



## NUTRITIONAL MANAGEMENT OF HORSES ON A BREEDING FARM



Kentucky  
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Research®

3910 Delaney Ferry Road  
Versailles, Kentucky 40383  
859-873-1988 | fax 859-873-3781  
[info@ker.com](mailto:info@ker.com)

7/35 Dunlop Road  
Mulgrave 3170, Victoria, Australia  
03 8562 7000 | fax 03 8562 7007  
[advice@ker.com](mailto:advice@ker.com)

[ker.com](http://ker.com) | [EquineNews.com](http://EquineNews.com)



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## INTRODUCTION

The equine population of a breeding farm typically includes horses of various ages and occupations. The nutritional needs of the residents are just as variable. Young horses require nutrients to grow soundly and optimally so they can mature to do the job asked of them. Broodmares demand a nutrition schedule that centers on the nurturing of future generations. Similarly, stallions require careful management to balance their energetic needs, provide nutrients critical for fertility, and avoid obesity during idle periods. In order to achieve the best results, each class of horse on the breeding farm must be fed and managed appropriately.

While high-quality forage is the basis of all equine diets, formulation and manufacture of feeds for specific life stages has removed much of the guesswork from nourishing the residents of a breeding farm. Long gone are the days of feeding straight oats as a concentrated source of energy. Reputable feed manufacturers work with professional equine nutritionists to devise specific formulas for young horses as well as mares and stallions in various stages of the production cycle. When fed according to the manufacturer's recommendations, these formulas ensure that nutrient requirements are met for optimal growth and development.

*Nutritional Management of Horses on a Breeding Farm* provides an overview of how to best feed weanlings, yearlings, pregnant and lactating mares, and stallions. When appropriate, supplement recommendations are provided.

## MARES

Mares represent the mainstay of any commercial or private breeding enterprise. In addition to their all-important genetic contributions, mares provide a protective and nourishing environment to raise their foals, both before and after birth. Without a doubt, the nutritional status of mares is a critical component in foal health from the moment of conception and through gestation, lactation, and weaning.

### PREGNANT MARES

Careful consideration should be given to a mare's nutritional needs as she advances through gestation.



Mark Lewellyn

Until recently industry professionals divided a mare's gestation into two distinct nutritional periods: (1) from the time a mare was pronounced in foal to about eight months (early gestation; first and second trimesters), and (2) nine months to approximately eleven months or birth (late gestation; third trimester).

Dietary requirements for mares in the first and second trimesters were once similar to any mature horse at maintenance. Moreover, because it is a well-known fact that fetal growth is most rapid during the last trimester, an increase in certain nutrients such as energy and protein was recommended during the last three months of pregnancy.

Recent research has indicated, however, that the provision of some vital nutrients should be increased long before the nine-month mark. As previously, mares should be nourished the same as any horse at maintenance for the first four months of gestation, but every subsequent month represents a separate period, leading to eight distinct periods.

The research that brought about these changes takes into account not only maintenance of the mare's body weight and fetal growth, but also the nutritional expenditures involved in the creation and maintenance of less obvious gestational tissues such as the placenta and mammary glands. Collectively, these are called non-fetal tissues. With no changes made to nutritional requirements in early gestation (0 to 4 months) or late gestation (9 to 11 months), new recommendations suggest nutritional changes primarily for mares during midgestation, the period between the fifth and eighth months of pregnancy.

To support development and maintenance of nonfetal tissues, protein and energy requirements should be raised 5 to 8% above maintenance during midgestation for an average (1,100-lb or 500-kg) mare. Unlike protein and energy, the requirement for additional minerals seems to appear later in the gestation, at approximately seven months. This can be attributed to the fact that nonfetal tissues require mostly protein and energy and very few minerals for accretion and subsequent maintenance.

Mare owners can ensure energy and protein requirements are met by keeping mares in moderate to moderately fleshy body condition through the use of good-quality forage and a well-formulated concentrate or vitamin and mineral supplement.

### Feeding management

- Mares should be maintained in moderate to moderately fleshy body condition. This equates to a score of 5 or 6 on the familiar scale of 1 (poor) to 9 (extremely fat). Moderate body condition describes a mare whose ribs cannot be seen but can be felt with some additional fat deposits around the withers, shoulders, and possibly the tailhead. For mares that are known to drop weight quickly during peak lactation, they may be kept slightly more fleshy through late gestation to accommodate the eventual falloff.
- Always provide mares with sufficient forage to meet at least their daily minimum requirement, which is approximately 1.5 to 2% of their body weight. Mares are often given unlimited access to pasture or hay, and this is certainly an acceptable method of providing forage. Many mares can maintain their body condition on forage alone.
- If mares are able to maintain acceptable body condition on forage, they should be fed a vitamin and mineral supplement, such as I.R. Pellet, or a balancer pellet so they consume all of the nutrients needed for optimal health and growth of the fetus. This feeding schedule is appropriate for mares in early and late gestation if mares can sustain body condition.
- If mares cannot maintain acceptable body condition on forage alone, a suitable concentrate should be fed. One formulated specifically for broodmares is ideal. Care should be taken to carefully follow the manufacturer's instructions, which are printed on the feed tag or bag. Feeding less than the recommended rate will compromise nutrient intake. For instance, if the recommended feeding rate is 6 to 14 lb (2.8 to 6.4 kg) per day, mares should be fed at least 6 lb (2.8 kg) per day, increasing

as necessary to maintain body condition. Concentrate meals should be no larger than approximately 0.5 lb per 100 lb of body weight (5 lb for a 1,000-lb horse).

■ Feed the mares according to their individual requirements. Be aware of differences in caloric requirements (or differences in efficiency) between breeds, understand and compensate for seasonal effects on pasture quality and quantity, and make condition scoring of the mares a routine management task, acting on the slightest noticeable changes with the aim of always keeping the mare in a desirable body condition.

■ Pregnant mares should have access to clean water at all times. A salt block, either white or mineralized, should also be available. Mineralized salt blocks do not provide horses with sufficient quantities of minerals for optimal health; choose a concentrate, balancer pellet, or vitamin and mineral supplement to ensure proper mineral intake.

■ Maintain a veterinarian-recommended vaccination and deworming program. Include timely and regular farriery and dental services into your broodmare management routine.

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#### **EO-3™**

Pregnant mares fed omega-3 fatty acids have enhanced passive transfer of antibodies to foals, which in turn have stronger immune systems. Improved fertility, lowered incidence of uterine inflammation, and decreased risk of abortion are also noted with omega-3 supplementation.



#### **I.R. Pellet™**

A scientifically formulated vitamin and mineral supplement suitable for pregnant mares that maintain their weight on forage alone.



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Natural-source vitamin E improves fertility and enhances immunity in both foals and mares.

## LACTATING MARES

Milk production requires top-notch nutrition, as a mare's energy needs are greatest during early lactation.



Mark Lewellyn

Nutritional requirements for lactation have historically been based on the combination of two specific values: the requirements necessary to keep the mare in optimal body condition and the nutrients required for high-quality milk production (volume and nutritional composition).

Traditionally, nutrient requirements were thought to be much greater in early lactation (one to three months after foaling) than in late lactation (four to six months after foaling). So great are the energy demands during early lactation that most equine nutritionists believe that few horses require more energy than the broodmare at this time, even the majority of high-performance horses.

Researchers have suggested increased energy, protein, and mineral requirements for lactating mares during both early and late lactation. The increase in energy was partially due to a shift in the maintenance requirement of lactating mares.

The maintenance requirement for a lactating mare has long been assumed to be similar to other mature horses. Researchers now believe that mares actually require more energy for maintenance of body condition than previously thought. Two reasons include the increased movement associated with protecting and tending to a foal and the increased energy needed by the gastrointestinal tract to digest the larger meals required to support lactation.

### Feeding management

- Most mares cannot maintain their weight on forage-only diets during lactation, especially during peak milk production, thought to be at two to three months after foaling. Certain mares of notoriously easy-keeping breeds are capable of maintaining milk production and body condition on forage-only diets, especially when an

abundance of high-quality forage is available. Most normal mares, however, need the additional energy provided by concentrates. Forage intake for lactating mares could increase significantly, sometimes as high as 3.5% of body weight.

■ An appropriate concentrate should be fed, ideally one specifically formulated for broodmares. Care should be taken to carefully follow the manufacturer's instructions, which are printed on the feed tag or bag. Feeding less than the recommended rate will compromise nutrient intake. For instance, if the recommended feeding rate is 6 to 14 lb (2.8 to 6.4 kg) per day, mares should be fed at least 6 lb (2.8 kg) per day, increasing as necessary to maintain body condition. Concentrate meals should be no larger than approximately 0.5 lb per 100 lb of body weight (5 lb for a 1,000-lb horse).

■ Some mares have a difficult time maintaining body condition during lactation even when they are fed high-quality forage and concentrate meals. For these mares, a high-fat supplement might be appropriate. Vegetable oils are calorie-dense and are usually palatable to mares. These should be started slowly to acclimate the mare to the taste and texture. Once the mare is familiar with the oil, it can be added to each grain meal.

■ Feed the mares according to their individual requirements. Be aware of differences in caloric requirements (or differences in efficiency) between breeds, understand and compensate for seasonal effects on pasture quality and quantity, and make condition scoring of the mares a routine management task, acting on the slightest noticeable changes with the aim of always keeping the mare in a desirable body condition.

■ Lactating mares should have access to clean water at all times. In general, lactating mares will drink significantly more water than most other horses. For mares and foals that spend a significant time in stalls or runs, be sure plenty of water is available (e.g., two or three five-gallon buckets). A salt block, either white or mineralized, should also be available. Mineralized salt blocks do not provide horses with sufficient quantities of minerals for optimal health; choose a concentrate, balancer pellet, or vitamin and mineral supplement to ensure proper mineral intake.

■ Maintain a veterinarian-recommended vaccination and deworming program for the mare and foal. Include timely and regular farriery services for broodmares and foals. Try to schedule dentistry appointments when mares are least stressed such as after weaning.

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### EO-3™

Lactating mares fed omega-3 fatty acids have enhanced passive transfer of antibodies to foals, which in turn have stronger immune systems. Improved fertility, lowered incidence of uterine inflammation, and decreased risk of abortion are also noted with omega-3 supplementation.



### **EquiShure®**

For lactating mares that receive significant amounts of grain to maintain body condition, hindgut acidosis risk increases. Hindgut acidosis can reduce digestive efficiency or lead to colic. Help mares maintain healthy, efficient digestive function with EquiShure.



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A scientifically formulated vitamin and mineral supplement suitable for lactating mares that maintain their weight on forage alone.



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Natural-source vitamin E improves fertility and enhances immunity in both foals and mares.

## POST-WEANING MARES

Weaning can be as stressful on mares as it is on foals, but proper nutritional management will help make the transition as smooth as possible.



Maintaining the nutritional well-being of mares and foals throughout weaning is part and parcel of a successful separation. Weaning will likely be the most stressful event of the foal's life, and worse, its primary source of comfort will have vanished. While concern for the foal is justified, the mare deserves consideration as well, and for her the chief management task involves shifting nutritional requirements.

### Feeding management

- Owners should consider tapering off concentrates fed to mares as weaning day approaches, though concentrates should still be available to the foal. Keep a mare from snatching the foal's feed by using a creep feeder or by tying the mare while the foal eats.
- All mares should be taken off concentrates during weaning, regardless of body condition. Because many broodmares are also pregnant at this time, they should be kept on an appropriate vitamin and mineral supplement, and should still have access to as much good-quality forage as they choose.
- Generally, a one- to two-week break from concentrates will suffice. As soon as milk production stops and the udder returns to a normal, nonlactating size, the mare can be started back on concentrates. As long as the calories and the protein content of the diet decrease and there is no suckling stimulus, milk production should stop fairly quickly.

- Once the mare has dried up, the focus should turn to weight management of the mare. The demands of lactation affect mares differently. Some mares maintain weight without a problem, while body condition seems to melt off others throughout lactation. Those that lose significant amounts of weight during lactation require the most consideration after weaning.
- If the mare has lost a lot of body condition while nursing a foal, then a high-calorie diet is recommended to help get the mare back to an acceptable weight. The best way to add calories to a diet is through provision of high-quality forage. This may include full-time access to good-quality pasture or generous helpings of a calorie-rich legume hay such as alfalfa or perhaps a mixed hay.
- Concentrates can be introduced back into the diet gradually. Without the physiological drain of milk production, the mare should use the dietary energy to increase body condition. Choose high-caloric feeds, such as those with a higher fat content (greater than 6%).
- For the thin mare, it is really important to add body condition before the third trimester of pregnancy to prepare for the high caloric needs of late gestation and lactation. Even if the mare is just a little ribby, it would be important to get her to an acceptable body condition score (a 5 or 6). She may gain weight quickly once the foal is weaned.
- Some mares handle lactation with extraordinary ease from a physiological perspective. If a mare is still at optimal weight after nursing a foal for months, then the chief concern would be to offer adequate vitamin and mineral intake to balance the inadequacies of forage. This can be done with a pelleted vitamin and mineral supplement, such as I.R. Pellet, or a balancer pellet.
- Though uncommon in mares, another possible health concern is mastitis or inflammation of the mammary system. Mastitis seems to be more common at weaning, probably because milk sits in the udder and has a higher chance of becoming infected. Careful observation of the mare and her mammary system following weaning will help ensure her well-being.

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Mares fed omega-3 fatty acids have enhanced passive transfer of antibodies to foals, which in turn have stronger immune systems. Improved fertility, lowered incidence of uterine inflammation, and decreased risk of abortion are also noted with omega-3 supplementation.



#### I.R. Pellet™

A scientifically formulated vitamin and mineral supplement suitable for mares that maintain their weight on forage alone.



### **Nano-E<sup>®</sup>**

Natural-source vitamin E improves fertility and enhances immunity in mares. Nano-E provides immune and antioxidant support through stressful times, such as weaning.



### **RiteTrac<sup>™</sup>**

Helps offset the stress of weaning and guards against gastric ulcers that could derail weight gain and appetite after weaning.

## MAIDEN MARES

Moving from a performance career to life as a broodmare can be challenging from a nutritional perspective.



Mark Llewellyn

Maiden mares that have recently been in training (particularly if being retired from racing) may not be in optimal condition for breeding and may need special treatment. They should always be let down gradually from their previous training program. Individuals accustomed to intense training and management should not be immediately turned out to pasture on a reduced ration or they may rapidly lose weight. Instead, begin by transitioning from the performance ration as body condition dictates while the mares are still in a barn or in a small group of mild-mannered mares.

### Feeding management

- Once maiden mares are settled into their new environment, assess their weight. Like other mares in the production cycle, maiden mares should be kept in moderate to moderately fleshy body condition. This equates to a score of 5 or 6 on the familiar scale of 1 (poor) to 9 (extremely fat). Moderate body condition describes a mare whose ribs cannot be seen but can be felt with some additional fat deposits around the withers, shoulders, and possibly the tailhead.
- An appropriate body condition can be achieved by manipulating energy sources. Coupled with a cessation of exercise, some mares may gain sufficient weight on unlimited access to good-quality forage.
- If forage alone does not provide enough calories for weight gain, a well-formulated concentrate should be offered. Care should be taken to carefully follow the manufacturer's instructions, which are printed on the feed tag or bag. Feeding less than the recommended rate will compromise nutrient intake. For instance, if the

recommended feeding rate is 6 to 14 lb (2.8 to 6.4 kg) per day, mares should be fed at least 6 lb (2.8 kg) per day, increasing as necessary to maintain body condition. Concentrate meals should be no larger than approximately 0.5 lb per 100 lb of body weight (5 lb for a 1,000-lb horse).

- Weight gain takes times. Researchers believe that moving from one body condition score to the next can take months. While good-quality forage can often be offered free-choice to mares on a weight-gain diet, be careful not to overfeed concentrates. Periodic evaluation of body condition will help determine if mares are gaining weight. For most idle mares, concentrate intakes of 1 to 1.5 lb per 100 lb of body weight are usually sufficient for weight gain.
- If mares are able to gain and then maintain weight on good-quality forage, they should be fed a balancer pellet or a well-formulated vitamin and mineral supplement, such as I.R. Pellet, to ensure nutrient needs are met.

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#### Nano-E®

Natural-source vitamin E improves fertility and enhances immunity in both foals and mares.



#### RiteTrac™

If gastric ulcers are suspected in performance mares being transitioned to the breeding herd or to reduce the risk of digestive disturbances in mares on a weight-gain program receiving large rations of grain.

# YOUNG HORSES

The cornerstone of raising sound, healthy horses is the provision of optimal nutrition. Foals, weanlings, and yearlings that have access to high-quality forage and well-fortified concentrates fed in the correct amounts will have a physiological head start on those young horses with an uncertain or inconsistent nutritional history. Long-term health and soundness often hinges on management decisions implemented within the first two years of life. Sound and steady growth should be the goal of all horsemen who manage young stock.

## FOALS

Milk provides the nutritional foundation foals require for sound growth.



Mark Lewellyn

Mares satisfy the early immune and nutritional requirements of young foals through colostrum and milk. Colostrum is the thick yellowish fluid produced by mares before their true milk. Colostrum is rife with antibodies that fight pathogens until the foal's own immune system matures. This vital fluid is produced for no more than 24 hours before it is replaced by mare's milk, which is thinner and lighter in color. The foal's digestive tract is able to absorb antibodies for only the first 12 to 24 hours after birth, so it is important for the foal to get colostrum from the mare or another source very soon after it is born. Preferably, the foal should nurse within the first two hours after birth and frequently thereafter, ingesting at least 1.5 to 2 liters (up to half a gallon) of colostrum.

Without a strong immune system, foals are at risk for infections that might require intensive veterinary care to overcome. Even the best treatment may not be effective; unfortunately, infection is the leading cause of death in newborn foals.

## Feeding management

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- Some foals are weak or sick and are unable to nurse, and others that seem to nurse strongly may not consume enough colostrum if the mare has been dripping fluid for several days before delivery. If mares drip significant amounts of colostrum before foaling, they can be milked out as needed and the colostrum can be frozen and given to the foal at birth. To be ready to care for these foals, managers can obtain a supply of frozen colostrum from donor mares. The frozen colostrum should be thawed in warm water rather than in a microwave before bottle-feeding. If the dam has plenty of colostrum but the foal is too weak to stand and nurse, the mare can be milked out and this colostrum can be bottle-fed to the foal. It can also be administered via nasogastric tube by a veterinarian.
- Foals should be examined by a veterinarian after birth to ensure general health and well-being. Careful attention should be paid to foals and their nursing patterns, and a veterinarian should be alerted immediately if the foal seems weak, listless, mildly lame, nurses infrequently, or refuses to nurse.
- Measurement of IgG levels should be part of the routine well-foal examination and should be performed on all foals. An immunoglobulin (IgG) test reveals the concentration of antibodies in the foal's blood. This test should be done in the interval of 12 to 24 hours after birth. If the level is low, the foal can be treated with an intravenous infusion of antibody-rich hyperimmune plasma.
- Many owners routinely have the IgG test done on all foals, regardless of nursing behavior or attitude. Foals can look bright and lively and still have low antibody levels, leaving them open to infection. Taking steps to ensure that your foal has adequate immunity decreases the risk of infections early in life.

## Products from Kentucky Equine Research

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### Nano-E<sup>®</sup>

Provides antioxidants for support of immune function. Recommended for immunocompromised foals or foals experiencing a difficult birth.

## ORPHAN FOALS

When properly cared for, orphan foals often thrive and mature without complications.



Mark Llewellyn

Horse breeders are sometimes faced with raising an orphan foal. Foals can become orphaned for several reasons including lack of milk production, poor mothering, mare death, and in some cases old mares have their foals removed after birth to avoid the stress of lactation. A number of options are used to raise orphan foals, and the course taken with an individual foal will depend upon a number of factors. Raising an orphan foal is possible, but particular care must be given to the changing nutritional needs of the youngster as it matures.

### Feeding management

- If the mare dies at birth, the foal must receive colostrum produced by another mare. Many breeding farms keep frozen colostrum from other mares for this purpose, and stores of frozen colostrum are also kept by veterinary clinics. The orphan foal is going to experience a great deal of stress regardless of how it is raised, and it is important that the foal receives plenty of antibodies via colostrum during the first hours of life. Foals orphaned at a very early age should ideally be placed on a foster mare, called a nurse mare, or receive milk replacer.
- In an effort to be certain that newborn foals have received sufficient colostrum, many farms will take a blood sample from the foals between 12 and 24 hours after birth to have an IgG test done.
- If the IgG test comes back with a low result, most farms will provide the foal with a plasma transfusion.
- The use of a nurse mare is the easiest way to foster an orphan foal. Nurse mares are typically docile and extremely maternal, which simplifies the process of grafting orphan foals onto them. An experienced nurse mare will accept a newborn that is

not her own after an acclimation process. The foal is usually quick to bond with the mare.

- If no nurse mare is available, a common method for raising orphan foals is to use milk replacer. In recent years there has been significant development of foal-specific milk replacers designed to mimic the nutrient composition of mare's milk, and many have additional fortification with trace minerals and vitamins. They are only good, however, if fed properly. Carefully managing the amount and timing of the feedings helps to eliminate some of these problems. Using milk replacers is obviously more labor intensive than raising the foal on a nurse mare, and this can be a drawback for some breeders.
- It is very important to mix the milk replacer powder and water as recommended on the manufacturer's label to avoid diarrhea or underfeeding.
- Feeding large quantities of milk in a single meal especially to very young foals will overwhelm the digestive tract's ability to process and absorb the sugars and protein in the milk and will lead to diarrhea and the pot-bellied appearance so often seen in foals fed milk replacer.
- The trick to feeding milk replacer to young horses is to feed small amounts often from a bottle or bucket. Training a foal to drink from a bucket is surprisingly easy. Place a small amount of milk in the bucket so that the foal's muzzle can easily touch the base. This contact with the base of the bucket elicits a suckle response, and the foal will usually drink quite happily. This method is significantly easier than a bottle. When starting a foal, no more than 1.5 to 2 liters of milk replacer should be offered at one time.
- Particular care must be given to the changing nutritional needs of the foal. Too much milk can cause growth problems as can milk with inappropriate levels of nutrients. For foals being raised on milk replacer, it is essential to carefully monitor the amount and timing of feedings and to pay close attention to providing a balanced diet as the foal is weaned from the milk replacer.
- Goat's milk has been used as milk replacer for orphan foals. Goat's milk is similar to mare's milk, and probably more so than milk from other species. Foals generally accept goat's milk more readily than milk replacer. That said, goat's milk is not a perfect match for mare's milk, and there are differences that can result in suboptimal growth of the foal.
- Foals raised on milk replacer should be offered small amounts of high-quality feed beginning at two weeks of age. A feed appropriate for foals is typically 14 to 16% protein concentration and provides similarly concentrated sources of vitamins and minerals. Intake should be gradually increased about 0.22 lb (100 g) per week until the foal is eating about 3.3 lb (1.5 kg) of feed per day at three months of age. At this point, the milk replacer intake can be reduced by one liter per day until the foal is completely weaned.
- A veterinarian is an incredible resource when raising an orphan foal. Meticulous record-keeping of when and how much milk replacer a foal consumes may help a veterinarian plan a course of action should a health problem arise.

## WEANLINGS

Weanlings require optimal nutrition to grow properly and to avoid developmental problems.



Weaning is a stressful time for foals. While mares are often ready to say good-bye to their rowdy charges, foals can be far more fretful and often enter a growth slump immediately following weaning. Therefore, proper nutrition is paramount.

Foals are typically weaned at four to six months of age. Prior to weaning, the foal should be accustomed to eating concentrates (textured or pelleted feed). This is usually not a problem if the mare is being fed a concentrate, as many foals are dipping into their dam's feed bin by a few weeks of age. However, if the mare has maintained her condition on forage and is not consuming a concentrate, then the foal will not have been exposed to grain or pellets until weaning.

Some foals are introduced to a concentrate by two to three months of age, a time when milk production begins to decrease and often no longer fulfills the nutritional needs of the foal. Creep feeding serves two purposes: to guarantee the nutritional needs of weanlings are being met, and to familiarize weanlings with eating grain so feeding time will be less stressful once separated from their dams.

Regardless of their eventual use, the primary goal of feeding all weanlings is the same: steady, sound growth. Nutritional mistakes made early in the lives of horses can lead to structural problems that may limit performance potential. Therefore, proper nutrition of the post-weaning foal is critical.

### Feeding management

- In order for the weanling to achieve optimal growth, sufficient dietary energy and protein must be supplied. Weanlings generally cannot consume enough forage to satisfy energy requirements for steady growth at the rate needed by modern breeders. Therefore, a concentrate must be fed. Choose a feed that is formulated

for young, growing horses and follow the manufacturer's feeding instructions. In general, approximately 0.5 to 1 lb (0.3 to 0.5 kg) of grain per day per month of age is recommended for weanlings of light horse breeds such as Thoroughbreds or Standardbreds. This can also be expressed as up to 1% of body weight. Pony weanlings would receive less, about 0.3 to 0.5 lb (0.2 to 0.3 kg) per day per month of age.

- Concentrates should provide the energy, protein, and minerals necessary to compensate for those not present in the forage. In addition, the grain should have sufficient levels of lysine, an amino acid essential for proper growth. Grain mixes made with soybean meal or canola meal are preferred because of their high lysine content, and these meals are usually mixed in a pellet to ensure intake.
- A grain concentrate appropriate for a weanling on pasture will generally contain 14 to 16% crude protein. Feeding mild excesses of protein does not cause bone problems. Higher protein feed concentrates that contain minerals and vitamins that are fed at lower rates (e.g., 2.2 lb or 1 kg per day), called balancer pellets, can be mixed with oats or other grains so the total grain mix supplies these levels of protein. In some breeds (e.g., Warmbloods and ponies) and situations (e.g., high-quality pasture), 2.2 lb (1 kg) of balancer pellet may be all that is required.
- Adequate forage should be offered to make up for energy deficiencies between the weanling's energy needs and that provided in the grain. The safest way to achieve this is by allowing the weanling access to all of the nonlegume forage it will consume. Feeding legume forage (alfalfa or clover) is acceptable, but weanlings should not be allowed unrestricted access to it. Rather, they should be fed enough to provide sufficient digestible energy for moderate growth. Feeding too much legume forage is no different than feeding too much grain. Either way, excessive intake of dietary energy results.
- Like many adult horses, some weanlings are easy keepers and likely to become overweight on even minimal amounts of grain. In these cases, weanlings can be fed balancer pellets, a low-calorie, low-intake source of essential protein, vitamins, and minerals, without feeding excessive energy.
- Once a group of weanlings is established on a suitable feeding program, there is no automatic need to increase it during winter or as the weanlings get older. Usually an increase in appetite and forage intake can fulfill extra needs and maintain growth rate. Regular observation of condition or growth rate will determine whether grain intakes need to be increased or decreased.
- Weanlings should be maintained in moderate body condition. This equates to a score of 5 on the familiar scale of 1 (poor) to 9 (extremely fat). Weanlings will often show more rib than mature horses as they grow, so it is important to assess the entire animal when assigning a condition score.
- As with mature horses, weanlings should have unlimited access to fresh water and salt.
- Maintain a veterinarian-recommended vaccination and deworming program. Include timely farrier services into the management scheme of weanlings. Unless a specific dental issue is noticed, there should be no need for dental work in weanlings.

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Supports proper bone maturation throughout growth and development. Offers specialized postsurgical orthopedic support.



### EO-3™

Omega-3 supplementation enhances bone metabolism and development, and provides immune support and anti-inflammatory benefits, which are critical during weaning and other stressful times.



### Nano-E®

Provides antioxidants for support of immune function as weanlings head into winter or during stressful times and vitamin E is less abundant in dormant pastures and hay.



### RiteTrac™

Provides proper support and buffering of the entire digestive tract to allow for optimal nutrient absorption. Protects gastric and hindgut environments by maintaining neutral acidity for young horses during weaning.



### Synovate HA®

Growing horses benefit from lubrication of the joint capsule, especially when they begin a training program and more stress than ever is placed on joints and other skeletal tissue. Helps manage joint health proactively by supporting synovial fluid.

## YEARLINGS



Mark Lewatlyn

Proper nutrition of yearlings builds on the foundation established as weanlings.

A continuation of the sound nutrition program implemented as weanlings will hold yearlings in good stead. Based on high-quality forage and supplemented with an appropriate source of protein, vitamins, and minerals, the diet should change little except an increase in quantity. Proper nutrition of young horses provides the foundation for future soundness and longevity in sport, so its importance in the management of young horses cannot be overemphasized.

### Feeding management

- In addition to high-quality forage, yearlings should be fed a concentrate formulated specifically for young, growing horses. By following the manufacturer's feeding instructions, yearlings will consume sufficient nutrients for optimal growth.
- Yearlings should be maintained in moderate body condition. This equates to a score of 5 on the familiar scale of 1 (poor) to 9 (extremely fat).
- Yearlings that are easy keepers should be kept from becoming too fat by replacing a calorie-laden concentrate with a low-intake, low-calorie source of essential protein, vitamins, and minerals such as a balancer pellet.
- On the other hand, yearlings that are large-framed with much growth potential can consume normal amounts of fortified concentrate to reduce the risk of developmental orthopedic disease.
- With an eye toward long-term health and soundness, breeders should strive for steady growth. It is often necessary, however, to yield to economic considerations

when preparing horses for sales and shows. A pattern of slow early growth is more appropriate for foals that will not be sold or shown as yearlings. Delaying rapid growth until after the window of vulnerability for development of bone disease significantly reduces the risk of growth-related developmental orthopedic disease. Foals that are born later in the season and pointed toward sales or shows in late fall could follow a more moderate growth curve. This growth pattern is used by most breeders of Thoroughbreds because it results in large, well-grown yearlings with minimal joint problems.

- A rapid growth curve, in which weight gain is concentrated over a short period of time, is used for later-born foals targeted at earlier sales and shows. This growth pattern is most likely to result in skeletal problems, but can result in more mature yearlings earlier in the season if they are properly managed. Rapid growth can be managed somewhat by spreading the growth over several months rather than trying to achieve weight gain during the traditional sale or show preparation period of 60 to 90 days before a sale.
- Ongoing research suggests a relationship between the glycemic nature of feed and the incidence of skeletal problems in young horses. Diets high in starch and sugar (typical grain-based concentrates) produce a large blood glucose and insulin response after feeding and have been implicated in the etiology of developmental orthopedic disease. It may be beneficial to replace a significant portion of the energy normally supplied by cereal grain with fat and fermentable fiber to reduce the glycemic response to concentrates.

### Products from Kentucky Equine Research



#### Bio-Bloom™ PS

Provides the nutrients necessary for healthy hooves and top-notch coat, and is especially useful for sales preparation.



#### DuraPlex®

Supports proper bone growth during the high-risk transition associated with initial training, including breaking and training. Offers specialized postsurgical orthopedic support.



#### EO-3™

Omega-3 supplementation enhances bone metabolism and development, and provides immune support and anti-inflammatory benefits.



#### Nano-E®

Provides antioxidants in the form of natural-source vitamin E for immune support as yearlings mature and prepare for sales or a performance career.



### **RiteTrac™**

Provides proper support and buffering of the entire digestive tract to allow for optimal nutrient absorption. Protects gastric and hindgut environments by maintaining neutral acidity for young horses during sales and training.



### **Synovate HA®**

Growing horses benefit from lubrication of the joint capsule, especially when they begin their training program as long yearlings and more stress than ever is placed on joints and other skeletal tissue. Helps manage joint health proactively by supporting synovial fluid.

## TWO-YEAR-OLDS

Nourishing two-year-old horses takes into account the nutrients needed for growth and performance.



Mark Lewellyn

By the time a horse has reached its second birthday, there is little question that it has achieved the majority of its mature height. A horse may still grow a couple of inches, but vertical growth is nearly complete. Absolute skeletal maturity, when there are no remaining growth plates whatsoever, does not occur till much later in life, perhaps at around six years old.

Many two-year-old horses do not have the appearance of mature horses because they lack the width and breadth across the chest and quarters, and the depth of barrel and flank. The volume of muscling is also likely not near that of an adult horse.

While vertical growth might be almost complete, the skeletal and other tissue systems of the two-year-old horse are far from mature. In addition, many horses begin their athletic careers long before they have reached maturity. Thoroughbreds, for example, enter race training as young as 18 months of age and might race before they have reached two years of age. More and more show horses are being saddled and broken to ride and drive at two years of age. Therefore, in feeding two-year-old horses, owners and trainers must take into account the nutrients needed for both growth and performance.

### Feeding management

- Little research has been done to quantify the nutrient requirements of two-year-old horses. Requirements for two-year-olds are derived largely from combining information about the nutritional needs for growth and performance. Kentucky Equine Research found that the quantity of a well-formulated, properly fortified concentrate necessary to sustain moderate exercise often contains sufficient nutrients to support growth.

- Because of a fairly high level of intake (but ideally not more than 0.5 lb per 100 lb of body weight), most high-quality concentrates contain adequate protein, calcium, and phosphorus for two-year-olds. Though it doesn't happen often, if calorie intake must be restricted in a two-year-old (such as with an easy keeper), vitamin and mineral fortification might be indicated, and can be achieved through the use of a balancer pellet.
- There are risks involved in feeding large concentrate meals. You can replace a portion of the concentrate with a high-fat supplement such as vegetable oil or rice bran. These energy-dense supplements will add calories to the ration but not much volume, so meal size stays the same or decreases. Another strategy is to feed the same amount of grain but separate it into more than two meals. A midday meal will significantly decrease the size of the morning and evening meals. Be sure horses have high- or mid-quality hay to eat at all times during the day. Not only will this decrease boredom and reduce the likelihood of gastric ulcers and hindgut acidosis, but it will increase energy consumption.
- The nutrient requirements of the two-year-old are intermediate between the growing horse and the adult performance horse. If a two-year-old is in training, it can be fed any high-quality concentrate that would typically be fed to adult performance horses. The elevated level of feed intake needed to meet the energy demands for exercise will provide the nutrients needed for growth.
- For those two-year-olds in work, replacement of electrolytes lost through sweat is best achieved through the provision of a well-formulated electrolyte supplement.

### Products from Kentucky Equine Research

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#### DuraPlex®

Supports proper bone growth during the high-risk transition associated with breaking and training. Offers specialized postsurgical orthopedic support.



#### EO-3™

Omega-3 supplementation enhances bone metabolism and development, and provides immune support and anti-inflammatory benefits.



#### Nano-E®

Provides antioxidants in the form of natural-source vitamin E for immune support as two-year-olds mature and prepare for a performance career.



#### Restore®SR

Slowly delivers sodium and other key electrolytes such as chloride, potassium, and magnesium to replace those lost in sweat.



### RiteTrac™

Provides proper support and buffering of the entire digestive tract to allow for optimal nutrient absorption. Protects gastric and hindgut environments by maintaining neutral acidity for young horses during sales and training.



### Synovate HA®

Growing horses benefit from lubrication of the joint capsule, especially when they begin their training program and more stress than ever is placed on joints and skeletal tissue. Helps manage joint health proactively by supporting synovial fluid.

## MANAGING DEVELOPMENTAL ORTHOPEDIC DISEASE IN GROWING HORSES

Developmental orthopedic disease (DOD) can rob a young horse of its future as a sound athlete. Each year the consequences of diseases such as osteochondritis dissecans (OCD) and angular limb deformities render hundreds, maybe thousands, of young horses structurally inadequate for the work they were bred to do. Over the last several years, researchers have found that appropriate nutrition of the gestating mare as well as her young offspring lays the foundation for proper bone development, thus sidestepping developmental problems and possible unsoundness.

Nutrition often plays an important role in the onset of DOD. Deficiencies, excesses, and imbalances of nutrients may result in an increase in both the incidence and severity of phytitis, angular limb deformity, wobbler syndrome, flexural deformities, osteochondrosis, and OCD. Genetics, environment, body size, growth rate, mechanical stress, trauma, and hormonal factors are also risk factors for DOD.

### *Developmental orthopedic disease defined*

Developmental orthopedic disease refers to a set of skeletal problems related to improper bone development and maturation. The term developmental orthopedic disease encompasses all general growth disturbances and orthopedic problems seen in the growing foal as well as some found in older horses.

### *Causes*

Developmental orthopedic disease is a significant economic problem for modern horse breeders because the crippling lameness can make affected foals or yearlings essentially worthless. A single factor that can prevent DOD has not been identified, but several are known to be important. Nutrition is a critical factor, and awareness of the problem has led to the design of feeding and management programs to decrease the incidence and severity of the disease.

### *Mineral deficiencies*

Proper feed formulation can help to prevent DOD in foals. Amounts and ratios of copper and zinc, for example, are related to some cases of DOD. Most natural feeds do not contain sufficient copper and zinc, which are inexpensive and nontoxic, so high levels of supplementation are suggested; however, excessively high levels will also predispose to DOD. Rations for late-pregnant mares and young horses should provide adequate copper and zinc intakes.

Copper supplementation, together with zinc and selenium, of pasture-fed pregnant mares can lead to a significant reduction in the incidence and severity of physitis and articular cartilage lesions in their weanlings. Interestingly, supplementation of the mares and foals after birth does not reduce the incidence of DOD. If the mare has been supplemented in late pregnancy, the foal will have built up adequate stores of trace minerals in the liver prior to birth. Milk is a relatively poor source of these minerals. Other minerals such as manganese, sulphur, and magnesium are involved in the formation of bone and maturation of cartilage, and deficiencies of calcium and phosphorus will drastically affect skeletal development.

### *Mineral excesses*

Foals consuming high levels of zinc in conjunction with marginally deficient levels of copper have a severe risk of DOD because zinc interferes with the absorption and utilization of copper, thus creating a deficiency.

Excess phosphorus increases the risk of DOD, such as when foals are fed very large amounts of grain or bran. High-calcium diets have also been implicated in the development of DOD, perhaps by reducing the availability of other minerals and thus creating deficiencies. Excessive calcium supplementation can occur in young horses eating large amounts of alfalfa and a calcium-only supplement such as ground limestone. The diet for the growing horse should have a calcium to phosphorus ratio of 1.1-2:1. Have your horse's diet analyzed by a qualified equine nutritionist to check that these minerals are being supplied in the correct amounts and proportions.

### *Overfeeding*

Horses that are forced to grow at a rapid rate are more prone to DOD. Overly fat young horses will not become good athletes; a study of 10,000 Thoroughbred yearlings in the United States and England showed that overweight and obese yearlings performed substantially worse on the racetrack.

Breeders should monitor the body condition of growing horses and not let them get too fat. Exercise is important for young horses and can limit the side effects of a high-energy diet. When weanlings and yearlings are confined or cannot exercise because of lameness, reduce the amount of grain and slowly reintroduce them to exercise.

The sensitivity of cartilage to insulin has been a focus of research in the past several years. Management practices that reduce the post-feeding levels of insulin are recommended, such as feeding small amounts of grain in each meal or using feeds with alternative energy sources such as fat and fermentable fiber.

Owners of young horses can reduce the risk of DOD in their equines by using a well-formulated commercial feed designed to meet the nutritional needs of growth. Feeding directions on the bag should be followed to ensure horses consume the right amounts and ratios of important nutrients.

## Minimizing the risk of developmental orthopedic disease

### *Foals*

If the broodmare has been fed properly during late pregnancy, it is unnecessary to supplement foals with feed until they reach 90 days of age. At this time, moderate amounts of a well-fortified foal feed can be introduced and gradually increased until the foal is consuming around 1 lb (0.5 kg) per month of age. It is critical that the foal be accustomed to eating grain before it is weaned. If it is not, a dramatic decrease in growth rate at weaning may occur. This is sometimes referred to as a “growth slump” or “weaning slump.” When the weanling finally starts eating grain, a compensatory growth spurt will occur that may result in skeletal problems.

### *Weanlings*

The most critical stage of growth for preventing DOD is from weaning to 12 months of age, when the skeleton is most vulnerable to disease and nutrient intake and balance is most important. Weanlings should be grown at a moderate rate with adequate mineral supplementation. In temperate regions, the contribution of pasture is often underestimated, leading to excessive growth and developmental orthopedic disease.

### *Yearlings*

Once a horse reaches 12 months of age, it is much less likely than a younger horse to be affected by developmental disease. Many of the lesions that become clinically relevant after this age are typically formed at a younger age. Still, proper nutrient balance remains important for the yearling. It is best to delay the increased energy intakes that are required for show conditioning or sales prepping as long as possible because the skeleton is less vulnerable to DOD as the yearling ages. Normally, increasing energy intake 90 days before a sale is enough time to add the extra body condition that is often expected in a sales yearling.

Bone-related problems of the knee, namely physitis, are often a major concern with yearlings that have been pushed for growth. To reduce the incidence of physitis in these horses, the level of trace mineral supplementation should remain high and a significant portion of the energy normally supplied from grain should be replaced with fat and fermentable fiber. Feed mixes for these horses can contain as much as 10% fat. Sources of fermentable fiber include beet pulp and soy hulls.

Studies conducted at Kentucky Equine Research have shown that high levels of blood glucose and insulin, which occur following the consumption of certain feeds, are linked to higher than average levels of osteochondritis dissecans. While there is more to be learned about the causes of osteochondritis dissecans, there is some evidence that high levels of insulin caused by large grain meals may affect the maturation of cartilage cells, possibly leading to altered cartilage growth or faulty mineralization.

Some commercial textured feeds have a glycemic index as high as 129; whole oats have a glycemic index of 100. By contrast, rice bran has a glycemic index of 47, and rinsed beet pulp has a glycemic index of 34. The use of concentrates with a low glycemic index is suggested to support growth in young horses without causing a potentially dangerous starch overload.

### Feeding horses with developmental orthopedic disease to promote recovery and growth

The recommendation for a growing horse with developmental orthopedic disease (DOD) is to feed a restricted diet by reducing the amount of starch in the diet, limiting calories, and supplying all the protein, vitamins, and minerals needed by the individual for healthy growth. KER-formulated ration balancers supply these essential nutrients missing in forage-only diets without adding significant amounts of starch.

### *Osteochondritis dissecans*

One of the most career-debilitating bone afflictions of young horses is osteochondritis dissecans (OCD), a developmental orthopedic disease that's invisible to the eye. OCD can be defined simply as an interruption in bone development.

During normal bone growth, cartilage is remodeled into bone. It is during this physiologic revision that ossification goes awry and OCD lesions originate. On radiographic or arthroscopic examination, these lesions appear as flaps, which in severe cases may actually detach from the bone and enter the joint capsule.

Some lesions are detectable when horses are as young as one month of age, but most are likely formed by the time horses are six months old. Usually, lesions are not diagnosed until later in life. In racehorses such as Thoroughbreds and Standardbreds, lesions are often detected when horses enter training, typically by two years of age.

Three categories of OCD lesions are recognized: (1) those showing clinical and radiographic signs; (2) those showing clinical without radiographic (but arthroscopic) signs, and (3) those showing radiographic but no clinical signs. Clinical signs of OCD include joint effusion or swelling and lameness of varying degrees. Often clinical signs are absent altogether.

In typical cases of OCD, horses have one or two lesions that are frequently bilaterally symmetrical, which means that if the joint of one hind limb is affected the contralateral joint may also be diseased. Severity of bilaterally symmetrical lesions may differ; only one, for instance, may cause lameness or other clinical signs of disease. Interestingly, if a lesion is found in one fetlock, practitioners will often radiograph the remaining three fetlock joints because there is a tendency for OCD to be present quadrilaterally. Once again, clinical signs may not accompany all lesions. In rarer instances, horses present with multiple lesions in various joints and bilateral symmetry may not be evident.

Veterinarians have pinpointed certain joints in which lesions typically occur, including the fetlock, shoulder, stifle, and hock. Though less common, lesions have also been described in the elbow, hip, and cervical vertebral joints.

### *Reducing the incidence of OCD through nutrition*

Nutrition is thought to play an important role in the pathogenesis of OCD. Deficiencies, excesses, and imbalances of nutrients may result in an increase in the incidence and severity of the syndrome. Appropriate mineral balance of rations is of particular importance in deterring the development of OCD.

Deficiencies of calcium, phosphorus, copper, and zinc may invite bone growth problems. Less common than mineral deficiencies are mineral excesses, which usually occur because of overfortification or environmental contamination. Though massive supplementation can occur, environmental contamination is a more likely cause. If a farm is experiencing an unusually high incidence of affected foals or if the location and severity of the lesions are abnormal, environmental contamination should be investigated. Blood, feed, and water analysis should be performed. Chemical analysis of hoof and hair samples may uncover the underlying cause in such a situation.

The ratio of minerals may be just as critical as the actual amounts of individual minerals in the ration. Too much calcium, for instance, may stand in the way of proper absorption of phosphorus, zinc, and iodine.

Excessive energy intake can lead to rapid growth and increased body fat, which may predispose young horses to OCD. A study conducted by Kentucky Equine Research in the mid-1990s revealed that growth rate and body size may increase the incidence of OCD in Thoroughbred foals. Yearlings that possessed OCD of the hock and stifle were large at birth, grew rapidly from three to eight months of age, and were heavier than the average population of yearlings.

The source of calories for young horses may also be important, as hyperglycemia and hyperinsulinemia have been implicated in the pathogenesis of OCD. Foals that repeatedly experience an exaggerated and sustained increase in circulating glucose or insulin in response to a carbohydrate (grain) meal may be predisposed to the development of OCD.

Studies with fetal and foal cartilage cells suggest that the role of insulin in growth of cartilage may be to promote cell survival and that hyperinsulinemia may be a contributory factor in OCD. To help protect foals from OCD, therefore, it is prudent to feed them concentrates that produce low glycemic responses, such as those that incorporate fat and fiber as energy sources. These specialty feeds minimize the amount of sugar and starch in the diet, thereby reducing the likelihood of OCD.

### *Feeding practices*

One of the most common problems of feeding young horses is excessive intake that results in accelerated growth rate or fattening, two conditions that may result in OCD. Calorie consumption is key. Large intakes of grain are appropriate if the forage is sparse or poor quality. For example, grain intakes as high as 2% to 2.5% of body weight may be necessary to sustain reasonable growth in weanlings that have no access to forage other than tropical pasture. Conversely, grain intakes higher than 1% of body weight may be considered excessive when weanlings are raised on lush pastures or have access to high-quality alfalfa hay.

Occasionally, the concentrate offered to a growing horse is incorrectly fortified to complement the forage that is being fed. The problem occurs particularly when the forage is mostly alfalfa or clover. Most concentrates for young horses are formulated with levels of minerals and protein needed to balance grass hay.

Inadequate fortification of grain is another concern for managers of young horses. The most common reasons for inadequate fortification are using unfortified or underfortified grain mixes, using correctly fortified feeds at levels of intake that are below the manufacturer's recommendations, or using fortified feeds diluted with straight cereal grains. These errors in feeding can be corrected by the incorporation of a highly fortified balancer pellet. Feed stores typically stock a balancer pellet that will round out the nutritional profile of the young horse's diet.

### *Prevention*

In almost every circumstance of OCD, the surest way of determining if nutrition is a contributing factor is to perform a ration evaluation, which compares the intake of several essential nutrients with the requirements of the horse. Gross deficiencies or excesses of key nutrients can then be identified and corrected.

Ration evaluations can be approached in two ways. One way is to add up what is being fed and compare it to the horse's requirements. This is actually more difficult than it may first appear since most horsemen do not actually know exactly what their horses are eating. Alternatively, a new ration may be developed.

One easy way to determine the appropriateness of a ration is through the use of Gro-Trac®, the growth-monitoring software designed by Kentucky Equine Research. See page 38 for more information on Gro-Trac.

Not all cases of OCD can be traced to a nutritional origin. Other factors such as heredity and trauma may also be implicated. By feeding a well-balanced, low-starch diet and aiming for moderate growth, breeders can help build a sound skeleton and a solid foundation for a long-lasting athletic career.

### *Phyinitis*

Phyinitis is not normally a severe orthopedic problem and rarely has permanent effects on the long-term soundness of the horse. However, it can be painful for growing horses, and compensating for the pain might strain other parts of the body, including other immature joints. Therefore, a proactive approach to treating foals is wise.

Restricting activity of the foal is recommended because it can help keep the foal from getting too sore on the stressed joints. This is particularly important if the foal shows any signs of soreness or lameness. If the phyinitis causes noticeable lameness, then weaning may be a consideration.

Excluding the foal from its mother's feed tub is an excellent idea, because it is so difficult to measure how much of the meal the foal is eating. Some mares allow their foals to eat a significant portion of the feed. The foals you do not have to worry about are those that are kept away from the feed tub by mares that are more strict or protective of their feed.

Reducing caloric intake is recommended to slow growth. Growth may slow but it will not stop; therefore, the foal still requires vital nutrients for healthy growth. Cutting the foal back to a balancer pellet is the best step, but cutting all fortification is not a wise choice. Without fortification (such as what the balancer pellet provides), the foal will not get the supplemental protein, vitamins, and minerals necessary for proper bone and tissue development.

Contrary to popular belief, overconsumption of protein is not responsible for orthopedic problems and is vitally important for healthy bone and tissue growth. Nutrition-related bone problems are usually caused by excessive calories from carbohydrates and fats.

### *Flexural deformities*

Flexural deformities are often called contracted flexor tendons, and the young horse is frequently described as “upright” or “upish.” The functional length of the muscle/tendon unit is shorter than needed to maintain normal limb conformation. These problems may be congenital (present at birth) or acquired during growth, and can involve all four limbs or just the forelimbs. These cases tend to respond quickly to management or veterinary treatment.

Acquired flexural deformities tend to involve the forelimbs and can be unilateral or bilateral. They can involve the deep digital flexor tendon and therefore the coffin joint. The horse will have a raised heel and a club foot. This tends to occur in foals up to six months of age. Older weanlings and yearlings usually suffer from superficial flexor tendon contraction, which means the pastern and fetlock go upright but the heel stays on the ground. In severe cases in which both flexor tendons and the suspensory ligament are involved, the fetlock may knuckle forward. In chronic cases, the tendons and ligaments do not lengthen normally, and these cases become more difficult to treat.

There has been no specific research on the role of nutrition on flexural deformities, but nutritional factors such as mineral deficiencies, mineral excesses, mineral imbalances, and dietary energy excess may be involved as risk factors. In addition, feeding practices such as overfeeding grain, inappropriate grain for forage/pasture, and inadequate mineral and vitamin fortification can lead to an increased incidence of DOD. Minerals of importance are calcium, phosphorus, copper, zinc, and manganese. Rapid growth is a key risk factor for many forms of DOD, especially flexural deformities.

Dietary evaluation is necessary for foals with flexural deformities. Changes in diet tend to follow a similar pattern. In almost every instance, energy intake should be reduced while maintaining adequate levels of protein, vitamins, and minerals. The rationale for this type of modification is that skeletal growth should be slowed, but adequate substrate is still available to promote healthy bone, muscle, tendon, and ligament development.

Grain should be removed from the diet, and pasture/hay intake restricted to a level supplying around 75% of the foal's normal energy requirement. This restriction, how-

ever, should not compromise protein and mineral intake, so a different type of feed will be required. Just feeding forage will lead to a diet deficient in minerals and vitamins. The best approach involves the use of a low-calorie, low-intake balancer pellet. This would be fed at approximately 2.2 lb (1 kg) per day for a weanling or yearlings with a mature weight of 1,000 to 1,300 lb (450 to 600 kg) and supplies key amino acids, minerals, and vitamins missing from the forage. This type of diet will reduce growth rate and body condition and assist in resolving the flexural deformity while still supplying the nutrients needed for development of the skeleton and connective tissues.

With time and good management, many cases of flexural deformities can be rectified so that surgical treatment options are not required. Early action is vital as the longer the condition is present, the more difficult it is to treat.

### *Angular limb deformities*

When one or more of a foal's limbs has the appearance of being bent sideways or rotated, the condition is known as an angular limb deformity. A number of foals exhibit this problem, which sometimes self-corrects in mild cases as the foal grows. More significant deformities can be treated during the foal's early months of life, leading to a resolution of the deformity and a better chance for an athletic future.

Angular limb deformities can take the form of lateral or medial deviation of the limb. The angulation can arise in association with uneven elongation from the growth plate (physis) or alternatively can be involved in abnormalities of the cuboidal bones of the carpus and tarsus. Most commonly the problems are associated with uneven physical growth and involve the physes of the distal radius, metacarpus and metatarsus, or tibia, in that order. When a deviation results in the lower part of the limb bending out (lateral), it is termed valgus, while a deviation to the inside (medial) is termed varus.

The etiology of angular limb deformities is complex and thought to be multifactorial. The two main categories of factors include perinatal and developmental. Perinatal factors are usually involved when a foal is born with an angular limb deformity, whereas foals that are normal at birth but develop an angular limb deformity are more likely to suffer from one or more of the developmental factors.

It is important to consult with a veterinarian regarding the best treatment and management options for foals with angular limb deformities. All foals cannot be considered the same in regard to conservative or surgical treatment. Breed differences, age of the foal, and location and severity of the angular limb deformity all impact the decision for the best therapy.

From a nutritional perspective, young foals with angular limb deformity should be allowed to nurse normally, and foals can transition from milk to a typical diet containing forage and concentrate as age dictates.

## USING GRO-TRAC® TO MANAGE GROWTH

Horses destined for early performance, sales, and racing careers are often managed to achieve rapid growth in order to be as large as possible at a young age. While yearlings and two-year-olds are typically 90% and 95% of their mature height, respectively, most horses do not achieve their full mature weight and height until around four or five years of age. However, reaching maximal size in the least amount of time is a tricky proposition in the horse as there are many value- and career-limiting developmental orthopedic diseases (DOD) such as osteochondritis dissecans (OCD) that are more likely to occur in rapidly growing horses.

Research has shown that with respect to performance at yearling sales, “bigger is better,” as taller, well-conditioned Thoroughbreds are more likely to sell above their session median and shorter, underconditioned horses have a higher probability of selling below the median or not attaining the sales reserve.

The key is to develop a plan to support an optimal growth rate rather than push for maximum growth. Optimal growth rate results in a desirable body size with the least amount of developmental problems, making the art of raising a successful athlete a sensitive balancing act.

### Optimal growth

Managing the growth and development of the athletic horse is a balancing act between achieving maximal physiological size and preventing developmental orthopedic disease. Maintaining a steady growth rate by regularly weighing and measuring horses during the growth period and tracking this growth against a reference is recommended to help maximize athletic potential before entering training.

The growth rate of young horses is affected by factors such as the environment, nutrition, and management. The best way to evaluate the success of a feeding and conditioning program is through assessment of body weight, height, and condition. Managers have the most control over the rate that young horses gain weight because as long as adequate nutrient and caloric intake is supplied, genetics are most responsible for the horse’s ultimate mature height. However, the rate at which height is attained may be slowed by lack of energy and nutrition in the diet. Regular monitoring of weight and body condition allows farm managers to maintain a steady growth rate while preventing the animal from becoming too heavy.

How can the breeder determine how the growth of their young horses stacks up against that of other weanlings and yearlings? They can certainly eyeball other young horses, but in an industry that is depending more on technology and less on old-school methodologies, there is a valuable tool available to help ensure

sound and steady growth—an integral factor in reducing skeletal problems in young horses.

### Gro-Trac® equine growth monitoring

Gro-Trac is an equine growth-tracking program that allows breeders to contrast the growth rates of their stock with those of other young horses in similar peer groups worldwide. Gro-Trac includes the weights, heights, and average daily gains of thousands of foals, weanlings, and yearlings arranged in reference peer groups. By using Gro-Trac, breeders can compare the growth of their young horses with the growth patterns of the population of horses in a particular reference group. The standard comparison information displays both graphically and in tabular form and includes the following for both the individual horse and the reference population: days of age, birth weight, periodic body weight, average daily weight gain, and height. The weight and height line graphs display a growth curve for the young horse in question as well as the reference group and farm average.

Early measurements taken in central Kentucky formed the foundation of the program nearly 20 years ago, but thousands more are added annually, thanks in large part to the popularity of the program throughout the world. Horsemen in 20 countries on six continents are now using the program to ensure horses grow steadily. By using a database of growth records collected from over 30,000 horses, farm managers and breeders can assess how their young horses compare to other horses of the same age, gender, and breed around the world without ever leaving their property.

Breeders agree that Gro-Trac is an objective management instrument. With Gro-Trac, farm managers are able to quickly flag youngsters that are experiencing changes in body condition, some of which might be overlooked by even the most observant caretakers. In other instances, the program validates opinions about a certain horse. This information is archived so it is available for future use.

Traditionally, Gro-Trac has provided an indication of how a horse is growing compared to the chosen reference population by indicating the percentage that the individual differs from the reference values for height and weight. This method was useful, but it didn't take into account the spread of the data around the average. For example, there is a much wider range for a horse's body weight than for wither height at a particular age. Body weights can differ by as much as 50 kg (110 lb), whereas differences in height will be only a few centimeters. A horse that is four percent above the reference body weight is not that much heavier than the average, but if he is four percent above the reference height, then he is a lot taller.

Therefore, a superior method of comparing individuals to their peers has been implemented. Percentiles deal with this data spread issue and allow a more relative comparison with the entire population. Furthermore, this method allows horses to be compared regardless of gender and age. The use of percentiles is not a new concept in growth studies and is commonly used in pediatrics. However, this is the first time such a large equine data set has been acquired to create reference populations

from which percentiles can be calculated for Thoroughbred horses.

Using percentiles, breeders can quickly and meaningfully tell how an individual compares to the population. For example, the population mean or average is the 50th percentile, where half the population are either above or below it. A colt that is in the 90th percentile for height and 75th percentile for weight is taller than 90% of the population and heavier than 75% of the population, so he is well above average.

The Gro-Trac program is provided free to farms that use feeds formulated by Kentucky Equine Research and is licensed to other farms for an annual fee based on the number of mares whose offspring will be managed. Feed company representatives or farm staff weigh and measure foals and input the data into a report that can be securely accessed via the Internet by linking with the Gro-Trac web server. Farm managers can also e-mail questions about rapid growth or slow growth of their foals to nutritionists at Kentucky Equine Research for recommendations about feeding programs.

# STALLIONS

Proper nutritional management of the breeding stallion is paramount. Breeding stallions are often the most frustrating horses on a farm to maintain at optimal body condition; some become too lean at the height of breeding season, while others remain obese no matter the season. By providing a carefully balanced diet and monitoring weight regularly, a stallion's waistline can be kept trim and tidy all year long.

## STALLIONS

Precise nutritional management is sometimes necessary to keep stallions in ideal body condition.

- From a nutritional standpoint, the act of breeding can loosely be classified as work. Breeding stallions expend nearly the same amount of energy as performance horses in light work. This may be slightly elevated when stallions are bred multiple times a day. Commercially popular stallions may breed three times daily during the peak breeding season. Stallions also vary greatly in the amount of exercise they give themselves; some are naturally more sedentary than others. During breeding season, nervous stallions may burn valuable calories fence walking, stall circling, pacing, and weaving.
- Breeding may not be the only work certain stallions perform. Some continue to be ridden and trained while performing stud duties. In these instances, energy requirements would be higher still.
- The breeding stallion requires, above all else, a balanced diet. Stallions should be provided with high-quality forage, consuming approximately 1.5 to 2% of their body weight per day. Depending upon the time of year, good-quality pasture may supply some or all of the stallion's forage needs.
- During the breeding season, the addition of energy-dense feeds, usually a concentrate, may be necessary to satisfy calorie requirements for the increased workload of breeding. Follow the manufacturer's feeding instructions. Fortified concentrates will contain the vitamins and minerals stallions need for optimal nutrition.



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- Stallions should be maintained in moderate to moderately fleshy body condition, which equates to a score of 5 or 6 on the familiar scale of 1 (poor) to 9 (extremely fat). The stallion's ribs should be palpable but not visible and minimal fat may be deposited along the withers, behind the shoulder, and around the tailhead. Once an ideal weight is achieved, every attempt should be made to keep the stallion's weight static. This is best achieved by weighing the horse periodically, usually weekly or biweekly. A weight tape or portable scales can also help track weight.
- An extremely thin stallion may not have the energy stores necessary to endure an arduous breeding season without a drop in performance. Stallions become too thin when they expend more calories than they consume. To encourage weight gain, provide free-choice access to high-quality forage (usually in the form of pasture and/or mixed legume/grass hay) and supplement with the recommended amount of a fortified concentrate. If a stallion fails to gain weight on this basic diet, a fat supplement such as rice bran or vegetable oil can be included in the ration. Because of the energy density of these supplements, stallions will be consuming far more calories than it is possible to obtain from feeding safe amounts of common feedstuffs. One benefit of a fat-enriched diet is a glossy coat, which will enhance the stallion's appearance.
- Reduced appetite is a common cause of inadequate condition. The anxiety surrounding the breeding shed may prevent some stallions from polishing off meals. If this is the case, every effort should be made to make meals especially palatable. The use of molasses and other appetizing feedstuffs will typically encourage an otherwise distracted stallion to eat.
- More common than underfeeding, however, is overfeeding. Obesity predisposes stallions to laminitis and soundness problems (particularly of the hind legs, which is reflective of the strain placed on them during breeding).
- Extremely overweight stallions are also thought to have lowered libido. If obesity is a problem, stallions should have restricted access to pastures, especially in the spring, and only enough grain to ensure the stallion's vitamin and mineral requirements are being met. An alternate way to satisfy these requirements is to feed a balancer pellet or a multipurpose vitamin and mineral supplement. In addition, exercise can be added to the stallion's daily routine to manage obesity.

## Products from Kentucky Equine Research



### Bio-Bloom™ PS

Provides the nutrients necessary for healthy hooves and top-notch coat.



### EO-3™

Omega-3 supplementation results in increased sperm production, concentration, and mobility, while decreasing the number of abnormal sperm. Increases insulin sensitivity in overweight stallions, and reduces body-wide inflammation. Improves the quality of shipped semen.



### EquiShure®

Reduces the risk of hindgut acidosis when stallions are fed high-grain diets or are allowed access to lush pastures.



### Nano-E®

The antioxidant properties of natural-source vitamin E contribute to an increase in sperm quality and resistance to cold shock.



### RiteTrac™

Helps prevent gastrointestinal upset brought on by the anxiety and stress of breeding season.



### Synovate HA®

Helps maintain joint health by lubricating the joint capsule, and contains anti-inflammatory properties to help high-motion joints.

## BODY CONDITION SCORES AND DESCRIPTIONS

<b>[1] Poor</b>	Animal extremely emaciated; vertebrae, ribs, and hip bones projecting prominently; bone structure of withers, shoulders, and neck easily noticeable, no fatty tissue can be felt
<b>[2] Very thin</b>	Animal emaciated; slight fat covering over vertebrae; ribs, tailhead, and hip bones prominent; withers, shoulders, and neck structure faintly discernible
<b>[3] Thin</b>	Slight fat cover over ribs; ribs easily discernible; tailhead prominent, but individual vertebrae cannot be identified visually; hip bones appear rounded but easily discernible; withers, shoulders, and neck accentuated
<b>[4] Moderately thin</b>	Slight ridge along back; faint outline of the ribs discernible; tailhead prominence depends on conformation, fat can be felt around it; hip bones not discernible; withers, shoulders, and neck not obviously thin
<b>[5] Moderate</b>	Back is flat (no crease or ridge); ribs not visually distinguishable but easily felt; fat around tailhead beginning to feel spongy; withers appear rounded over; shoulders and neck blend smoothly into body
<b>[6] Moderately fleshy</b>	May have slight crease down back; fat over ribs spongy; fat around tailhead soft; fat beginning to be deposited along the side of withers, behind shoulders, and along the sides of neck
<b>[7] Fleshy</b>	May have crease down back; individual ribs can be felt but noticeable filling between ribs with fat; fat around tailhead soft; fat deposited along withers, behind shoulders, and along neck
<b>[8] Fat</b>	Crease down back; difficult to feel ribs; fat around tailhead very soft; area along withers filled with fat; area behind shoulder filled with fat; noticeable thickening of the neck; fat deposited along the inner thighs
<b>[9] Extremely fat</b>	Obvious crease down back; patchy fat appearing over ribs; bulging fat around tailhead, along withers, behind shoulders, and along neck; fat along inner thighs may rub together; flank filled with fat

## Selected references

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Bondo, T., and S.K. Jensen. 2011. Administration of RRR-alpha-tocopherol to pregnant mares stimulates maternal IgG and IgM production in colostrum and enhances vitamin E and IgM status in foals. *Journal of Animal Physiology and Animal Nutrition*. 95:2, 214-222.

Brown-Douglas, C.G. 2008. The balancing act of growing a sound, athletic horse. In: *Advances in Equine Nutrition IV*. Nottingham University Press. p. 203-212.

Brown-Douglas, C.G. 2012. Nutritional management of growing horses. In: *Proc. Kentucky Equine Research Conference. Modern Feeding Management for Healthy and Compromised Horses*. Lexington, Kentucky. p. 7-19.

Crandell, K. 2011. Maintaining broodmares on high-forage diets. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Duren, S.E., and K. Crandell. 2001. The role of vitamins in growth of horses. In: *Advances in Equine Nutrition II*. Nottingham University Press. p. 169-177.

Hoekstra, K.E., B.D. Nielsen, M.W. Orth, D.S. Rosenstein, H.C. Schott, and J.E. Shelle. 2001. Stalling young horses alters normal bone growth. In: *Advances in Equine Nutrition II*. Nottingham University Press. p. 165-166.

Huntington, P. 2011. Equine nutrition in the management of flexural deformities. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Huntington, P. 2012. Dietary factors in equine developmental orthopedic disease. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Huntington, P. 2012. Feeding broodmares during lactation. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Huntington, P. 2012. Feeding broodmares in early pregnancy. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Huntington, P. 2012. Feeding management of broodmares. In: *Proc. Kentucky Equine Research Conference. Modern Feeding Management for Healthy and Compromised Horses*. Lexington, Kentucky. p. 44-65.

Huntington, P. 2012. Nutrition of the breeding stallion. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Kentucky Equine Research. 2003. Bridge the gap between OCD and nutrition. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Kentucky Equine Research. 2008. Feeding to prevent developmental orthopedic disease. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Kentucky Equine Research. 2012. From track to turnout: Racing fillies become broodmares. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Kentucky Equine Research. 2013. Supporting fertility in stallions. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

Lawrence, L.A. 2005. Nutritional assessment of weanlings and yearlings. In: *Advances in Equine Nutrition III*. Nottingham University Press. p. 319-326.

Pagan, J.D. 2005. Nutritional challenges of feeding the two-year-old. In: *Advances in Equine Nutrition III*. Nottingham University Press. p. 359-364.

Pagan, J.D. 2011. Nutritional management of the horse. In: C.W. McIlwraith and B.E. Rollin, editors. *Equine Welfare*. Wiley-Blackwell, Ames, IA. p. 71-93.

Pagan, J.D., and D. Nash. 2008. Managing growth to produce a sound, athletic horse. In: *Advances in Equine Nutrition IV*. Nottingham University Press. p. 247-258.

Pagan, J.D., and D. Nash. 2008. Nutrition of the young equine athlete. In: *Advances in Equine Nutrition IV*. Nottingham University Press. p. 161-171.

Shimizu, H., Y. Takeuchi, T. Nozawa, Y. Yamamoto, T. Okamoto, T. Shimamura, A. Utsumi, T. Jitsukawa, M. Endo, T. Fukuda, and T. Yamanoi. 2002. Effects of vitamin E and selenium on pregnant, heavy draft mares on placental retention time and reproductive performance and on white muscle disease in their foals. *Journal of Equine Veterinary Science*. 22:5, 213-220.

Waldridge, B. 2011. Vitamin E requirements in stallions. [www.Equinews.com](http://www.Equinews.com). (Accessed September 1, 2013.)

## About Kentucky Equine Research

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Kentucky Equine Research (KER) was founded in 1988 when Joe Pagan, Ph.D., realized that information generated from research did not reach the individuals who needed it most: feed manufacturers and horse owners. Since then the primary focus of the company has been bridging the gap between the research community and horsemen.

The company accomplishes this through research, consultation, and nutritional solutions.

KER is one of the most prolific private equine nutrition and exercise physiology research companies in the world. The quantity of published research derived from studies conducted at KER rivals that of leading universities. In addition to its own research, KER collaborates with prominent universities to develop and patent products and diagnostic techniques that target specific problems in horses of all ages and uses.

Aside from its research efforts, KER serves as an industry-wide consultant. At the core of the KER consultation services rests its Team Members, a collection of feed manufacturers dedicated to the production of high-quality feeds. The roster of Team Members continues to grow as feed manufacturers around the world recognize the value added to their equine products through KER's research, technology, and credibility.

The advantages of purchasing a feed manufactured by a Team Member are numerous: expert formulation of feed designed specifically in the region or country in which it is to be fed, a complete understanding of trends in equine nutrition, and on-site consultation by leading equine nutritionists, just to name a few.

As a result of its research and consultation endeavors, KER has developed nutritional supplements to assist horse owners and managers in overcoming health problems. Many of these products are completely unique to the industry and provide nutritional solutions to common management problems.

For more information on Kentucky Equine Research, visit [ker.com](http://ker.com).

## Notes

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