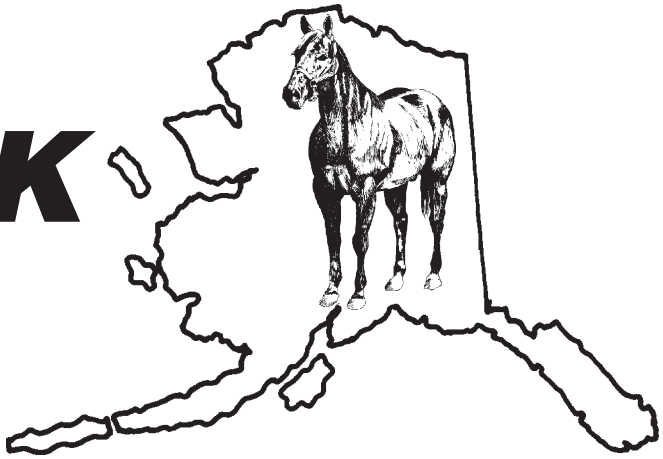
ALASKA LIVESTOCK SERIES



LPM-00748

Feeding Alternatives For Horses

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.

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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 first consideration 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 ¾ 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 ½ pound of energy. Without looking up TDN values, estimate good quality grass hays to contain 48 percent 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 ½ pound of 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 high in protein are alfalfa and the clovers. None the less 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.

NUTRIENT REQUIREMENTS FOR VARIOUS FUNCTIONS IN THE HORSE

Requirements 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.

This strong colt's dam is a good milker and is being properly fed to meet the high nutritional needs of both animals.

Photo by Ken Krieg, CES

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

Body Weight lbs.	Daily Feed[1] lbs.	Daily Gain lbs.	Crude Protein %[2]	TDN %	Ca %	P %	Carotene mg/day
400	2.25	1.50	13.10	63	.55	.30	6
600	12.00	.75	11.30	58	.40	.22	9
800	14.00	.75	10.80	55	.32	.18	12
1,000	14.50	.15	10.10	55	.31	.17	15

[1] Air dried to contain not more than 10% water

[2] All percentages shown on this publication are a percent of the air dried diet

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.

Requirements for Maintenance of a Mature Horse

The requirements for maintenance of a mature horse are relatively low and are essentially the same for all weights when express as a percentage of the total ration. They are as follows:

CP %	TDN %	Ca %	P %	Carotine mg/day
7.20	49	0.21	0.15	35

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 around the recommended requirements for maintenance and as with all recommendations they must be taken as guidelines only and not as absolutes.

Requirements 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 is slow enough that the maintenance requirement may provide enough to take care of it.

A mare in the last one third of pregnancy needs to be fed on a high plain of nutrition if she is to have a healthy foal and plenty of milk. *Photo by Ken Krieg, CES*

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

CP %	TDN %	Ca %	P %	Carotene mg/day
9.5	50	.40	.31	70/day

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 is appropriate to mention nutrition of the stallion at this point. He should always have a high quality, well-balanced ration. 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 to provide 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.

The NRC recommendations for a mature stallion are as follows:

CP %	TDN %	Ca %	P %	Carotine mg/day
8.6	50	.26	.19	50

Requirements for Lactation

As with the dairy cow, milk production puts the most severe nutritional strain upon the horse of 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 %	TDN %	Ca %	P %	Carotene mg/day
33	12.0	55	.47	.30	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 but remains high. The quantities of other nutrients required are necessitated by the amounts of protein, energy, calcium and phosphorus in milk, and the nutrient cost of synthesizing milk. One is really producing feed for his foal crop and the importance of sufficient quantities of this high quality feed makes the cost and effort of providing for it well worthwhile.

Requirements 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 to 3 hours per day
2. Medium work ..... 4 to 5 hours per day
3. Heavy work ..... 6 to 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 %	TDN %	Ca %	P %	Carotene mg/day
Light	8.8	53	.27	.19	15
Medium	9.4	55	.28	.22	15
Heavy	10.3	60	.31	.23	16

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 mineral losses via sweating and possibly urination. 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 the size of the horse, 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 species. 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 %	P %	Carotene mg/day
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	12	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 — 49%; protein — 7.2%; calcium — .21%; phosphorus — .15%; and carotene — 35 milligrams.

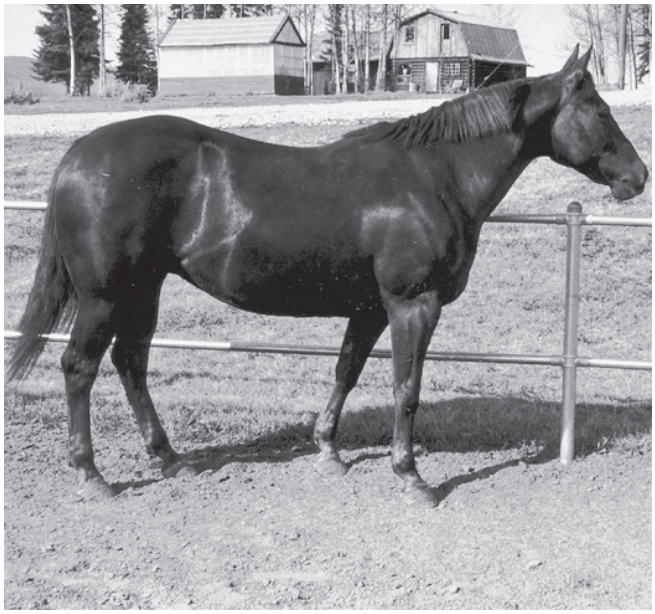
By comparing her requirements to the nutrient values of alfalfa hay one can see that a full feeding (16 to 25 lbs) of the hay will meet all her requirements. The only real fault to be found would be the ratio of calcium to phosphorus — about 6:1. It is quite a bit wider than recommended (1.25:1) and one would use a phosphorus supplement to bring it more nearly into line, taking care not to feed an excess of phosphorus.

As further illustrated, the situation with a heavily lactating mare is shown. Her requirements:

TDN %	CP %	Ca %	P %	Carotene mg/day
55	12.0	.47	.30	70

A grass hay diet would not fulfill her requirements. In this case one would need to supplement grass hay with alfalfa or grain. A mixture of 17.5 lbs of mixed hay and 8 lbs of barley provides 12% crude protein, 56% TDN, .72% calcium and .28 % phosphorus.

This ration yields enough or more of all nutrients in question and the Ca:P ratio is about 2.5:1. 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.



This mature mare has shed out early and come through the Alaska winter in excellent condition. Both are signs of a sound nutrition program.

Photo by Ken Krieg, CES

MAJOR FEED DEFICIENCIES

Feed deficiencies are of two kinds:

1. Man-made as the result of poor management and feeding practices.
2. Area deficiencies — primarily stemming from a mineral deficiency 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, molasses, fats, or oils.

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, fish 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 causes specific symptoms of mineral deficiency to show up. Salt is commonly fed free choice, as are ground limestone, bone meal and dicalcium phosphate. Trace-mineral mixtures may be used where needed. In Alaska salt blocks are not recommended for winter use as animals are reluctant to lick them.

Non-nutrient supplements. May improve performance of animals in some cases. Examples: antibiotic and hormone materials. These 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 substitutes 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, 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 and more water will be drunk, improving 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 1.5 pounds grain and 1.5 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:

	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

A tablespoon of dicalcium phosphate added to the grain mix would be ½ ounce or 3.75 grams of calcium and 2.7 grams of phosphorus added to the mineral balance of the rations.

12. With hay in short supply, plan ahead and ration your hay to make the supply last. A horse getting 8 or 10 pounds per day during the 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.

SUGGESTED DAILY RATION FOR 1,000-LB. IDLE HORSE

		lbs.*
1.	Alfalfa hay	1.5–2 /100 lbs. body wt
2.	Grass hay	2 /100 lbs. body wt
3.	Alfalfa hay	3
	Straw or Chaff	9
	Grain	5
4.	Grass hay	6
	Oat straw	10
	Oats	4
5.	Alfalfa	8
	Oat straw	8
	Molasses	3
6.	Grass hay	6
	Barley straw	7
	Barley	4
7.	Oat hay	6
	Barley straw	8
	Grain	3.5

Note: In addition: trace mineralized salt and steamed bone meal (50:50 mixtures by weight) free choice; vitamin A as vitamin A palmitate or stearate in grain or vitamin A injection; water at all times.
*Total pounds fed per day unless otherwise indicated.

AVERAGE COMPOSITION OF FEEDS

FEED	TOTAL DRY MATTER	CP	TDN	CA %	P %	CAROTENE MG/LB
ROUGHAGES						
Alfalfa hay, all analysis	90.5	14.0	50.7	1.28	0.24	8.20
Alfalfa grass hay	89.6	12.0	48.3	1.00	0.24	7.70
Barley Hay	90.8	7.8	51.9	0.18	0.26	
Barley Straw	90.0	3.6	42.2	0.30	0.17	
Bromegrass hay (Alaskan)	83.1	11.1	57.0	0.33	0.21	
Clover hay, red	88.3	13.2	51.8	1.81	0.30	7.30
Native hay (Alaskan), good	83.8	10.5	50.1	0.84	0.40	9.10
Native hay, dry and weathered	83.8	3.5	36.6	0.84	0.20	3.60
Oat Hay (Alaskan)	77.1	8.3	47.3	0.80	0.36	
Oat straw	89.8	4.0	44.8	0.30	0.16	
Orchardgrass hay	88.7	11.1	49.7	0.36	0.41	
Pea hay, field	89.3	13.6	55.1	1.05	0.30	
Pea straw, field	90.2	6.6	42.2	—	0.12	
Timothy hay (Alaskan)	83.7	9.4	55.0	0.92	0.41	4.40
Wheat hay	90.4	6.4	48.0	0.09	0.10	
Wheat straw	92.6	3.2	40.6	0.15	0.07	
CONCENTRATES - GRAINS (energy primarily)						
Barley (Alaskan)	85.4	11.1	74.1	0.06	0.27	0.20
Corn, dent No. 2	85.0	8.9	80.1	0.02	0.31	1.30
Corn and oat feed, good	89.4	9.4	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	0.16	0.03	
Oats, PC	91.2	11.8	67.0	0.10	0.35	0.05
Rye	89.5	8.3	79.9			
PROTEIN CONCENTRATES						
Beans, field or navy	90.0	22.9	78.7	0.15	0.57	
Cottonseed meal, 45%	94.3	37.4	75.1	0.16	1.20	
Cottonseed meal, 36%	92.6	28.2	64.4	0.16	1.20	
Fin fish meal (Alaskan)	96.3	70.6	89.4	2.59	1.87	
Linseed meal, 36%	91.0	35.3	70.3	0.44	0.89	
Milk, whole, dried	96.8	25.2	88.7	0.89	0.68	
Milk, skim, dried	93.9	33.5	79.8	1.28	1.04	
Peas, field, cull	91.6	22.5	79.1	0.17	0.50	
Salmon meal	93.5	65.0	90.5	5.56	3.21	
Soybean meal, all analysis	91.0	43.8	77.9	0.27	0.63	
Tankage or meat meal, 60%	92.8	59.8	65.8	5.94	3.17	
MINERAL SUPPLEMENT						
Bone meal, steamed	95.5	12.1	15.0	28.98	13.59	

This publication originally authored by Joe B. Johnson, Former Extension Animal Scientist, Washington State University.

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