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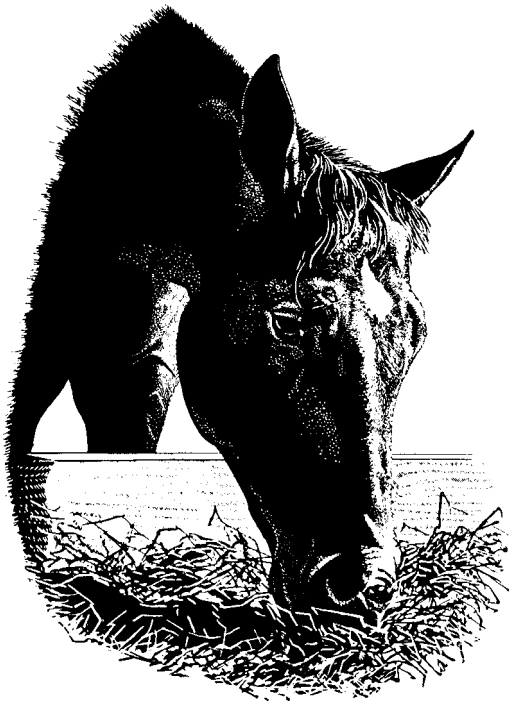

Feeding Alternatives for Horses

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The horse is a roughage eater by nature. Unfortunately, humans, in an endeavor to achieve more rapid growth and development and greater performance, have tended to overlook this fact. Since the horse is produced and maintained for its athletic ability, energy is required for various types of activity rather than for fattening as in the case of market animals. During periods of heavy energy demand, concentrate feeds must be furnished since the horse's digestive tract is not large enough to allow enough roughage to be eaten to supply its energy needs. When energy requirements are low, as with the mature idle horse, energy needs can often be met by roughage alone.

A balanced ration for horses should provide nutrients required for body maintenance, growth, reproduction, and work. These nutrients include carbohydrates and fats (energy), protein, vitamins, minerals, and water.

Animals differ considerably in the amounts of energy they use. Voluntary feed consumption of mature animals will generally be 1.5 to 2.5% of body weight, the percentage depending on the roughage content of the ration and on individual variation. Growing foals and lactating mares may eat up to 3% of their body weight.

The extent to which a horse's rations are supplemented with proteins depends on the age of the horse and on the quality of the forage being eaten. Growing or lactating animals require somewhat more protein than those that are breeding or working.

The need for vitamins, like other nutrients, depends on the forage base. The need for vitamins A and D is relatively constant but will increase if badly weathered or mature hay is being provided. The B-complex vitamins need not be added to the rations of most horses. When horses are under the stress of performance—racing or show—add B vitamins to ensure adequate intake.

Good pasture and free-choice minerals usually satisfy the nutrient requirements of mature horses performing up to medium levels of work and the requirements of mares during early gestation. If the pasture is primarily grass, a mineral mixture containing 2 parts of calcium to 1 part of phosphorus is recommended. If the pasture is primarily legume, the mixture should contain no more than 1 part of calcium to 1 part of phosphorus.

Salt is generally included in the mineral mixture to improve acceptability to the animals. Additional free-choice salt is recommended. Trace minerals may be included either in the salt or in the mineral mixture.

Energy

The daily requirements of many nutrients other than energy for horses depend on the daily energy intake, so the energy content of the ration must be given

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first considereration when the nutrient requirements are expressed as a percentage of the ration. Perhaps the best way to determine the adequacy of the energy intake of a horse is to observe the horse's body condition.

Energy in a horse ration comes primarily from a carbohydrate source such as sugar, starch, and cellulose. Grains such as oats, barley, wheat, or corn contain much sugar or starch and are referred to as concentrated, or concentrate, sources of energy. Cellulose, making up the fiber in plants, is harder to digest and is in a less concentrated energy form.

Other groups of energy nutrients are fats and oils. These are of little concern in practical horse feeding.

The amount of energy (energy value) in feed is measured and shown by several systems. One system shows DE (digestible energy). Other systems might be metabolizable energy or net energy. The system with which most people are acquainted expresses the amount of energy in a feed as TDN (total digestible nutrients) as shown in the appendix.

Oats (grain) have an average energy value of 75% TDN. This means each pound of oats contains 3/4 pound of energy. For practical purposes, good quality legume roughages may be estimated to contain 50% TDN. Accordingly each pound of good alfalfa can be figured to contain 1/2 pound of TDN. Without looking up TDN values, estimate good quality grass hays to contain 48% TDN and the various straws to contain 40% TDN.

Protein

Protein can be furnished in the ration. However, protein needs are in part synthesized by bacteria in the cecum from nonprotein nitrogen in plants or other sources. Researchers have fed up to 1/2 pound urea daily to horses with no ill effects. Fed urea has increased the levels of blood amino acids in horses. Biuret has not.

Classification of Feeds

Roughages are relatively high in fiber and low in energy in relation to bulk or volume of the material.

- Roughages in high protein are alfalfa and the clovers. They are still fed primarily as a source of energy.
- Roughages said to be primarily a source of energy are timothy, various grass hays, and the cereal grain hays or straws.

Concentrates are relatively high in energy and low in fiber in relation to their bulk.

- Concentrates fed primarily for their protein content are residues from plant or animal sources and are commonly called "protein supplements." Cottonseed, soybean, or linseed oil meals are examples.
- Carbohydrate concentrates (cereal grains) are fed primarily as a source of energy. Some of these are barley, oats, corn, and wheat.

Nutritive Requirements for Various Functions in the Horse

Requirement for Growth

In general a foal will subsist quite well on its dam's milk, provided she has a sufficient supply of feed in a well-balanced ration. If optimum growth of the foal is to be obtained, it is desirable to provide a concentrate mixture containing a source of readily digestible energy and of a relatively high level of good quality protein as well as a balance of minerals and vitamins. Creep feeding is particularly needed as the lactation period progresses and the mare's milk flow declines because of time and mature and overmature pastures or other nutritional factors.

Following are the approximate requirements for a growing foal at several stages:

Body Weight	Daily Gain	Crude Protein	TDN	Ca	P	Carotene
lbs.	*lbs.*	*lbs.*	*lbs.*	*grams*	*grams*	*milligrams*
400	1.2	1.1	6.2	15	12	6
600	0.8	1.0	7.1	14	12	9
800	0.5	0.9	7.7	13	12	12
1,000	mature	0.9	6.8	11	11	15

It may be pointed out that the protein requirement declines as the growing horse increases in size and approaches maturity. This is a reflection of the greater synthetic or anabolic activity in the cells resulting in the rapid increase in muscle mass early in the life of the growing animal. The energy (TDN) needs also increase to fuel the maintenance requirement and

growth process until maturity is reached, at which time the requirement reduces to the maintenance level only. Calcium and phosphorus ratios narrow and quantity declines with approach to maturity. This reflects the early rapid growth of bone and later slowing in that process. Vitamin A requirement is a function of body size and increases right up to maturity.

The growing phase is the foundation-building phase and no period is more critical to what one will have as a mature horse.

The maintenance requirements listed are those for the 1,000-pound horse in this illustration. Maintenance implies no expenditure of energy beyond that required for necessary life processes, with usually a small activity factor. A horse's needs vary considerably around the recommended requirements for maintenance and as with all recommendations they must be taken as guidelines only and not as absolutes.

Requirement for Reproduction

Requirements in this category are for the same basic nutrients; the difference being some alterations in amount and proportions. Requirements for reproduction include not only those indicated by the developing fetus but also the sum of the maintenance requirement, growth requirement, if maturity has not been attained, and requirement necessitated by work if it is being performed during pregnancy.

It is generally agreed, based on good evidence, that as with most species the nutritional rigors of pregnancy in the horse are not great enough to be of particular concern until the last approximately three months of gestation. Prior to that time the development of fetus and membranes are slow enough that the maintenance requirement may provide enough to take care of it.

The NRC recommendation for a mature, 1,000-pound mare during the last quarter of pregnancy is as follows:

CP *lbs.*	**TDN** *lbs.*	**Ca** *grams*	**P** *grams*	**Carotene** *milligrams*
1.12	7.3	16	15	70

It may be noted that all categories have been increased in varying degrees. The protein reflects the laying down of new tissue. The increased demand for energy indicates a demand by the fetus. Increases in calcium and phosphorus are to build fetal bone and the carotene increase is for membrane health as well as a number of other functions. It must still be kept in mind that these are guidelines and not absolutes.

It may be appropriate to mention nutrition of the stallion at this point. He should have a high quality, well-balanced ration always. It need not be elaborate or expensive and usually the proper combination of farm-grown feeds will do the job.

Many horsemen like to increase protein intake during the breeding season and, although evidence of the efficacy of this practice is lacking, it is not harmful. Be certain of sufficient minerals in proper ratio. Provide vitamins as needed, prevent overfatness, provide plenty of exercise, and no problems of a nutritional nature should normally be encountered.

Requirement for Lactation

As with the dairy cow, milk production puts the most severe nutritional strain upon the horse in all functions, except possibly hard work. This is illustrated in the NRC requirement for the 1,000-pound mare at peak lactation:

Milk/Day *lbs.*	**CP** *lbs.*	**TDN** *lbs.*	**Ca** *grams*	**P** *grams*	**Carotene** *milligrams*
44	2.55	14.4	30	24	70

It should be pointed out that the amount of milk in the illustration is probably double the average over a lactation period and is for peak production only.

The sharp increase in all categories is very evident. Only the vitamin A requirement is not sharply increased over the gestation requirements and it remains high. The quantities of other nutrients required are necessitated by the amounts of protein, energy, and calcium and phosphorus in milk, and the nutrient cost of synthesizing milk. A person is really producing feed for his/her foal crop and the importance of sufficient quantities of this high quality feed makes the cost and effort of providing for it well worthwhile.

Requirement for Work

Horses, with the exception of those kept strictly for breeding, are subjected to some level of work. Nutrient requirement recommendations are often based

on three levels of work effort:
1. Light work—2–3 hours per day
2. Medium work—4–5 hours per day
3. Heavy work—6–8 hours per day

It must be recognized that the level of work within these times may vary greatly. The "medium" worked horse may be called upon to expend more energy in five hours than the "heavily" worked horse is in eight hours. Therefore, the recommendations based on these intensities must be used only as a rough guide. The NRC recommendations for work for a 1,000-pound, mature horse are as follows:

Work	CP *lbs.*	TDN *lbs.*	Ca *grams*	P *grams*	Carotene *milligrams*
Light	0.9	10.2	12	12	15
Medium	0.9	11.9	14	14	15
Heavy	0.9	14.6	16	16	16

The requirement for protein is not increased by work and is essentially the same as for maintenance.

There are substantial increases in the energy needs of working horses as would be expected when one considers that energy is the major expenditure in performing work. This rather notable increase in need for energy necessitates a change to higher energy feeds, particularly in the heavily used horse.

The increase in minerals is to provide for greater losses via sweating and possibly urinary losses. It is not very great and probably will be supplied by the increased feed if care is taken to provide the proper kinds.

The carotene requirement, being largely a function of size, remains the same for the several levels of work.

Balancing Rations for Horses

In balancing rations for horses, the same basic information is required as for other classes of animals. The process of using the information also is no different. One needs to have a knowledge of the following to balance rations:
1. The nutrient content of the feeds to be used.
2. The nutrient requirements of the animal to be fed.

By calculating the amounts and combinations of Item 1 to fulfill the requirements of Item 2, a ration is balanced. To illustrate, the following arbitrary values are given to several feeds one might use in horse feeding:

Feed	TDN *%*	CP *%*	Ca *grams*	P *grams*	Carotene *milligrams*
Alfalfa hay	52	15	1.5	0.25	8.5
Alfalfa-grass hay	48	12	1.0	0.25	7.0
Grass hay	48	8	0.5	0.20	6.0
Concentrate (grain)	75	9	0.05	0.35	0.05

The first example illustrates the requirement of the 1,000-pound, mature horse for maintenance. The requirements are: TDN—6.8 pounds; protein—0.9 pound; calcium—11 grams; phosphorus—11 grams; and carotene—15 milligrams.

The starting point of ration balancing is to provide for the energy needs. If we take the alfalfa-grass hay we find that 14.5 pounds will fulfill the TDN requirements (48% of 14.5 pounds = 6.96 pounds). Will it provide enough protein? Twelve percent of 14.5 pounds = 1.74 pounds of protein and the answer is yes.

Next we have a look at the calcium and phosphorus requirements. Fourteen and a half pounds of hay times 1% calcium yields 0.145 pound of calcium; converting to grams, 0.145 x 454 (the approximate grams per pound) = 65.8 grams—more than enough. Phosphorus at 0.25% times 14.5 pounds yields 0.036 pound. Converting to grams 0.036 x 454 = 16.3 grams—a slight margin above the requirement. At 7 mg. carotene per pound, the 14.5 pounds of hay will provide over 100 mg. carotene, more than enough. The only real fault to be found would be the ratio of calcium to phosphorus—about 4:1. Experience tells us that we probably will have no problem with this but it is quite a bit wider than recommended (1.1:1) and one might use a phosphorus supplement to bring it more nearly into line, taking care not to feed an excess of phosphorus.

As futher illustration, the situation with a heavily lactating mare is shown. Her requirements:

TDN *lbs.*	CP *lbs.*	Ca *grams*	P *grams*	Carotene *milligrams*
14.4	2.55	30	24	70

It would require 30 pounds of the mixed hay to fulfill the TDN requirement. This is perhaps possible but is an excessive amount of dry matter to ingest, and

some concentrate should be fed to reduce the dry matter intake. Calculation will show that there will be adequate quantities of the other nutrients in question. The ratio of calcium to phosphorus would still be wide and might need some adjustment, although feeding some concentration will bring the ratio more into line. A more desirable combination of feeds might be the following:

	TDN *lbs.*	**CP** *lbs.*	**Ca** *grams*	**P** *grams*	**Carotene** *milligrams*
Mixed hay— 17 1/2 lbs.	8.4	2.10	79.5	20	122.5
Concentrate— 8 lbs.	6.0	0.72	0.2	13	0.4
Total	14.4	2.82	79.7	33	122.9

This ration yields enough or more of all nutrients in question and the Ca:P ratio is about 2.4:1. This Ca:P ratio is somewhat wider than the NRC recommendation of 1.25:1, but again experience tells us that it probably is acceptable.

Major Feed Deficiences

Feed deficiencies are of two kinds:
1. Man-made as the results of poor management and feeding practices.
2. Area deficiencies—primarily mineral deficiencies from a lack in the soil.

Important deficiencies ranked:
1. Energy—just plain not enough to eat. Increasing total feed intake can show dramatic recovery from many so-called minor element deficiencies and diseases.
2. Protein—a lack of protein aggravates a lack of total energy in the ration. Increasing protein doesn't help much if not enough total energy is present. Protein is expensive and often promoted for use when total energy should be increased in a ration.

Use of Supplements

Numerous supplements are recognized in the United States today. Any feed can be called a supplement under certain circumstances.

Energy supplements. Needed when range or pasture is short or when hay is of poor quality. Examples: Cereal grains or molasses.

Protein supplements. Often needed when grass hay or straw is fed or the pasture is dry. Especially important for young, growing animals. Examples: cottonseed, soybean or linseed oil meals, or field peas.

Vitamin supplements. Needed when performance of animals indicates vitamin deficiency. Mature horses do not need the various B vitamins or vitamin C in their feed since the bacteria in the intestine supplies these. Vitamin D is usually supplied through sunlight. Vitamin A may come from fresh, green feeds, silage, properly cured hay, or vitamin A palmitate or stearate.

Mineral supplements. Needed when natural feedstuffs do not contain enough minerals, or when rations and management by man cause specific symptoms of mineral deficiency to show up. Salt is commonly fed free choice, as are bone meal and dicalcium phosphate. Trace-mineral mixtures may be used where needed.

Non-nutrient supplements. May improve performance of animals in some cases. Examples: antibiotic and hormone materials. There feed additives cannot compensate for faulty nutrition in the feeding of livestock. To be effective and economical, feed additives must be superimposed on a balanced ration.

Thumbnail Feeding and Management Rules

1. Two pounds of hay per 100 pounds of body weight of horse per day. Twenty pounds of good quality grass hay would suffice per day for an ideal 1,000-pound horse. Three pounds of alfalfa hay could be added as a protective feed.
2. Three pounds of hay substituted for one pound of grain.
3. Three pounds of silage substitutes for one pound of hay.
4. Green pastures are adequate for mature, idle horses. Dry pastures are low in protein and phosphorus and can be low in energy if not enough dry forage is available.
5. Legume hays, alfalfa in particular, are "protective" roughages containing enough energy, protein, Vitamins A and D, and calcium and phosphorus for most horses. Heavily lactating mares, hard-working horses, and young, growing horses may be exceptions.
6. Warm the drinking water in cold weather to at least 40˚F. This will stretch the feed supply as energy from the horse's body is not needed to warm cold water. More water will be drunk, im-

APPENDIX
AVERAGE COMPOSITION OF FEEDS

Feed	Total Dry Matter	CP	TDN	Ca *grams*	P *grams*	Carotene *Milligrams/lbs.*
Roughages						
Alfalfa hay, all analysis	90.5	10.9	50.7	1.47	0.24	8.2
Alfalfa straw	92.7	4.7	42.6		0.13	
Alfalfa and grass hay	89.6	7.7	48.3	1.18	0.24	7.7
Barley hay	90.8	4.0	51.9	0.26	0.23	
Barley straw	90.0	0.7	42.2	0.33	0.10	
Bentgrass hay	88.5	2.8	49.1		0.18	
Bromegrass hay	88.8	5.3	49.3	0.42	0.19	
Cheat hay	91.7	3.7	50.3	0.29	0.25	
Clover hay, red	88.3	7.2	51.8		0.24	7.3
Corn stover, no ears, mature, very dry	90.6	2.1	51.9	0.54	0.09	
Grass straw	85.0	1.8	40.0			
Marsh or swamp hay	90.2	4.1	48.0	0.32	0.10	
Mint hay	88.3	8.5	49.4	1.51	0.19	
Native hay, good	93.3	5.1	53.8	0.53	0.16	9.1
Native hay, dry and weathered	90.0	1.6	36.6	0.53	0.07	3.6
Oat chaff	91.8	0.9	33.1	0.80	0.30	
Oat hay	88.1	4.9	47.3	0.21	0.19	
Oat hay, wild	92.5	4.0	49.4	0.22	0.25	
Oat straw	89.8	0.7	44.8	0.24	0.09	
Orchardgrass hay	88.7	4.2	49.7	0.27	0.18	
Pea hay, field	89.3	10.6	55.1	1.22	0.25	
Pea straw, field	90.2	3.2	42.2		0.10	
Quackgrass hay	89.0	2.5	40.3			
Quackgrass hay, very early cut	85.0	9.0	55.2			
Timothy hay, all analysis	89.0	3.0	49.1	0.35	0.14	4.4
Wheat chaff	90.0	2.0	35.8	0.21	0.14	
Wheat hay	90.4	3.3	46.7	0.14	0.18	
Wheat straw	92.6	0.3	40.6	0.15	0.07	
Concentrates—Grains (energy primarily)						
Barley, PC	89.9	6.9	78.8	0.06	0.33	0.2
Corn, dent No. 2	85.0	6.7	80.1	0.02	0.27	1.3
Corn and oat feed, good	89.4	8.4	77.2	0.05	0.30	
Corn and oat feed, low quality	90.1	6.7	60.9			
Molasses, beet	80.5	4.4	60.8	0.05	0.02	
Oats, PC	91.2	7.0	72.2			0.05
Rye	89.5	10.0	76.5	0.10	0.33	0.04
Wheat, soft PC	89.1	8.3	79.9			
Protein Concentrates						
Beans, fileld or navy	90.0	20.2	78.7	0.15	0.57	
Buttermilk, dried	92.0	28.6	83.1			
Cottonseed meal, 45%	94.3	37.4	75.1	0.23	1.12	
Cottonseed meal, 36%	92.6	28.2	64.4			
Fish meal, all analysis	92.0	63.5	70.8	5.36	3.42	
Linseed meal, 36%	91.0	30.7	70.3			
Milk, whole, dried	96.8	22.3	118.7	0.91	0.76	
Milk, skim, dried	93.9	29.8	79.8	1.28	1.04	
Peas, field, cull	91.6	18.9	79.1	0.17	0.32	
Soybean meal, all analysis	91.0	37.0	77.9	0.27	0.63	
Tankage or meat meal, 60%	92.8	50.5	65.8	6.37	3.23	
Mineral Supplement						
Bonemeal, steamed	95.5			30.14	14.53	

Suggested Daily Ration for 1,000-Pound Idle Horse

	*lbs.**
1. Alfalfa hay	1.5 to 2 per 100 lbs. body weight
2. Grass hay	2 per 100 lbs. body weight
3. Alfalfa hay	3
Straw or chaff	9
Grain	5
4. Clover hay	4
Oat straw	10
Oats	4
5. Alfalfa	8
Oat straw	8
Molasses	3
6. Alfalfa hay	4
Barley straw	7
Barley	4
7. Alfalfa hay	4
Corn fodder with ears	14
8. Orchard grass hay	10
Oat hay	4
Shelled corn	2
9. Legume hay	3
Oat straw	10
Grain	3.5

Note: In addition: trace mineralized salt and steamed bone meal free choice; vitamin A as vitamin A palmitate or stearate in grain or vitamin A injection; water at all times.

*Total pounds fed unless otherwise indicated.

proving general health and performance.

7. If low quality dry roughages or pellets or pelleted feeds are fed, an ample supply of good water is important.

8. Provide a shed or windbreak to keep horses from burning up energy to keep warm.

9. Weanlings not on pasture should have 1 to 1 1/2 pounds grain and 1 1/2 to 2 pounds hay for each 100 pounds of body weight.

10. Water and salt (trace mineralized) are the cheapest feeds of all. Be sure the horse has plenty.

11. If you are feeding mineral supplements by the "tablespoon" measure, remember that you are not adding a tablespoon of actual mineral. An ounce equals thirty grams or two tablespoons. The following table shows how much actual mineral you would be giving for several mineral supplements. A tablespoon of dicalcium phosphate added to the grain mix would be 1/2 ounce or 3.75 grams of calcium and 2.7 grams of phosphorus added to the mineral balance of the ration.

12. With hay in short supply, plan ahead and ration your hay a little to make the supply last. A horse getting 8 to 10 pounds per day this winter, even if it needs 12 to 15 pounds, and still getting 8 to 10 pounds the first of April will be far ahead of the horse eating 15 pounds per day now and then eating fence posts and boards later when you can't find hay. If you have to ration hay, add a little grain or pelleted feed to keep up with the energy (TDN) level.

	Ca *%*	**Ca** *grams/ oz.*	**P** *%*	**P** *grams/ oz.*
Dicalcium phosphate	24	7.5	18	5.4
Monocalcium phosphate	26	7.7	11.4	3.4
Monosodium phosphate	0	0	21.4	6.4
Steam bone meal	32.6	9.8	15.2	4.65

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