

Min. 3.3
#348

APR 24 '68

Horse Nutrition and Feeding

R. M. Jordan, Professor, Animal Science



This archival publication may not reflect current scientific knowledge or recommendations.
Current information available from University of Minnesota Extension: <http://www.extension.umn.edu>.

Horse Nutrition and Feeding

R. M. Jordan

Horse breeders are always concerned about the amount and kind of feed to give their horses. Many variables can affect horses' nutritional needs: 1) the temperament and disposition of the horse, 2) present condition, 3) age, 4) approximate size or weight, 5) how many hours a day the horse is ridden, 6) if it is a mare, whether she is pregnant or suckling a foal.

Our knowledge of horses' nutritional requirements is not as comprehensive as for cattle or swine. Most recommendations are based primarily on research information obtained with cattle and draft horses and on only a limited amount of light horse nutrition research. Although some people would argue that this is a poor basis on which to make feeding recommendations, it is the best we have. The nutrient requirements of a light horse may be different from those of a draft horse, due to differences in disposition and temperament.

The horse's digestive tract is very different from a cow's. The cow has a rumen (large fermentation vat where much of the digestion occurs) in the front of the digestive tract. Synthesis of the B vitamins and amino acids takes place in the rumen. Conversely, the horse has a relatively small, simple stomach but does have a large cecum located between the small and large intestines. To a degree, the cecum serves the same purpose for the horse that the rumen does for the cow. However, the cecum's location toward the end of the digestive tract probably reduces its contribution to the horse's overall digestive efficiency. Whether there is adequate synthesis of the B vitamins and amino acids in the cecum, and, if so, whether they are absorbed and utilized by the horse in sufficient quantity to assure optimum production (weight gain, work, and speed) is not entirely resolved, but most authorities believe there is considerable synthesis in the cecum. Therefore, if given good feeds, the horse will usually get an adequate supply of B vitamins and essential amino acids. However, under certain circumstances it is possible for a horse to suffer from B vitamin deficiency. Inadequate research data on B vitamins and amino acids enable the sale of many "magic elixirs" to the unsuspecting horse owner.

To feed your horse adequately you must have an understanding of the horse's nutritional needs and the nutritional composition and/or contribution of various feeds. An explanation of some of the terms used in discussing nutrient requirements of the horse and the composition of various feeds follows:

1. Dry matter—Most grains and hays contain 88 to 90 percent dry matter. If too little dry matter is provided daily, horses may become bored and chew on their stalls (cribbing) and eat bedding. However, if the feed has too much bulk (excessive amounts of fiber or water) the horse might not be able to eat enough to satisfy his nutrient requirements (carbohydrates, protein, minerals, and vitamins).
2. Total digestible nutrients (TDN)—A measure of the energy value of a feed. TDN is the "fuel" that keeps the horse going and puts the fat on his back. Energy per se is the element most often lacking in horse rations. Grains and good quality roughages are the usual sources of energy.
3. Protein—Necessary for all life processes. We are mainly concerned with quantity of protein and, to a lesser degree, quality of protein. Legume hays, pasture, soybean meal, linseed meal, and commercial protein supplements are the usual sources of protein.

4. Minerals—Salt, calcium, and phosphorus are the major minerals required by horses. Salt requirements increase with perspiration losses. Calcium and phosphorus should be provided in a ratio of not less than 1:1. Required trace minerals are normally supplied in adequate amounts in a good horse ration. Commercial mineral blocks or a mixture of trace mineralized salt and bone meal or dicalcium phosphate (equal parts) are the usual sources of minerals.
5. Vitamins—Vitamins A and D are both fat soluble vitamins. Vitamin A must be supplied in the ration. Exposure to sunlight will usually supply adequate vitamin D. The various B vitamins are usually present in adequate amounts in good quality forage. Furthermore, synthesis in the horse's cecum provides adequate quantities of these vitamins under most circumstances.

Knowledge about nutrition has expanded considerably since the days of draft and cavalry horses. But some people still harbor prejudices and misconceptions about feeding horses. For example, many horse owners believe that timothy hay and oats are essential components of a horse ration and that legume hay (alfalfa or clover) and corn or barley shouldn't be used. However, there is ample evidence to indicate that legume hay is excellent for horses and that corn or barley are often preferred grains by many successful horse trainers. Don't think that every horse needs a magic elixir. Just as false a notion is that all commercial feeds are poor investments. Commercial feeds may actually provide some nutrients, such as trace minerals, vitamins, and protein supplements in a less expensive form than the individual horse owner can provide.

Visual Evaluation of Feeds

Hays

- a) Color—Green feed is normally higher in all vitamins, particularly vitamin A (as carotene) and riboflavin, and the green color indicates the hay has not been rained on excessively.
- b) Type—Legume hay such as alfalfa and clovers are normally considerably higher in protein, vitamin A, and minerals (especially calcium) than grass hays.
- c) Stem to leaf ratio—A high leaf ratio makes a feed more nutritious and palatable, and such feed has greater value per ton.
- d) Date of cutting—This is one of the best indicators of feed value. As hays mature, they decline appreciably in protein and phosphorus, increase in fiber, and decrease in digestibility.

Grains

- a) Bushel weight—Oats weighing 26 pounds per bushel have more fiber, less energy, and therefore less feed value than heavy oats weighing 34-36 pounds per bushel.
- b) Color and smell—Grains should be clean and bright-colored. A dull gray appearance indicates grains have been rained on and may be musty or have mold and bacteria growth on them.
- c) Foreign material—Portions of cob, weed seeds, stones, etc. have no nutritional value and reduce feed value.
- d) Kind of grain—The energy value of grains varies widely. Corn is considerably higher in energy value than oats; conversely oats are higher in protein than corn.
- e) Moisture content—Corn and sorghums, in particular, may contain excessive moisture and thus be subject to mold and spoilage. In addition, excess moisture adds weight but no feed value.

Table 1 indicates the relative amount of major nutrients that various feeds contain as well as the variation often noted between a high- and low-quality feed. In general, one should remember that grains contain 70 to 80 percent TDN and hays about 50 percent TDN. The legumes are considerably higher in protein than grass hays. Hays are richer sources of calcium than are grains, whereas grains are richer sources of phosphorus. Furthermore, grains other than corn contribute almost no vitamin A value to a horse ration.

Table 1. Composition of typical horse feeds¹

Feedstuffs	TDN	Protein	Calcium	Phosphorus	Vit. A 1000's	Relative ² value	Percent of base feed it may replace
	%	%	%	%	I.U. ³		
<i>Grains</i>							
Oats	70	12	.09	.33	.08	100	100
Shelled corn	80	9	.02	.27	2.1	115	100
Barley	78	13	.06	.40	.3	110	100
Wheat	81	15	.04	.40	.06	115	40
Wheat bran	67	16	.13	1.30	2.0	100	20
Rye	76	13	.10	.33	.06	115	33
Beet pulp	72	9	.57	.07	.16	100	33
Molasses, beet	60	7	.05	.02	.....	85	10
<i>Protein supplements</i>							
Soybean meal, 44%	78	45	.29	.64	.16	100	100
Linseed meal, 36%	70	36	.40	.86	.....	100	100
Cottonseed meal, 41%	65	42	.20	1.11	.....	100	100
<i>Hays</i>							
Timothy, early bloom	52	8	.41	.21	15.0	100	100
late bloom	48	6	.15	.15	7.0		
Alfalfa, leafy	51	16	1.3	.24	20.0	135	100
stemmy.....	46	12	1.1	.19	15.0		
Brome-grass, early	50	11	.42	.19	10.0	100	100
mature	43	6	.29	.13	7.0		
Clover, red leafy	54	14	1.5	.21	18.0	125	100
stemy	49	10	1.1	.20	10.0		
Reed canary grass	46	8	.33	.16	10.0	90	100

¹ Morrison, Frank B., *Feeds and Feeding*, 22nd Edition, Morrison Publishing Co., 1956.

² The base feeds, oats, soybean meal and timothy hay, for each major type are assigned a value of 100 and the other feeds of that type are compared to it, i.e., timothy has a value of 100 and alfalfa 135. Alfalfa has 35 percent more feed value for a horse than timothy. (*Horses and Horsemanship*, Interstate Pub. Co.), 1963.

³ I.U. = International Units.

Nutritional Needs of the Horse

The next step is to understand what the horse's needs are and what affects those needs. The four basic nutrient groups—carbohydrates, protein, minerals, and vitamins—are all required in varying amounts by horses for the following purposes:

1. Maintenance—horse at rest
2. Work—riding
3. Pregnancy
4. Lactation
5. Growth

The first requirement for all nutrients is to simply maintain the horse at rest. If a horse is to work, reproduce, and suckle young, additional feed over and beyond the maintenance requirements must be provided. The type of production (lactation, work, etc.) determines what nutrient must be increased and to what degree. For example, riding a horse 2 or 3 hours a day (light work) increases the animal's need for energy about 1.5 times the amount needed for maintenance, but the protein requirement remains the same. Conversely, a mare during the last quarter of her pregnancy needs about 20 percent more protein than that required for maintenance, whereas her energy requirement increases only slightly.

Nutrient requirements of a 1,000-pound horse for various types of production along with the amount of average-quality hay required to supply these requirements are given in table 2. This table serves as an excellent guide, but horse feeding still involves some art. Individual horses vary considerably and should be fed accordingly. To accommodate those deviations from the norm, many horsemen would provide 15 to 20 percent more feed than the amounts given in table 2.

Table 2. Daily nutrient requirements of 1000 pound horse at various stages of production and growth¹

	Hay daily lb. ²	Total protein lb.	TDN lb.	Ca gm.	P gm.	Vit. A I.U., 1,000's
Maintenance	13.6	.9	6.8	11	11	8.3
Work						
Ridden, 1 to 2 hrs.	20.4	.9	10.2	12	12	8.3
Ridden, 3 to 4 hrs.	23.8	.9	11.9	14	14	8.3
Pregnancy, last quarter	14.6	1.1	7.3	16	15	23.3
Lactation	28.8	2.6	14.4	30	24	23.3
Growth						
400 lb., 6 mo.	12.4	1.1	6.2	15	12	3.3
600 lb., 14 mo.	14.2	1.0	7.1	14	12	5.0
800 lb., 24 mo.	15.4	.9	7.7	13	12	6.7

¹ Source: *Nutrient Requirements of Horses*. 1966. National Research Council, Washington, D.C., Pub. 1401.

² Hay has 50 percent TDN. Hay is not recommended as the sole ration but is used here to aid in understanding TDN requirements for various stages of production. The amount of hay indicated is that necessary to meet the TDN requirements. For work, lactation and growth some grain and/or protein supplement should replace some of the hay.

Tables of this type can be worked out for any weight horse. This table demonstrates the significant increase in energy, and therefore amount of feed, required by a horse that is ridden frequently. The table also shows that the energy requirement of a 1,000-pound mare during the last quarter of gestation amounts to only a half pound more TDN (1 pound of good hay) than the amount required to maintain a 1,000-pound nonpregnant mare.

Proper nutrition for horses is especially vital during lactation and early growth. Note that the amount of protein needed during lactation is almost three times that required for maintenance (2.6 pounds vs. .9 pound) and that twice as much TDN is required for lactation as for pregnancy (14.4 pounds vs. 7.3 pounds). Calcium and phosphorus needs are also more critical for lactation and growth. Vitamin A requirements during the last quarter of pregnancy are almost three times those needed for maintenance or for light work, and calcium and phosphorus requirements are likewise increased during lactation. All mention of nutrient requirements is on a daily basis.

It is imperative that a growing horse's nutritional needs be met. A 400-pound foal that will mature to a 1,000-pound horse requires 1.1 pounds total protein and 6.2 pounds of TDN daily. This is more protein and almost as much TDN as required for a 1,000-pound mare, although the foal is only 40 percent as heavy. To supply these amounts, high-quality feeds rich in protein and energy must be fed. Calcium and phosphorus requirements are slightly higher for the 400-pound foal than for maintenance of a 1,000-pound horse. Minimum vitamin A requirements are in proportion to weight (1.5 mg. of carotene/100 pounds of body weight).

In table 2 the column headed "Daily amount of hay fed" would provide the recommended amounts of TDN and more than the recommended levels of protein, calcium, phosphorus, and vitamin A. However, the "Daily amount of hay fed" is not a recommended ration but is used merely to put the nutrient requirements in terms of a typical feed. It is quite obvious to any knowledgeable horseman that 20 to 25 pounds of hay could cause a "hay belly" and make the animal less suitable for riding. The amount required to meet energy needs during lactation (28.8 pounds of hay) is more than the horse would readily consume. Certainly a 400-pound foal would not eat 12 pounds of hay.

In table 3 the requirements for a mature horse weighing 1,000 pounds are given in terms of percent of various nutrients in the ration. Such information is available on a commercial feed tag.

Table 3. Ration composition required to meet nutrient requirements of 1000 pound horse at various stages of production and growth¹

	Ration daily, lb. ²	Total protein %	TDN %	Ca %	P %	Vit. A I.U./lb.
Maintenance	10.9	8.2	63	.22	.22	760
Work						
Ridden 1 to 2 hrs.	16.3	5.3	63	.16	.16	510
Ridden 3 to 4 hrs.	19.0	4.5	63	.16	.16	440
Pregnancy, last quarter	11.7	9.7	63	.30	.30	2,000
Lactation	23.0	11.1	63	.29	.23	1,000
Growth						
400 lb., 6 mo.	9.9	11.1	63	.33	.27	330
600 lb., 14 mo.	11.4	8.8	63	.27	.23	440
800 lb., 24 mo.	12.3	7.3	63	.23	.22	540

¹ Source: *Nutrient Requirements of Horses*. 1966. National Research Council, Washington, D.C., Pub. 1401.

² The ration used above contained 63 percent TDN or consisted of equal parts of hay (50 percent TDN) and grain (75 percent TDN). This ration has more grain than necessary for maintenance and pregnancy.

These rations and the amount to feed are based on a ration containing 63 percent TDN. Thus the ration is approximately half hay (50 percent TDN) and half grain (75 percent TDN). This is a much higher proportion of grain than is fed under most circumstances, but is used in this case as it agrees with the level of TDN in the National Research Council's bulletin on horse nutrition.

To calculate an adequate ration for a horse, it's necessary to know the horse's need for specific nutrients in pounds or grams. Then you can determine the percent of protein or the amount of vitamin A (I.U.*) per pound required to meet specific requirements. In table 3, for example, 10.9 pounds of a ration that contains 8.2 percent total protein and 63 percent TDN provides .9 pound of total protein and 6.8 pounds of TDN—the specific requirements for maintenance of a 1,000-pound horse. A ration that contains 760 I.U. of vitamin A per pound when fed at 10.9 pounds per head would provide 8,300 I.U. of vitamin A.

Horsemen using this table should recognize that if a horse needs a specific amount of a nutrient, the more of a given feed used, the lower the percent of that nutrient required in the feed. For example, to maintain a horse you should feed 10.9 pounds of a ration that contains 8.2 percent protein. But when at light work the ration need contain only 5.3 percent protein to provide the necessary amount of protein (because the horse is fed more [16.3 pounds] to provide energy).



This mare is obviously well-fed and in sufficient flesh to adequately nurse her foal. For rapid development, the foal should be creep fed a palatable and nutritious grain mixture.

* I.U. = International Units.

How to Feed A Horse

From the previous tables (feed composition and nutrient requirements of horses) you should be able to formulate a ration that meets the requirements of the horse regardless of his size or stage of production. It helps to know about how much a horse will consume per day. This will vary depending on the horse's individuality, his size, age and condition, weather or environment, the type and quality of feed, and the above-mentioned stages of production.

In general, a mature horse will consume from 2 to 2.5 pounds of total feed per 100 pounds of body weight. An idle horse can meet his needs with hay. A horse that is ridden an hour or 2 per day should receive about .5 pound of grain and about 1.5 pounds of hay per 100 pounds of body weight. A horse ridden 3 to 5 hours a day should receive .75 pound of grain and 1 to 1.25 pounds of hay per 100 pounds of body weight. A horse at hard work (ridden from 5 to 8 hours a day) should get about 1.25 pounds of grain and a like amount of hay per 100 pounds of body weight. For example, race horses in hard training are often fed 10 to 15 pounds of grain a day. Naturally, the amount of hay horses consume under such circumstances is reduced.

Here are the steps to follow to balance a ration:

1. Write down the requirements:

1,000-pound lactating mare:

Total protein	TDN	Calcium	Phosphorus
pounds	pounds	grams	grams
2.6	14.4	30	24

2. Write down the percent of ingredients in the various feeds you intend to use. For example:

	Total protein	TDN	Calcium	Phosphorus
	percent	percent	percent	percent
Alfalfa hay	15	50	1.4	.24
Shelled corn	8.7	80	.02	.27

3. By trial and error, arbitrarily determine an amount of feed to use in a given proportion. Let's assume you were to use 20 pounds of feed containing equal parts of alfalfa hay and shelled corn. Multiply pounds of feed by percentage of each nutrient in the feed to determine amount of nutrient supplied (10 pounds alfalfa \times 15 percent protein = 1.5 pounds protein).

	Total protein	TDN	Calcium	Phosphorus
	pounds	pounds	grams	grams
10 lb. alfalfa	1.5	5.0	63.6	10.9
10 lb. corn .....	.87	8.0	.9	12.3
Total	2.37	13.0	64.5	23.2

You can see that 20 pounds of a ration containing 10 pounds of alfalfa hay and 10 pounds of shelled corn meets neither the TDN requirements nor the protein requirements. If 20 pounds of total feed were all the horse consumed, a protein supplement would have to be substituted for part of the hay to increase the TDN, phosphorus, and protein. Actually, a horse weighing 1,000 pounds would probably consume 22 to 25 pounds of such a ration, and in that case the ration would more than meet all nutrient requirements.



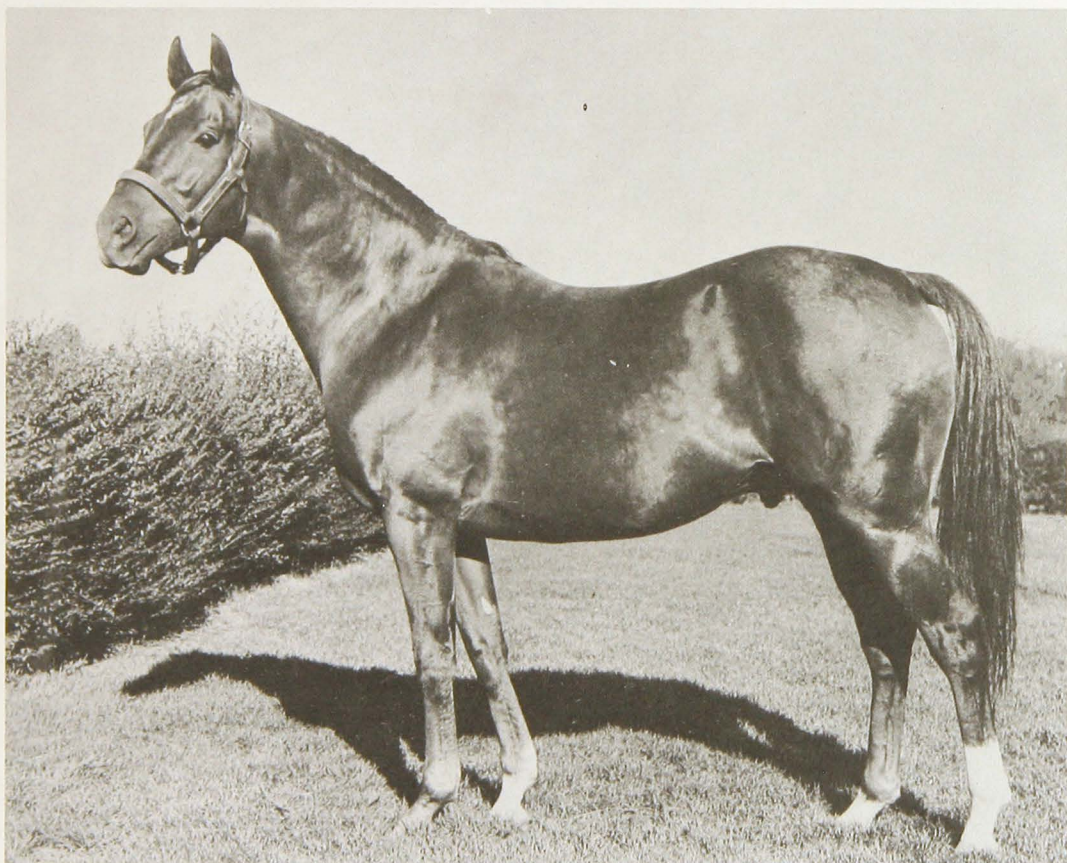
This horse has been fed to show; the animal has a shiny coat, spirit and animation, and the desire to perform.

Pastures

While pastures are not absolutely essential for successful horse production, they do provide an excellent source of good-quality feed and a place for exercise. The value of the pasture from a nutrition standpoint depends on the amount of forage available, the maturity of the forage, and the type of forage. Obviously, if the feed is so scarce that the horse must work for his feed, the pasture may do more harm than good. As the forage in the pasture matures, it increases in fiber and its nutritional value declines appreciably, necessitating the addition of some grain and/or protein to the horse's diet.

A mixture of grass and legume is an ideal horse pasture. Legumes are not only rich protein and mineral sources but are also laxative. The latter trait may be undesirable for horses being ridden and, in that case, dry hay should be fed. Legumes may also cause horses to sweat profusely when worked hard.

Keep in mind that pasture forage during the early season is extremely high in water content and unless some dry forage or grain is fed in conjunction with the pasture the horse may be unable to eat enough to fulfill his nutrient requirements.



During the breeding season a grain ration containing 12 to 14 percent protein and fortified with vitamin A should be fed in sufficient amounts to keep this stud in strong, vigorous condition.

Pelleted Rations

Good hay is often difficult to find, and storing hay is sometimes a problem. For these reasons, horsemen are interested in feeding a pelleted ration (hay and grain combined). Research work indicates that feeding pelleted rations presents some problems. The horse can eat 20 pounds of pelleted hay faster than 20 pounds of baled hay. Thus the horse often grows bored, will chew on his stall, and may become a cribber. Pelleting does not increase the digestibility of the ration but does speed its passage through the digestive tract. But when the same amount and quality of hay is fed as long hay or as pellets, the weight gains and condition of the horse are the same. Because some vices may develop when the entire ration is pelleted, it is recommended that about 25 percent of the daily ration be long hay.

A well-fed horse has a slick coat, is alert, relishes his feed, and is content. If your horse is well-fed but is losing weight, has a rough hair coat, or slobbers his feed, he may have bad teeth or be parasitized. Your veterinarian can help you remedy such problems.

GENERAL FEEDING RULES

1. Know the weight and age of your horse.
2. Feed and water at a regular time.
3. Avoid sudden and radical changes in the type and amount of feed.
4. Keep feed boxes and water clean.
5. Avoid moldy or dusty feeds.
6. Feed horse as an individual according to nutritional needs and condition of the animal.
7. Examine teeth periodically and have the sharp edges floated.
8. Control internal and external parasites with a systematic treatment program.
9. Provide adequate exercise.
10. Don't overfeed.

