



MARE & FOAL NUTRITION

Feeding Management of the Broodmare

Nutrition represents 70 to 80 percent of the total cost of managing a mare to produce a foal. Nutrition is also one of the more important factors affecting reproductive efficiency. A well-managed feeding program is the key to reducing production costs, increasing conception rates, and improving foaling rates. One method of efficiently managing broodmares is to divide them into three groups: open mares before breeding, pregnant or gestating mares, and lactating mares. Each group of mares is at a different stage of production and therefore requires different nutrient amounts and feeding management techniques.

Feeding Open and Maiden Mares

Open and maiden mares represent the nonproducing segment of the broodmare herd. By definition, an *open* or *barren mare* is one that has foaled in previous breeding seasons but failed to conceive or be bred during the current season. By contrast, a *maiden mare* has never been bred and is usually two to three years old. Under ideal

management situations, maiden mares should not be bred before three years of age when they have reached maturity.

Horsemen often make the mistake of grouping and feeding maiden and open mares together. The nutrient requirements of the younger, still-growing, two-year-old maiden mare are much higher than those of a mature, open mare (Table 1). If a group of maiden and open mares is fed a nutrient-dense diet to meet the requirements of the maiden mares, the

Table 1. Nutrient Requirements of Open Mares

	Maiden Mares (2- or 3-year-olds)	Mature Mare pregnant
Body weight (lb)	990 ^a	1,100
Daily gain (lb)	0.33 to 0.44	0.00
Digestible energy (Mcal)	18.80	16.40
Crude protein (lb)	1.76	1.44
Calcium (g)	24.00	20.00
Phosphorus (g)	13.00	14.00
Total feed intake ^b	2.0 to 2.5	1.5 to 2.0
Forage, percent of body weight	1.0 to 1.5	1.5 to 2.0
Concentrate, percent of body weight	1.0 to 1.5	0 to 0.5

Source: Adapted from National Research Council, *Nutrient Requirements of the Horse*, fifth revised edition, 1989.

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more mature, open mares consume more energy than they need. The surplus energy will be stored as body fat, which may represent an economic loss. Conversely, if the group is fed a high-forage, low-concentrate, low-energy diet that is sufficient to meet the nutrient needs of the open, mature mares, it will be inadequate for maiden mares. The incorrect feeding program may result in decreased growth, fertility, and pregnancy rates in maiden mares. Ideally, two- and three-year-old maiden mares should be separated from open mares and fed accordingly. Maiden mares may receive the same amount of hay as open mares but should be fed concentrates individually. This separation can be accomplished by providing run-in sheds divided into individual stalls or divided paddocks.

Open Mares

Open mares should be fed the same diet as a mature horse at maintenance (Table 2). Feeding high levels of forages with little or no concentrate is normally satisfactory. As a rule, good quality pasture or grass hay supplemented with trace-mineralized salt will meet a mature open mare's nutrient requirements. If low-quality forages are fed, they should be supplemented daily with 3 to 6 pounds of grain, depending on the mare's body size. The grain

should include a trace-mineral, vitamin premix if fed with poor-quality forages. For example, if you are feeding an 1,100-pound, mature, pregnant mare a mature Coastal bermudagrass hay, using the intake figures in Table 1, she would require the following amounts of feed to meet her nutrient requirements:

1,100-lb mare x 1.50 lb hay/100 lb
body weight = 16.5 lb hay
1,100-lb mare x 0.50 lb grain/100 lb
body weight = 5.5 lb grain mix
Total ration = 22.0 lb per day

Based on these calculations, the average 1,100-pound mare would require 16.5 pounds of mature Coastal bermudagrass hay and 5.5 pounds of concentrate daily on an as-fed (90 percent dry matter) basis. However, if this mare were fed a more nutrient-rich, immature grass hay, her nutrient requirements could be met with limited concentrate supplementation. Nutrient requirements vary among horses, and feeding according to a mare's estimated nutrient requirements may overfeed some horses while underfeeding others. Horsemen should feed according to the estimated requirement, then visually appraise the animal and make appropriate ration adjustments.

Maiden Mares

Feeding a maiden mare is more difficult because she requires a more

nutrient-dense diet per unit of body weight. Generally, high-quality hays or productive pastures alone will not satisfy the maiden mare's nutrient requirements. These mares' diets should be supplemented with a concentrate to meet their protein, energy, vitamin, and mineral requirements. Because many maiden mares are still growing, minerals, including calcium and phosphorus, are especially important. The higher the forage quality, the less critical the concentrate nutrient content. A high-quality legume hay such as alfalfa or a grass-legume mixed pasture should be fed. In addition, maiden mares should receive approximately 0.5 to 1 pound of concentrate daily per 100 pounds of body weight. Mares fed less nutritious forages such as mature grass hay should receive additional amounts of grain (Table 3).

Body Condition

Equine researchers have found that mares maintained in moderate to fleshy body condition have reproductive efficiency similar to that of mares in thrifty condition, exhibit no foaling problems, and rebreed more efficiently (See *Regulating Broodmare Body Condition*, AG-491-2). Also, mares foaling in a moderately fat to fleshy condition use stored energy for efficient reproduction and lactation while losing weight. Mares

Table 2. Nutrient Concentration in Total Horse and Pony Diets

	Digestible Energy		Diet Proportions					Phos.	Magnesium	Potassium	Vitamin D Mcal/lb
	M/lb	Conc. (%)	Hay (%)	CP (%)	Lysine (%)	Ca (%)					
Mature Horse											
Maintenance ^a	0.90	0	100	8.0	0.28	0.24	0.17	0.09	0.30	830	
	1.10	30	70	9.6	0.34	0.29	0.21	0.11	0.36	1,200	
Pregnant Mares											
9 months	1.00	20	80	10.0	0.35	0.43	0.32	0.10	0.35	1,680	
10 months	1.00	20	80	10.0	0.35	0.43	0.32	0.10	0.36	1,660	
11 months	1.10	30	70	10.6	0.37	0.45	0.34	0.11	0.38	1,660	
Lactating Mares											
Foaling to 3	1.20	50	50	13.2	0.46	0.52	0.34	0.10	0.42	1,250	
3 months to	1.15	35	65	11.0	0.37	0.33	0.22	0.09	0.33	1,370	

Source: Adapted from National Research Council. *Nutrient Requirements of the Horse*, fifth revised edition, 1989. Dry Matter Basis
^a Includes broodmares in the first 8 months of pregnancy.

carrying more condition require less feed during lactation, which reduces feed costs and the risk of colic and founder.

When feeding maiden and open mares, attempt to keep them in a fleshy condition, especially if they will be shipped a long distance to a breeding farm. Excessive fat deposition is not nearly as serious a problem as a nutrient deficiency. Thin, undernourished mares have difficulty conceiving, are more likely to abort, and require extremely high levels of concentrates to gain weight during both late pregnancy and lactation. In addition, a thin, pregnant mare will meet her own nutrient maintenance requirements before supplying the fetus with the necessary nutrients. A severe nutrient deficiency during early embryonic development could result in an abortion and future breeding difficulties.

Preparing Open Mares for Breeding

When preparing open mares for the breeding season, strive to keep them in a fleshy but not obese condition. Mares in adequate body condition are more likely to have higher conception rates. Extremely obese mares exhibit decreased fertility and are less likely to con-

ceive; whereas thin, undernourished mares may fail to display estrus, ovulate, conceive, or maintain a pregnancy. A mare's body condition can be regulated by adjusting energy intake, but it is more difficult to add weight to a thin mare than to reduce weight in a fat mare. Poor feeding methods are not a good way to regulate body condition. For instance, reducing both the grain and hay intake of an obese mare in an attempt to lower energy intake not only reduces energy and fiber intake, but also decreases levels of protein, vitamins, and minerals, which are still required by the mare, especially if the feeds are of poor quality. Some possible remedies for excess body condition are:

- Feed the complete ration, but exercise the mare daily to regulate body condition;
- Reduce grain intake, but increase the levels of protein, vitamins, and minerals in the grain mix;
- Reduce grain intake and supplement the diet with a commercial protein-vitamin-mineral premix;
- Dry lot the mare for a varying amount of time to limit energy intake if she has been grazing high-quality pasture, and limit grain intake.

Mares should be at the minimum desired breeding weight by January 1 of the breeding year. Then the energy level of the grain should be increased so that the mares are gaining weight 45 to 60 days before breeding.

Increased energy intake can be accomplished by feeding a high-quality grass or legume hay or by increasing the amount of grain fed. Research has shown that mares gaining weight during this period will come into heat approximately four weeks earlier and will conceive more quickly.

Mares should continue to gain weight until diagnosed in foal, but at no time should they reach obesity. A normal maintenance ration of 8.5 percent crude protein (CP), 0.90 megacalories per pound (Mcal/lb) of digestible energy (DE), 0.24 percent calcium (Ca), and 0.17 percent phosphorus (P) fed at a rate of 15 pounds per day would supply the proper nutrients for a mature, 1,100-pound mare (Table 2). Generally, a good quality legume hay such as alfalfa or lespedeza (Table 3) will contain excessive levels of protein, adequate levels of minerals, and enough energy to meet the mare's nutrient needs while allowing the mare to gain weight before the breeding season.

Table 3. Nutrient Composition of Hays Used in Horse Diets

Order of Preference	Feed	Digestible Energy (Mcal/lb)	Total Digestible Nutrients (%)	Crude Protein (%)	Digestible Protein (%)	Calcium (%)	Phosphorus (%)	Ca:P Ratio
LEGUMES								
1	Red Clover	0.98	49	14.9	8.3	1.49	0.25	6 : 1
2	Alfalfa	0.98	49	15.0	10.0	1.50	0.25	6 : 1
3	Lespedeza	0.94	52	13.4	7.5	1.04	0.23	4.5 : 1
GRASS								
4	Timothy	0.90	45	9.0	6.0	.41	0.19	2.15 : 1
5	Bromegrass	0.87	44	11.8	6.2	.32	0.22	1.4 : 1
6	Orchardgrass	0.94	47	10.1	6.0	.35	0.31	1.1 : 1
7	Bermudagrass	0.88	44	9.5	4.5	.46	0.18	2.5 : 1
8	Fescue	0.73	45	8.4	3.7	.36	0.21	1.7 : 1

Source: Adapted from National Research Council, *Nutrient Requirements of the Horse*, fifth revised edition, 1989. Values expressed on a dry matter basis. Hays harvested at an optimum, immature growth stage.

Mares fed poorer quality grasses containing lower levels of protein, energy, vitamins, and minerals, should be supplemented daily with 3 to 4 pounds of a 10 percent crude protein grain mix. Pay close attention to the calcium and phosphorus content and ratio of the total diet. All grass forages contain low levels of calcium and phosphorus in approximately a 1.1:1 up to a 2:1 ratio. Legume forages have a higher calcium-to-phosphorus ratio, which results in a wider range from 4.5:1 to 6:1 (Table 3).

Feeding the Pregnant Mare

Nutritionists commonly group pregnant or gestating mares into two categories: mares in their first two trimesters (eight months) of pregnancy and mares in their last trimester (three months) of pregnancy. The *Nutrient Requirements of the Horse*, 1989, fifth revised edition, provides nutrient requirements for pregnant mares at four production levels (Table 4). For practical purposes, the nutrient requirements of mares in the eleventh month of pregnancy (Table 4) are the same as those of mares in late pregnancy. Because the fetus is not

growing rapidly during the first eight months, nutrient requirements are minimal for early gestating mares and very similar to those of open mares before breeding or to horses at maintenance. The same diet may be fed to both groups of mares but with reduced forage intake and increased grain intake for late gestating mares.

During the last trimester, the fetus is growing rapidly and obtains the additional nutrients needed directly from the mare. The mare's increased requirements can be met by reducing the intake of bulky feeds, such as hay, while increasing the intake of concentrated, high-energy feeds like grains. One pound of good quality hay per 100 pounds of body weight (1 percent of body weight) and 0.75 pound of grain per 100 pounds of body weight (0.75 percent of body weight) should satisfy these requirements (Table 4). If poor quality forages are fed, the hay intake should be reduced to 0.75 pound per 100 pounds of body weight and grain intake increased to 1 pound per 100 pounds of body weight. For example, if an 1,100-pound pregnant mare were fed Coastal bermudagrass, she would receive the following daily hay and grain amounts:

1,100-lb mare x 0.75 lb hay/100 lb
body weight = 8.25 lb hay
1,100-lb mare x 1.00 lb grain/100 lb
body weight = 11.00 lb grain
Total ration = 19.25 lb/day

Recent research indicates that the copper content of the mare's diet in late pregnancy directly affects fetal bone development. Researchers reported that mares in their last three to six months of gestation fed copper-deficient diet (13 parts per million) produced foals with 58 percent more cartilage and bone lesions at 90 days of age than foals from mares fed 32 ppm copper. Care should be taken to ensure adequate intake of all nutrients including energy, protein, macrominerals, trace minerals, and vitamins (Table 5).

The total ration, including grain and hay, should contain a minimum of 10.6 percent crude protein, 1.0 Mcal/lb of digestible energy, 0.45

Table 4. Expected Feed Consumption of Feed by Horses

	Forage	Concentrate	Total
	(percent of body weight) ^a		
Maintenance ^b	1.5 to 2.0	0 to 0.5	1.5 to 2.0
Mares, late gestation ^c	1.0 to 1.5	0.5 to 1.0	1.5 to 2.0
Mares, early lactation ^d	1.0 to 2.0	1.0 to 2.0	2.0 to 3.0
Mares, late lactation ^e	1.0 to 2.0	0.5 to 1.5	2.0 to 2.5

Source: Adapted from National Research Council, *Nutrient Requirements of the Horse*, fifth revised edition, 1989. Values expressed on an air-dry feed (90 percent dry matter) basis.

^a Also expressed as 1 pound of feed per 100 pounds of body weight.

^b Includes mature open mares and pregnant mares in their first eight months of gestation.

^c Pregnant mares months 9 to 11.

^d From foaling to three months of lactation.

^e From third month lactation to weaning.

Table 5. Trace Mineral and Fat Soluble Vitamin Requirements of the Broodmare

	Pregnancy Months 1 to 8	Pregnancy Months 9 to 11	Lactation	Maximum tolerance level
Trace Minerals (ppm)				
Iron	40.0	50.0	50.0	1,000
Manganese	40.0	40.0	40.0	1,000
Copper ^a	40.0	40.0	40.0	800
Zinc ^a	100.00	100.0	100.0	500
Selenium ^b	0.1	0.1	0.1	5.0
Vitamins (IU/kg)				
A	2,000	3,000	3,000	16,000
D	300	600	600	2,200
E	50	80	80	1,000

Source: Value adapted from National Research Council, *Nutrient Requirements of Horses*, fifth revised edition, 1989. Values expressed on a dry matter basis.

^aValues represent increases above NRC recommendations based on research since 1989.

Adapted from Knight, et al., 1990. The effects of copper supplementation on the prevalence of cartilage lesions in foals. *Equine Vet. J.* 22(6):426-432.

percent calcium, and 0.34 percent phosphorus. The nutrient content of the grain mix will depend on the forage species. Examples of several grain mixes are provided in Table 6.

Fescue Toxicosis

At the beginning of the last trimester, **mares should be removed from fungus-infected fescue hay and pasture at least 90 days before foaling.** Research has shown most fescue contains an endophyte fungus, *Acremonium coenophiolium*, which causes **severe** complications during late pregnancy and foaling. Abortions, thickened placenta, prolonged pregnancies, little or no milk production, reduced rebreeding efficiency, and retained placentas are a few of the symptoms of fescue toxicosis. Maintaining pregnant mares in their last trimester in drylots while feeding a grain and hay diet is a safe alternative. The new, low-endophyte fescue varieties, which contain 5 percent endophyte or less, have been successfully grazed by horses without developing reproductive problems.

The North Carolina Department of Agriculture offers a fescue endophyte testing service that can identify the level of endophyte infestation in fescue seeds or pastures. A recent survey of more than 200 pastures in 80 North Carolina counties indicated

that 95 percent of the pastures were infested with the fungus. An average of 68 percent of the plants in each pasture contained endophyte infestation, and levels of 15 percent or higher have caused reproductive problems. For additional information, contact your county Extension Service agent or the Fescue Endophyte Testing Service, Plant Industry Division, Seed Section, North Carolina Department of Agriculture, P.O. Box 27647, Raleigh, NC 27611 (919-733-3930).

Nutritional Management of the Lactating Mare

Lactating mares must be fed the proper amounts of a balanced diet. The already elevated nutrient requirements of the pregnant mare are substantially increased during lactation because of the additional nutrients required for milk production. Immediately after foaling, the mare's energy requirements increase by as much as 90 percent, and protein requirements increase by 50 percent. Remember that the lactating mare must consume additional nutrients not only to support her own body weight but also to produce adequate levels of milk. On an average, a light horse mare is capable of producing 23 to 29 pounds of milk per day as compared

to some draft horse breeds that can produce more than 35 pounds daily. This places a tremendous nutritional strain on the broodmare.

Milk yield, energy, and fat content all peak during the first 30 days of lactation. During this same period, the foal's nutrient requirements increase rapidly. As a result, milk alone will satisfy the nursing foal's nutrient requirements only during the first month after birth. Foals will require an additional source of nutrients at 30 days of age, and by 60 days at least 50 percent of the foal's nutrient intake should be derived from creep feed to maintain an optimum growth rate.

In addition to the nutritional stress, there is also a psychological strain on the new mother—especially on first-foal mares. Minimizing this stress on broodmares will enable them to move smoothly from pregnancy into lactation. Mares should be gradually switched from a pregnancy ration to a lactating ration at least one week before their estimated foaling date. As a rule of thumb, a horse is capable of consuming approximately 2 to 3 percent of its mature body weight per day (Table 4). For mares that are hard keepers, in poor body condition, or fed low-quality forages, forage intake should be moderately

Table 6. Concentrate Mixes for Broodmares Consuming Grass or Legume Forages

Ration Ingredient ^a	Gestation (last 90 days)		Lactation	
	Grass Hay (%)	Legume Hay (%)	Grass Hay (%)	Legume Hay (%)
Corn	34.0	42.0	40.0	46.0
Oats	42.0	45.0	35.0	44.5
Wheat Bran	10.0	10.0	5.0	----
Molasses	3.0	3.0	3.0	5.0
Soybean Meal	10.0	----	15.0	5.0
Defluorinated PO ₄	----	----	----	----
Dicalcium PO ₄	----	----	0.5	0.5
Limestone	1.0	----	1.5	----
Calculated Analysis				
Crude Protein, (%)	14.0	14.0	16.0	16.0
Calcium, (%)	0.5	0.5	0.7	0.7
Phosphorus, (%)	0.4	0.4	0.5	0.5

^a All values presented on an as-fed (90 percent dry matter) basis.

reduced to allow an increased intake of the more energy-dense concentrates. Under no circumstance should daily forage intake be reduced to less than 0.5 percent of body weight as the mares become more susceptible to colic or founder. Pasture may replace part or all of the forage requirements, depending on the forage species, stocking rate (number of animals per acre), and level of pasture productivity.

Using the figures from Table 4, assume you are feeding a 1,000-pound broodmare in her first three months of lactation. The mare would require the following:

1,000-lb mare x 1.5 percent of body weight fed as hay	= 15 lb of hay
1,000-lb mare x 1.0 percent of body weight fed as grain	= 10 lb of grain
Total ration	= 25.0 lb/day

The concentrate or grain mix should supplement the forage and

meet the nutrient requirements listed in Table 2. Examples of possible concentrate mixes are provided in Table 6. The total ration should contain 13.2 percent crude protein, 1.20 Mcal/lb of digestible energy, 0.52 percent calcium, and 0.34 percent phosphorus.

One of the early nutritional barriers for the broodmare to overcome is the first meal after foaling. During the normal foaling process, blood is shunted away from the gastrointestinal tract to the reproductive tract. The reduced blood flow decreases food passage, bowel movements, and appetite. A palatable and digestible feed such as a wheat bran mash makes an excellent meal and has a laxative effect that will help reverse these conditions. Mix a wheat bran mash by filling a 5-gallon bucket half full of wheat bran and adding hot water until the

mixture has the consistency of oatmeal. Then place a towel over the bucket and allow the mixture to cool to 65°F. After cooling, sprinkle dried molasses or brown sugar on the mash to increase palatability, and then hand feed the mixture to the mare. The aroma and succulence makes the mash an attractive feedstuff for the mare. This ration should be gradually replaced with the lactation grain mix over a two- to three-day period.

Remember, getting a live foal on the ground and nursing is only half the battle. Ensuring that a foal grows at a healthy, normal rate is equally important, especially if an economic gain is to be realized. Proper nutrition for the broodmare during late pregnancy and early lactation will ensure normal production of nutritious milk and normal foal growth and development.

For Additional Information

The other publications in this series on Mare and Foal Nutrition are available from your North Carolina county Cooperative Extension Center.

AG-491-2, *Body Condition Scoring: A Management Tool for the Broodmare Owner*

AG-491-3, *Feeding the Newborn Foal*

AG-491-4, *Feeding Orphan Foals*

AG-491-5, *Weaning the Foal*

AG-491-6, *Feeding the Weanling & Yearling*

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3,300 copies of this public document were printed at a cost of \$760, or \$.23 per copy.

Published by
NORTH CAROLINA COOPERATIVE EXTENSION SERVICE