Feed Management Notes

Resources
NRC
http://nrc88.nas.edu/nrh/

Equi-Analytical (www.equi-analytical.com) in Itl

http://www.equianalytical.com/PuttingResultsToWork/Nutrient_Requirements/default.asp

Feed Horses by Class

Nutrient requirements vary depending on both a horse's nutritional class and its life status. For example, a broodmare in lactation has different nutritional requirements than a 10-year-old, non-working horse. Dividing horses into classes (mature idle, producing broodmares, working or young growing horses) relative to nutritional requirements is the first step in designing a workable feed management plan.

When feeding by class, most horse owners generally select one of two basic feeding plans, depending on their particular situation and availability of feeds.

One plan is to feed a single roughage source (e.g. grass hay), then feed from two to four different concentrate feed mixes which vary in protein content and amounts of other nutrients. The number of concentrate mixes would depend on how many classes of horses are being fed.

A second, more commonly used feeding program is to feed one well-balanced concentrate to all horses and supplement with either legume or grass hay to meet horses differing needs.

Weight and height ranges for common breeds

	English				Metric			
	Weight		Height		Weight		Height	
Horses	**lbs**	**lbs**	**in**	**in**	**kg**	**kg**	**cm**	**cm**
Albino, American	1003		56	60	455		142	152
Andalusian	1201	1301	60		545	590	152	
Appaloosa	1003	1301	56	60	455	590	142	152
Arabian	904	1102	56	59	410	500	142	150
Belgian, American	1896	2205	60	71	860	1000	152	180
Belgian, Ardennais	1400	1598	56	60	635	725	142	152
Cleveland Bay	1201	1499	64		545	680	162	
Clydesdale	1598	1797	63	67	725	815	161	170
Cream draft, American	1598	1995	60	67	725	905	152	170

Criollo	1201	1301	60		545	590	152	
Dutch Warmblood	1201	1301	63	67	545	590	160	170
Flemish	1797	2403	59	71	815	1090	150	180
Hackney	904	1201	60		410	545	153	
Hanoverian	1201	1400	64		545	635	162	
Irish Draught	1301	1499	63	67	590	680	160	170
Lipizzaner	904	1201	59	64	410	545	151	162
Lusitano	1003	1201	59	63	455	545	150	160
Morgan	904	1201	56	60	410	545	142	152
Oldenburg	1201	1499	64	68	545	680	162	172
Orlov Trotter	1003	1301	60	67	455	590	152	170
Paso	1201	1301	55	60	545	590	140	152
Percheron	1896	2105	63	68	860	955	160	172
Quarter Horse, American	1003	1301	56	67	455	590	142	170
Saddlebred, American	1003	1201	59	63	455	545	150	160
Selle Francais	1003	1201	63		455	545	160	
Shire	1698	2701	64	71	770	1225	162	180
Spanish Mustang	805	1003	48	56	365	455	122	142
Standardbred, American	1201		60		545		152	
Suffolk	1698	1896	63	67	770	860	160	170
Tenessee Walker	904	1400	59	60	410	635	150	152
Thoroughbred	1003	1301	63	67	455	590	160	170
Trakehner	1201	1499	63	68	545	680	160	172
Walkaloosa	1003	1301	56	60	455	590	142	152
Welsh Cob	1003	1301	56	60	455	590	142	152
Ponies								
Caspian	595		39	47	270		100	120
Connemara	805	1003	51	56	365	455	130	142
Dulmen	705	805	48		320	365	123	
Exmoor	595	805	48		270	365	123	
Haflinger	1201	1301	56		545	590	142	
Highland	1201	1400	51	56	545	635	130	142
Icelandic	705	904	47	55	320	410	120	140
Miniature Horse, American	198	496	24	35	90	225	60	90
Norwegian	1201	1400	51	56	545	635	130	142

Fjord								
Shetland	298	595	37	42	135	270	95	106
Welsh Pony	452	750	47	52	205	340	120	132
Welsh Pony, Cob	595	1003	53		270	455	135	
Welsh Pony, Mountain	397	705	47		180	320	120	

Feed Horses by Body Weight

Table I shows recommended daily feed intakes by horses as a percentage of body weight. To use this table, decide what class best fits your horse and your horse's body weight. While scales are most accurate for weighing horses, they are often impractical. Other methods, such as visual estimation, weight tapes or body measurement formulas can be used. One common method, a heart girth tape, is available from feed dealers, veterinarians and livestock supply companies. Another method is to use a body weight equation such as the following, which only requires a measuring tape.

One equation is:

$$W = \frac{HG^2 \times BL}{330}$$

W = Weight in pounds
HG = Heart girth in inches
BL = Body length in inches

heart girth is measured at the horse's circumference. Run the tape around the horse, at the highest point of the withers. Body length is measured from the point of the shoulder, along the horse's side and to the point of the buttocks (half the distance from the corner to the tail).

Find Class info like this at the NRC

600 kg (1323 lb)

Class	Weight, kg	Weight, lb	DMI, kg	DMI, lb	DMI% BW	DE, Mcal	CP, g	Lys, g
Maintenance	600	1323	9.7	21.4	1.62	19.4	776	27
Breeding Stallion	600	1323	10.1	22.3	1.68	24.2	970	34
Pregnant Mare								
9 months	600	1323	9.6	21.2	1.60	21.5	947	33
10 months	600	1323	9.7	21.4	1.62	21.9	965	34
11 months	600	1323	9.7	21.4	1.62	23.3	1024	36
Lactating Mares								
Foaling to 3 months	600	1323	12.9	28.4	2.16	33.7	1712	60

3 months to weaning	600	1323	11.8	26.0	1.97	28.9	1259	44
Working Horses								
Light work	600	1323	9.9	21.8	1.65	24.2	970	34
Moderate work	600	1323	11.0	24.3	1.83	29.1	1164	41
Intense work	600	1323	13.6	30.0	2.27	38.8	1552	54

How much should you feed your horse?

Here's an example:

1. Determine the class of horse you have: **Light working horse**
2. Estimate the horse's weight: Heart girth = 70 inches
   Body length = 69 inches

$$W = \frac{(70)^2\,(69)}{330} = 1{,}024 \text{ lbs}$$

3. Consider nutrient requirements *(Table I)*:
   Intake is based on a percent of body weight. From *Table I*, it is estimated this class of horse will have an intake of 1.5-2.5 percent of body weight.
   Range in total intake (forage + concentrate):
   • If intake is 1.5 percent of body weight, then:
   Total pounds of feed fed = .015 X 1,024 lbs = 15.36 lbs per day
   • If intake is 2.5 percent of body weight per day then:
   Total pounds of feed fed = .025 X 1,024 lbs = 25.6 lbs per day

Forage. Range of forage intake: 1-2 percent body weight *(Table I)*:

• If forage intake is 1 percent of body weight, then: Pounds of forage fed = .01 X 1,024 lbs = 10.24 lbs of forage per day
• If forage intake is 2 percent of body weight, then: Pounds of forage fed = .02 X 1,024 lbs = 20.48 lbs of forage per day

Concentrate. Range of concentrate intake: .5-1 percent of body weight *(Table I)*:

• If concentrate intake is .5 percent of body weight, then:
Pounds of concentrate fed = .005 X 1,024 lbs. = 5.12 lbs concentrate per day
• If concentrate intake is 1 percent of body weight, then:
Pounds of concentrate fed = .01 X 1,024 lbs = 10.24 lbs concentrate per day

This horse will need to eat between 10 1/4 and 20 1/2 lbs of hay and 5 to 10 1/4 lbs of grain each day, as long as the total daily feed consumption does not exceed 15 1/2 to 25 1/2 lbs of feed.

Weight Tapes

However, because they only measure one parameter, girth, weigh tapes alone are not the most accurate alternative to weighing.
Weight tapes can be as much as 5% or more off (50 pounds per 1000 pounds), and thus are not accurate enough for small, but potentially important, weight changes.

Table I. Expected feed consumption by horses (percent body weight)[1]			
	Forage	*Concentrate*	*Total*
Mature horses			
Maintenance	1.5-2.0	0-0.5	1.5-2.0
Mares, late gestation	1.0-1.5	0.5-1.0	1.5-2.0
Mares, early lactation	1.0-2.0	1.0-2.0	2.0-3.0
Mares, late lactation	1.0-2.0	0.5-1.5	2.0-2.5
Working horses			
Light work[2]	1.0-2.0	0.5-1.0	1.5-2.5
Moderate work[3]	1.0-2.0	0.75-1.5	1.75-2.5
Intense work[4]	0.8-1.5	1.0-2.0	2.0-3.0
Young horses			
Nursing foal, 3 months			
Weanling foal, 6 months	0	1.0-2.0	2.5-3.5
Yearling foal, 12 months	0.5-1.0	1.5-3.0	2.0-3.0
Long yearling, 18	1.0-1.5	1.0-2.0	1.8-3.0
months	1.0-1.5	1.0-1.5	2.0-2.5
Two-year-old, 24 months	1.0-1.5	1.0-1.5	1.75-2.5

[1]Air-dry feed (about 90% DM).
[2]Examples are horses used in pleasure, equitation or working 1-3 hours per day.
[3]Examples are horses in ranch work, roping, cutting, barrel racing, jumping, etc. or working 3-5 hours per day.
[4]Examples are horses in race training, polo, etc. or working more than 5 hours per day.

Consumption and Weight

Horses can eat about 2 to 2-1/2 pounds of air-dry feeds (as grain in the bin and hay in the bale) daily per 100 pounds (cwt.) of their body weight.

In average condition, a light-legged mature mare over 14.2 hands (58 inches) will weigh approximately 1,100 pounds while mature geldings and stallions will weigh about 1,200 pounds.

Mature ponies under 46 inches will weigh from 400 to 600 pounds. Taller ponies up to 56 inches will average 700 to 900 pounds.

Weanling horse foals will weigh from 400 to 600 pounds when 7 months old. Pony foals will weigh from 200 to 300 pounds when 7 months old.

Well-fed foals will reach about 50 to 60 percent of their mature weight during the first year and about 75 percent at the end of the second year. Horses reach maturity between four and five years of age.

Feed Horses to Condition Scores

While feeding horses according to body weight is ideal, most horse owners should use a horse's condition (degree of fat cover) as a feeding guide. Research has shown the amount of bodyfat, an estimate of stored energy, influences many physiological functions, such as reproduction and work performance. Condition scoring requires visual observations and/or feel of fat covering six body sites (back, ribs, mid-barrel, neck, behind the shoulders at the forerib, withers and tailhead, *(Figure 2)*. Estimates of fat cover are then compared to a numerical description of a condition score system *(Table II)* to determine a condition score.

When condition-scoring horses, long, winter-type hair coats or muscle tone and bulk can give incorrect body condition assessments. Take time to run a hand over the horse at the points identified in *Figure 2* to determine degree of fat cover at these various body locations. According to condition scores, adjust the amount of hay and grain being fed so horses are fed to their optimal condition and subsequently achieve maximum reproductive and performance efficiency. Research has shown broodmares at a condition score of 4 or below will have compromised reproductive performance. Horse owners should try to maintain their horses at condition scores between 5 and 7.

Table II. Condition scoring (degree of fatness) system.

Score	*Back*	*Ribs*	*Neck*	*Shoulder*	*Withers*
1	very prominent vertebrae	very prominent	extremely thin	prominent	prominent
2	prominent vertebrae	prominent	very thin	very thin	very thin
3	fat vertebrae - 1/2 way up	can easily see	thin	thin	thin
4	negative crease	can still see outline	less thin	less thin	less thin
5	level	not seen but easily felt	blends into shoulder	blends smoothly into body	rounded
6	slight crease	not seen can be felt	a little fat	a little fat	a little fat
7	average crease	can barely be felt	average fat should and ribcage	almost level	between fat
8	prominent crease	difficult to feel	fat and ribcage	level between shoulder	fat filled
9	very deep crease	cannot feel (patchy fat)	bulging fat	bulging fat	bulging fat

1. Observe horses visually. Cautions: long hair will interfere with scoring; therefore, palpation of fat cover (i.e. ribs) will be necessary. Certain conformation characteristics or pregnancy status may influence the degree of fat appearance over certain body parts; therefore, use all locations in accessing a composition score. Do not confuse fat for muscle tone of a physically fit horse.
2. Assign condition scores (CS) and record in whole or half units (i.e. CS = 5.5, CS = 8.0).

Feed by Ration Weight, Not Volume

Feeding by weight decreases the chance of overfeeding, due to differences in weight per volume of different feeds and different processing methods. For example, a horse owner's universal feed measurer is a 3-lb coffee can. A coffee can of corn, though, weighs more than a coffee can of oats, and a coffee can of pelleted feeds weighs more than one of textured feed. Substituting a coffee can of corn for that of oats may result in feeding twice as much energy. Such sudden changes in the energy density can make a horse susceptible to digestive disorders, such as colic or laminitis (founder). In fact, one of the most common causes of digestive upset is overfeeding of energy in a single feeding because weight differences of grain mixes were not taken into account.

To assure against energy overfeeding, always check feed weights, especially when new or different feeds or hays are purchased. Learn the approximate weights of different size blocks of hay and of various concentrates. Mark cans and other feed-dispensing containers to standardize portion amount.

Feed Daily at Set Feeding Times

Horses are creatures of habit. When fed on consistent time schedules, the chances of colic or founder are reduced. Horses are also more content, less likely to go off feed and seldom develop stable vices when maintained on a regular schedule. In contrast, horses fed erratically usually appear annoyed in the stalls and may develop stall vices such as digging, pawing, kicking, chewing or others. Evenly spaced feeding times, such as at 12-hour intervals for twice-a-day feeding, will enable the horse to more efficiently utilize its ration, which is especially important when feeding large amounts of grain.

Avoid Abrupt Ration Changes

Ideally, changes in the type or amount of feed given a horse should be conducted over several days, depending on the degree of change. This practice allows the digestive system to adapt to different levels and physical forms of nutrients and is especially important when feeding energy-dense rations. When large increases in the amount of grain fed are necessary (e.g. fattening thin, lactating mares), increase the grain intake by one-half pound every two to three days until the energy balance is met. Some feed changes can be made almost immediately, some require a few days, and others require a week or longer to assure a safe adjustment. For example, when changing from one sweet feed to another, if both have similar energy levels, the change is minimal and can be completed over a few days. However, if the ration has been primarily oat-based and will now be corn-based, there is a significant increase in the energy level. This new, high-energy ration should be introduced over seven to 10 days. When changing to a new concentrate, mix the new and old rations together for each feeding. Gradually increase the new ration amount while decreasing the old.

For finicky horses I use the 3-day 1/4, 1/2, 3/4 rule. Introduce a small amount (handful) of new food stuff with the current feed for 3 days. Then replace 1/4 of the ration with new foodstuff for 3 days. If that is going well, increase to 1/2 new and 1/2 old. Still going well...replace with 3/4 new, 1/4 old for 3 days. It may take more than 3 days at each interval, there is no rush, so make the change gradually.

Take similar precautions when changing a horse from an all-hay diet to lush pasture. Wean horses onto the pasture by turning them out for a few hours for two to three days, then half a day for two to three days, then leave them out. If this gradual introduction to pasture is not possible, fill horses up on hay before turning them onto lush pasture.

Provide All Horses with Fresh Water and Salt

Horses need a good source of clean, fresh water. . A mature, idle horse will drink approximately 10 to 12 gallons of water daily, more if lactating or sweating. While automatic waterers provide a labor reduction, some horse owners prefer watering with buckets to monitor water intake. No matter what method is used, water sources should be checked twice daily and never left empty.

All horses require some dietary salt. Give pastured horses not receiving mixed feeds free-choice access to trace mineralized salt in a loose form. Horses fed commercially prepared feeds, which usually contain 0.5 to 1.0 percent added salt, will not need supplemental salt. One exception: the working horse. Sweating horses may require more salt than they consume in their diet and thus may need accessibility to free choice salt.

Never Feed Grain Mixes Containing Rumensin

Grain mixes containing Rumensin, a commercial growth-enhancing cattle feed additive, should never be fed to horses. Rumensin has been found to be lethal to horses.

Feed only High Quality, Clean Feeds

Horses require top-quality grains and hay. Clean, fresh feeds aid against digestive and respiratory disorders. Grains with hard seedcoats, such as corn, must be coarsely processed for maximum nutrient availability. Processing of soft-coated grains, such as oats, has less effect on improving nutrient digestibility. Avoid finely processed grains, as small particle size may increase incidence of colic and respiratory problems. Finely processed grains should be pelleted before feeding. Examine all feeds for signs of mold or dust. Discard any feed (hay or grain) that is moldy, dusty or smells spoiled.

Check Daily for Feed Refusals

Daily observation of both feeders and horses is important in detecting health problems. Occasionally horses do not “clean up” or finish their feed. Feed refusals can suggest a health problem, over-feeding, something wrong with the feed, limited access to water or teeth problems. All uneaten hay or grain should be removed with each feeding and inspected for indications of spoilage. Loose stools or changes in manure consistency may be signs of digestive problems.

Group Feeding versus Individual Feeding

In groups, horses tend to behave similarly. For example, if one horse is eating, it encourages others to eat. Appetite also can be stimulated in individually housed horses by allowing them to observe others eating. In some situations, competition may allow some horses to eat excess feed while others receive inadequate amounts. Usually, foals and young growing horses can be fed in groups with minimal problems. As they age, however, horses develop “pecking orders,” and feeding time brings out these aggressive behaviors. Reduce competition when group-feeding older horses by providing individual feeders for grain. Spread the feeders over a large open area and space them 40- to 50-feet apart. Feeders should be free of sharp points and projecting edges.

Water

The average mature light horse may drink about 10 to 12 gallons of water daily varying with the amount of work, the type of feed, and the weather. Horses should be watered regularly and frequently. After heavy exertion, very warm or very thirsty horses should be watered lightly until they are properly cooled. In very cold weather, water should be heated to 40 or 50F.

Some horse feeding/management recommendations

- Feed only quality feeds.
- Feed balanced rations.
- Feed half the weight of the ration as quality hay.
- Feed higher protein and mineral rations to growing horses and lactating mares.
- Feed legume hay to young, growing horses, lactating mares and out-of-condition horses.
- Use non-legume hays for adult horses doing light work or no work.
- Regulate hay-to-grain ratio to control condition in adult horses.
- Feed salt separately, free-choice.
- Feed a free-choice mineral mix unless minerals are included in the concentrate mix.
- Keep teeth functional. Horses 5 years old and older should be checked annually by a veterinarian to see if their teeth need floating (filing).
- See that stabled horses get exercise. Horses will eat better, digest food better and be less likely to colic.
- Feed according to the individuality of horse. Some horses are hard keepers and need more feed per-unit of body weight.
- Feed by weight, not volume. A gallon of different grains may vary 100 percent in nutrient yield.
- Minimize fines in a prepared ration. If a feed is ground fine, horses will be reluctant to eat it and the chances of colic will increase.
- Offer plenty of good water, no colder than 45 degrees Fahrenheit. Free-choice water is best. Horses should be watered at least twice daily.
- Change feeds gradually. When changing from a low-density (low-grain), high-fiber ration to one of increased density, change gradually over a period of a week or more.
- Start on feed slowly. Horses on pasture should be started on dry feed gradually. Start this on pasture if practical and gradually increase the feed to the desired amount in a week to 10 days.
- Do not feed grain until tired or hot horses have cooled and rested, preferably one or two hours. Instead, feed hay while they rest in their blankets or are out of drafts.
- Feed before work. Hungry horses should finish eating at least an hour before hard work.
- Feed all confined horses at least twice daily. If horses are working hard and consuming a lot of grain, three times is mandatory.
- When feeding hay, give half the hay allowance at night, while horses have more time to eat and digest it.

Feed and Behavior

Large fluctuations in blood glucose and insulin may affect behavior in horses. If this is true, then meal size should be small and a portion of the concentrate's DE should come from fat and fermentable fiber

1. A single meal should never supply over 0.3-0.35% of the horses body weight as non-structural carbohydrate (NSC) since higher levels of grain intake will result in starch overload which may lead to colic and
laminitis. Keep meal sizes small. Blood glucose increases in response to the size of the meal.

2.Feed plenty of forage. Feed at least 1% of body weight to all horses and increase that to at least 1.5% in horses that are particularly excitable. If nothing else, they will spend more time eating and less time being bored.

3.Add fat to the diet. Substituting fat for carbohydrates will reduce glycemic response. Fat (usually vegetable oil) contains about 3 times as much digestibleenergy (DE) as oats and 2.5 times as much DE as corn. Also, research at KER (Pagan et al, 1995) has shown that adding fat will actually reduce glycemic response of the NSC fraction of the diet, possibly by slowing gastric emptying.

4.Substitute fermentable fiber for NSC. Certain fiber sources (beet pulp, soy hulls) can replace part of the grain in a horses concentrate.
5.Feed supplemental chromium. Unfortunatelychromium has not yet beenapproved for inclusion in horse feeds, so you must get it from your health food store (it is approved for humans) or from your veterinarian.

Even if feeding doesn't affect behavior, guidelines 1-4 listed above will result in a healthy digestive system and reduce the danger of starch overload in the large intestine.

Feeding Costs

The cost of feeding a horse varies with the season and the availability of feed. Some approximate on-farm costs of feedstuffs and supplements are given below. These costs will be higher in urban areas because of additional expenses for transportation and handling.

Hay costs $50 to $140 per ton, or 2-1/2 cents to 7 cents per pound.

Oats cost $1.50 to $2 per bushel, or 4-1/2 to 6 cents per pound.

Shelled corn costs about $2 to $3 per bushel, or 3-1/2 to 5-1/2 cents per pound.

Soybean meal (42 to 50 percent crude protein) costs about $150 per ton, or 7-1/2 cents per pound.

Linseed meal (36 percent crude protein) costs about $150 per ton, or 7-1/2 cents per pound.

Complete pelleted feed costs $220 to $250 per ton, or 11 to 12-1/2 cents per pound.

Dicalclion phosphate costs about $15 per 100 pounds, or 15 cents pound.

Trace-mineralized salt costs about $8 per 100 pounds, or 8 cents per pound.

Three examples of the cost of feeding a horse are given below. These figures assume that a horse consumes about 2 pounds of feed 100 pounds of body weight per day.

Example A: Horse weighing 1,000 pounds fed only mixed grasslegume hay.

1,100 pounds X 2 pounds per hundredweight = 22 pounds hay daily
22 pounds X 365 days 8,030 pounds hay annually
8,030 pounds X 5 cents = $401.50 annual cost

Example B: Horse weighing 1,100 pounds and working about 3 to 6 hours per day fed grain, hay, and meal.

11 pounds grain X 5-1/2 cents per pound = 60-1/2 cents
13 pounds grass hay X 4 cents per pound = 52 cents
1 pound soybean or linseed meal X 7-1/2 cents = 7-1/2 cents
Total daily cost = $1.20
Total annual cost: $1.20 X 365 days =: $438

Example C: Horse weighing 1,000 pounds fed a complete pelleted ration.

1,100 pounds X 2 pounds per hundredweight = 22 pounds daily
22 pounds pellets X 12-1/2 cents per pound = $2.75
Total annual cost: $2.75 X 365 days = $1,003.75

Ration Calculations

A knowledge of the composition of a ration along with feed analyses (Table 3) makes it possible to calculate the percent protein and percent energy of a ration. Research shows that the maintenance requirement of a horse is about 0.8 pound of T.D.N. per cwt. and that a pound of gain above maintenance requires about 3.63 pounds of T.D.N. per cwt.

The percent of crude protein (C.P.) and digestible protein (D.P.) in a typical ration for an 800-pound yearling can be calculated as in the following example. The C. P. figures are taken from Table 3.

Daily Ration of:	lb.	X	C.P.	=	lb.C.P.
Oats	6		.12		.72
Corn	2		.08		.16
Alfalfa	5		.15		.75
Bromegrass	5		.05		.25
Soybean meal	.75		.50		.375
Totals	18.75				2.255

TABLE 5-2A Nutrient Concentrations in Total Diets for Horses and Ponies (dry matter basis)

	Digestible Energy[a]		Diet Proportions		Crude Protein	Lysine	Calcium	Phosphorus	Magnesium	Potassium	Vitamin A	
	(Mcal/kg)	(Mcal/lb)	Conc. (%)	Hay (%)	(%)	(%)	(%)	(%)	(%)	(%)	(IU/kg)	(IU/lb)
Mature horses												
Maintenance	2.00	0.90	0	100	8.0	0.28	0.24	0.17	0.09	0.30	1830	830
Stallions	2.40	1.10	30	70	9.6	0.34	0.29	0.21	0.11	0.36	2640	1200
Pregnant mares												
9 months	2.25	1.00	20	80	10.0	0.35	0.43	0.32	0.10	0.35	3710	1680
10 months	2.25	1.00	20	80	10.0	0.35	0.43	0.32	0.10	0.36	3650	1660
11 months	2.40	1.10	30	70	10.6	0.37	0.45	0.34	0.11	0.38	3650	1660
Lactating mares												
Foaling to 3 months	2.60	1.20	50	50	13.2	0.46	0.52	0.34	0.10	0.42	2750	1250
3 months to weaning	2.45	1.15	35	65	11.0	0.37	0.36	0.22	0.09	0.33	3020	1370
Working horses												
Light work[b]	2.45	1.15	35	65	9.8	0.35	0.30	0.22	0.11	0.37	2690	1220
Moderate work[c]	2.65	1.20	50	50	10.4	0.37	0.31	0.23	0.12	0.39	2420	1100
Intense work[d]	2.85	1.30	65	35	11.4	0.40	0.35	0.25	0.13	0.43	1950	890
Growing horses												
Weanling, 4 months	2.90	1.40	70	30	14.5	0.60	0.68	0.38	0.08	0.30	1580	720
Weanling, 6 months												
Moderate growth	2.90	1.40	70	30	14.5	0.61	0.56	0.31	0.08	0.30	1870	850
Rapid growth	2.90	1.40	70	30	14.5	0.61	0.61	0.34	0.08	0.30	1630	740
Yearling, 12 months												
Moderate growth	2.80	1.30	60	40	12.6	0.53	0.43	0.24	0.08	0.30	2160	980
Rapid growth	2.80	1.30	60	40	12.6	0.53	0.45	0.25	0.08	0.30	1920	870
Long yearling, 18 months												
Not in training	2.50	1.15	45	55	11.3	0.48	0.34	0.19	0.08	0.30	2270	1030
In training	2.65	1.20	50	50	12.0	0.50	0.36	0.20	0.09	0.30	1800	820
Two year old, 24 months												
Not in training	2.45	1.15	35	65	10.4	0.42	0.31	0.17	0.09	0.30	2640	1200
In training	2.65	1.20	50	50	11.3	0.45	0.34	0.20	0.10	0.32	2040	930

[a] Values assume a concentrate feed containing 3.3 Mcal/kg and hay containing 2.00 Mcal/kg of dry matter.
[b] Examples are horses used in Western and English pleasure, bridle path hack, equitation, etc.
[c] Examples are horses used in ranch work, roping, cutting, barrel racing, jumping, etc.
[d] Examples are race training, polo, etc.

3 months to weaning	400		19.7	839	29	29	18	6.9	26.4	24
Working horses										
Light work[a]	400		16.8	670	23	20	15	7.7	25.5	18
Moderate work[b]	400		20.1	804	28	25	17	9.2	30.6	18
Intense work[c]	400		26.8	1,072	38	33	23	12.3	40.7	18
Growing horses										
Weanling, 4 months	145	0.85	13.5	675	28	33	18	3.2	9.8	7
Weanling, 6 months										
Moderate growth	180	0.55	12.9	643	27	25	14	3.4	10.7	8
Rapid growth	180	0.70	14.5	725	30	30	16	3.6	11.1	8
Yearling, 12 months										
Moderate growth	265	0.40	15.6	700	30	23	13	4.5	14.5	12
Rapid growth	265	0.50	17.1	770	33	27	15	4.6	14.8	12
Long yearling, 18 months										
Not in training	330	0.25	15.9	716	30	21	12	5.3	17.3	15
In training	330	0.25	21.6	970	41	29	16	7.1	23.4	15
Two year old, 24 months										
Not in training	365	0.15	15.3	650	26	19	11	5.7	18.7	16
In training	365	0.15	21.5	913	37	27	15	7.9	26.2	16

TABLE 5-1C Daily Nutrient Requirements of Horses (500-kg mature weight)

Animal	Weight (kg)	Daily Gain (kg)	DE (Mcal)	Crude Protein (g)	Lysine (g)	Calcium (g)	Phosphorus (g)	Magnesium (g)	Potassium (g)	Vitamin A (10^3 IU)
Mature horses										
Maintenance	500		16.4	656	23	20	14	7.5	25.0	15
Stallions (breeding season)	500		20.5	820	29	25	18	9.4	31.2	22
Pregnant mares										
9 months	500		18.2	801	28	35	26	8.7	29.1	30
10 months			18.5	815	29	35	27	8.9	29.7	30
11 months			19.7	866	30	37	28	9.4	31.5	30
Lactating mares										
Foaling to 3 months	500		28.3	1,427	50	56	36	10.9	46.0	30
3 months to weaning	500		24.3	1,048	37	36	22	8.6	33.0	30
Working horses										
Light work[a]	500		20.5	820	29	25	18	9.4	31.2	22
Moderate work[b]	500		24.6	984	34	30	21	11.3	37.4	22
Intense work[c]	500		32.8	1,312	46	40	29	15.1	49.9	22
Growing horses										
Weanling, 4 months	175	0.85	14.4	720	30	34	19	3.7	11.3	8
Weanling, 6 months										
Moderate growth	215	0.65	15.0	750	32	29	16	4.0	12.7	10
Rapid growth	215	0.85	17.2	860	36	36	20	4.3	13.3	10
Yearling, 12 months										
Moderate growth	325	0.50	18.9	851	36	29	16	5.5	17.8	15
Rapid growth	325	0.65	21.3	956	40	34	19	5.7	18.2	15
Long yearling, 18 months										
Not in training	400	0.35	19.8	893	38	27	15	6.4	21.1	18
In training	400	0.35	26.5	1,195	50	36	20	8.6	28.2	18
Two year old, 24 months										
Not in training	450	0.20	18.8	800	32	24	13	7.0	23.1	20
In training	450	0.20	26.3	1,117	45	34	19	9.8	32.2	20

Sample Calculation

A brief example of how to do calculations by hand follows:

If a mature horse weighs 400 kg and is not exercising, maintaining his weight and body condition will require approximately 504 g of protein (according to recent NRC guidelines). If the horse is eating 1.5 percent of its body weight in coastal bermudagrass hay, it is eating approximately 6 kg of hay each day (400 X 0.015). The average coastal bermudagrass hay contains approximately 10.4 percent crude protein. If you multiply 6 kg by 0.104, you get 0.624 kg, or 624 g. Therefore, in this instance, the horse's protein requirement is being met through the forage it is consuming.

As another example, if that same 400 kg horse is working at a very intense level, it will require approximately 804 g of crude protein. If the horse is eating the same 1.5 percent of its body weight in coastal bermudagrass hay, it will be short 180 g of protein (804-624) necessary to meet its needs. Therefore, a concentrate (grain) must be provided to make up the difference, and/or hay with higher protein content (e.g., alfalfa) can be fed instead of coastal bermudagrass. (Special note: When allowing the NRC computer program to calculate the dietary supply a certain foodstuff you are providing, it will often calculate slightly lower than when you calculate by hand. This accounts for losses that are difficult to determine by hand calculations; however, hand calculations will still give a fairly accurate estimate as to whether your feeding program is meeting your horse's requirements).

Converting nutrients from 'as fed' to 'dry matter'

The percent dry matter is 100% - percent moisture
To find the dry matter content of the nutrient of interest, divide the as-fed number by the percent dry matter in the diet

Example calculation

Sample food contains:
Protein 22%
Fat 12%
Moisture 11%

To find the dry matter protein content, find the total dry matter content:
100 % -11 % = 89% dry matter
Dry matter protein level is 22/89 = 0.2472
Multiply X 100 to derive percent DM protein, which is 24.72%

Label format as recommended by the Association of American Feed Control Officials

(A) JOHNSON'S 12% TEXTURED HORSE FEED

(B) For Maintenance of Mature Horses

(C) Guaranteed Analysis

Crude Protein (Min)	12.0%
Crude Fat (Min)	3.0 %
Crude Fiber (Max)	12.0%
Calcium (Min)	1.0%
Calcium (Max)	1.5%
Phosphorus (Min)	1.0%
Copper (Min)	20 ppm
Selenium (Min)	0.20 ppm
Zinc (Min)	40 ppm
Vitamin A (Min)	2,000 IU/Lb

(D) Ingredient Statement

Grain Products, Plant Protein Products, Processed Grain By-Products, Molasses Products, Roughage Products, Vitamin A Supplement, Vitamin D3 Supplement,

Vitamin E Supplement, Vitamin B12 Supplement, Riboflavin Supplement, Pyridoxine Hydrochloride, Folic Acid, Biotin, Thiamine, Calcium Carbonate, Salt, Dicalcium Phosphate, Manganous Oxide, Ferrous Sulfate, Copper Sulfate, Magnesium Oxide, Ethylenediamine Dihydriodide, Cobalt Carbonate, Potassium Chloride, Sodium Selenite.

(E) Feeding Directions:

Feed ½ to 1 lb. of feed per 100 lbs. of body weight for the maintenance of mature horses. Feed good quality hay at the rate of 1 to 2 lbs. per 100 lbs. body weight daily. Provide fresh, clean water at all times.

Important: Feed hay along with this ration, as per directions.

(F) Manufactured By:
JOHNSON'S FEED MILL
HORSEVILLE, KY 55555

(G) NET WT 50 LB (22.67kg)

Label Definitions

(A) **Brand name**, if any, and **product name**.

(B) **Purpose** - identifies the species and class(es) for which the feed is intended. The purpose statement may be omitted if the purpose is inherent in the product name.

(C) **Guaranteed analysis** - lists the amounts of regulated and significant nutrients in the feed.

(D) **List of ingredients** - ingredients in livestock feeds are generally not listed in order of predominance, i.e., the first ingredient is not necessarily the major ingredient. Additionally, general terms are often used to define ingredients such as "grain products or plant protein products." This allows the manufacturer to 1) respond to market conditions by incorporating flexibility into the formulation and 2) protect the proprietary nature of their product.

(E) **Feeding directions plus any warning or caution statements.**

(F) **Name and address of manufacturer.**

(G) **Quantity statement.**

Unless otherwise stated, all of the information on the label is on an "*as fed* or *as sampled*" basis. If evaluating or formulating a ration on a dry matter basis, this information must be converted to a dry matter basis. Most grain mixes are assumed to be 90% dry matter. The label information can be converted to a dry matter basis by dividing the values by 0.9. For example, the crude protein content of this feed equals 12.0/0.9 = 13.3% on a dry matter basis. If the actual dry matter is known, it should be used instead of 0.9.

Table 2. Grains*	Lbs./quart
Barley, whole	1.5
Barley, ground	1.1
Beet pulp	0.7
Corn meal	1.5
Corn & cob meal	1.4
Linseed meal	1.3
Molasses	3.0
Oats, whole	1.0
Oats, ground	0.7
Soybeans, ground	1.4
Wheat, ground	1.7
Pelleted feed, 1/8 dia.	1.7
Pelleted feed, 1/4 dia.	1.4
Sweet feed	1.1

* Pounds per quart weights are provided as quart coffee cans are commonly used for feeding.

Conversion Tables

Abreviations

oz = ounces
lb, lbs = pounds = 16 oz
g = grams
mg = milligrams = 0.001 g
kg = kilograms = 1000 g
cal = calories
kcal = kilocalories = 1,000 calories
Mcal = megacalories = 1,000,000 calories
J = joules
MJ = megajoules = 1,000,000 joules

Conversions

	Unit Given	Mulitply By	=	Unit Wanted
English				
	lb	453.6		g
	lb	0.4536		kg
	oz	28.35		g
	mg/lb	2.2046		mg/kg
Metric				

g	0.0022046	lb
kg	2.2046	lb
g	0.0353	oz
mg/kg	0.4536	mg/lb

Energy

Mcal	1000	kcal
kcal	0.001	Mcal
Mcal/lb	2.2046	Mcal/kg
Mcal/kg	0.4536	Mcal/lb
kcal/lb	2.2046	kcal/kg
kcal/kg	0.4536	kcal/lb
calories	4.184	joules
Mcal/lb	9.224	MJ/kg
Mcal/kg	4.184	MJ/kg
kcal/lb	0.009224	MJ/kg
kcal/kg	0.004184	MJ/kg

Percents & Parts per million (ppm)

ppm	0.0001	%
%	10,000	ppm
ppm	1	mg/kg
ppm	0.4536	mg/lb
mg/kg	0.0001	%
%	10,000	mg/kg
mg/lb	0.0002205	%
%	4,536	mg/lb

Estimating Pasture Intake

Whether on a seasonal or continual basis, pasture is often the primary feed in many diets. Pasture consumption must be determined to correctly assess its contribution of nutrients to the diet. Unlike barn-fed feeds that can be weighed, pasture intake must be estimated. The understanding of a few basic concepts (Dry matter Intake, As vs. DM) will enable you to simply calculate pasture intake.

The first step is to determine total dry matter intake. Total intake is based on body weight, level of activity, reproductive status and growth stage. Intake values are located in Dry Matter Intake Table. Combining this information with the known consumption of other feeds, enables the calculation of pasture intake by difference.

Examples

A. Pasture as the sole feed.

An 1100 lb. horse is on a maintenance diet. It spends the majority of it's time on pasture and

is ridden occasionally on weekends. It's summer, and no hay or grain is fed in the barn. Pasture is the sole feed. It's lush and 20% dry matter (80% moisture). From the Dry Matter Intake Table, intake is estimated at 1.6% of body weight.

1. Calculate Lbs. of dry matter intake.

   Lbs. dry matter intake = body weight x (%Dry Matter Intake/100)

   Lbs. dry matter intake = 1100 x (1.6/100) = 17.6 Lbs.

2. Calculate Lbs. of pasture consumed, *as fed*.

   Lbs. consumed, *as fed* = Lbs. Dry Matter Intake / (dry matter %/100)

   Lbs. consumed, *as fed* = 17.6 / (20/100) = 88 Lbs.

Thus, to meet it's daily need for dry matter, this horse will need to consume 17.6 Lbs. of dry matter, which converts to 88 lbs. of pasture *as fed*.

B. Pasture as one of several feeds.

An 1100 lb. horse under light work is fed 7 lbs. of hay and 5 lbs. of grain in the barn and has open access to pasture. From the Dry Matter Intake Table, expected intake is 1.8% of body weight. The hay and the grain are both 90% dry matter and the pasture is 20% dry matter.

1. Calculate Lbs. of dry matter intake.

   Lbs. dry matter intake = body weight x (% Dry Matter Intake/100)

   Lbs. dry matter intake = 1100 x (1.8/100) = 19.8 Lbs.

2. Calculate the Lbs. of dry matter consumed from hay and grain.

   Lbs. dry matter consumed = Lbs. *as fed* x (dry matter %/100)

Feed	Lbs., as fed	x	Dry matter %	=	Lbs. Dry Matter
Hay	7		90/100		6.3
Grain	5		90/100		4.5
Total					10.8

3. Estimate Lbs. of pasture dry matter consumed.

Predicted 19.8

total dry matter intake	
Calculated amounts of other feeds	-10.8
Estimated pasture dry matter intake	9.0

4. Estimate Lbs. of pasture consumed, *as fed*.

Lbs. of pasture, *as fed* = Lbs. of pasture dry matter / (dry matter %/100)

Lbs. of pasture, *as fed* = 9.0 / (20/100) = 45 Lbs.

In summary, pasture intakes are predicted estimates and will vary depending upon the quality, quantity and availability of pasture, as well as the individual horse. Monitor the body condition of horses consuming pasture as the primary forage. If they begin to lose weight, it's good evidence that they are not consuming enough or that nutrient quality is deficient. Consult with your nutrition professional and adjust the ration to insure that daily nutrient needs are met.