hay containing 16 percent crude protein fed at an intake level described in Table 4.

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*3,000 copies of this public document have been printed at a cost of \$915.00, or \$.305 per copy.*

Published by  
**North Carolina Cooperative Extension Service**