



# HEALTH ZONE

## Foal Health

### Pre- and Post-weaning Nutrition for Foals

BY HEATHER SMITH THOMAS

**THE GOAL WHEN RAISING FOALS** is to optimize health and growth. This means proper and adequate nutrition, avoiding extremes—before and after weaning—that could lead to developmental problems.

Dr. Kathleen Crandell, equine nutritionist for Kentucky Equine Research near Versailles, Ky., says the foal's diet is milk at first, but he soon starts nibbling grass or whatever feed mama is eating, mimicking her. By a week or two of age he is regularly sampling what she eats—forages and/or grain. The majority of diet, however, will be milk for the first three months.

“This is the period when foals grow the fastest and have the highest average daily gain,” she said. “It's a time when they learn eating habits and are developing a healthy microbiota in their digestive tract. During this time there's not a lot we need to do in feeding the foal except to pay attention to what the mare is eating and that she is

being properly fed. The foal is also influenced by what the mare was fed during her pregnancy.

“We can't change this now, since the foal is already on the ground, but we can make sure the mare is not gaining or losing too much weight during lactation,” she said. “She will give from herself to provide nutrients to the foal with her milk, supplying what the foal needs during this time of swift growth, regardless of whether she receives adequate nu-



It is important a mare, with a foal on the ground, doesn't gain or lose too much weight during lactation

PHOTOS PROVIDED BY HEATHER SMITH THOMAS

trition, to a point. It's not necessary to supplement the foal during the first three months (unless the mare isn't milking adequately), but it's a good idea to watch and make sure that a foal does not eat too much of mom's feed if she's fed a lot of concentrate."

Some foals acquire a taste for concentrate and may be eating a significant amount by the time they are three months old.

"This can influence their total energy intake and lead to rapid growth, which may lead to developmental problems," explained Crandell.

"After three months you can start adding some creep feed to the foal's diet. This should be something that balances the foal's needs at this time, so it should be fairly high in protein—between 16% and 18% protein. The foal needs a high-quality protein with the right balance of amino acids.

"The feed should be highly digestible with a balance of carbohydrates—not too much starch—while containing some digestible fiber and a little fat," Crandell said. "Starting foals on creep feeds, especially Thoroughbred foals, helps them adjust to life after weaning. The forages (green pasture while they are out with their mothers) help them develop adequate fiber-digesting bacteria in the gut, but the concentrate also has an influence on the microbiota and production of digestive en-



There are several ways to monitor a foal's growth

"The goal when feeding any foal is to maintain steady growth. You don't want erratic growth and compensatory spurts."

— Dr. Kathleen Crandell

zymes. If the foal already has forage and concentrate in the diet, when he's weaned and loses milk from the diet, there won't be such a severe/abrupt change in the microbiota, which makes that transition easier.

The system is already primed for digesting concentrates, and the foal already knows how to eat this feed.

"The foal also needs high quality forages," she said. "This means in addition to pasture, a good quality grass hay or an alfalfa-grass mix. The better the forage quality, the more calories the foal will get from it, and the less excess bulk will be maintained in the digestive tract. Feeding good digestible fiber is one way to keep a foal from getting the typical pot-bellied look."

Age at weaning will make some difference in what you feed. Some foals must be weaned earlier than others, for various reasons. When weaned at four months or younger, addition of a milk-based creep feed is advisable.

"The goal when feeding any foal is to maintain steady growth," she said. "You don't want erratic growth and compensatory spurts. Too-rapid growth often occurs after a slowdown in growth rate (which may be due to weaning, illness, or inadequate nutrition at some point)."

Then when the foal gets better (if he or she was sick) or adjusts to weaning or has the opportunity to eat more again, there's usually a growth spurt to make up for it. That's when the skeletal system is more vulnerable to orthopedic problems. Thus you want to keep a smooth growth rate without those spurts.

"You also want to provide the amount of calories that will produce steady growth," Crandell said. "If foals are getting too many calories they may get too fat, which is not healthy for their skeletal system, and increases the chance of developmental orthopedic disease. You want to maintain moderate body condition and steady growth."

#### MONITORING GROWTH RATE

It's always wise to monitor foal growth and this can be done several ways.

"Regular visual observation helps, and you can also use a system of weighing and measuring foals, checking withers and hip height," she said. "Generally something like this only needs to be done once a month to graph the progress. When



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Kentucky Equine Research has accumulated thousands of weights and measurements on growing horses

graphing the growth curve of a foal it is useful to be able to compare it to a standard growth curve to compare your foal with the average.”

For example, Kentucky Equine Research has accumulated thousands of weights and measurements on growing horses and combined them to develop a series of standard growth curves, used in a program (GroTrac) for monitoring growth.

“You enter the weight and height of the foal on a monthly basis, and this program compares the foal’s data to standard curves for age and breed,” she explained. “In Thoroughbreds there are specific weights and height standard curves for comparisons, by month of birth, sex of the foal, etc.”

This type of monitoring gives you an idea whether your foal is above or below average in growth and whether the growth is steady or erratic.

“If you compare a foal’s growth curve to that of the average Thoroughbred born in March, for example, yours might be above or below the standard curve, partly due to genetics,” Crandell said. “A foal’s genetics determine how big he will be. You can feed and push a foal that genetically isn’t predeter-

## COMPLEX BALANCING ACT

Many factors play into proper growth and prevention of orthopedic diseases, with nutrition being one of those factors.

“If you can get the nutrition right, that’s one less thing to worry about,” said Dr. Kathleen Crandell, equine nutritionist for Kentucky Equine Research. “Even if you have the nutrition perfect for the pregnant mare, and the foal, and have maintained steady growth—and the foal is not too heavy for his age—and he’s been outside with lots of exercise, there are still some things that can go wrong. Genetics and conformation play a role, creating a predisposition toward certain problems. Trauma or illness may also be factors.

“Usually, however, if you get the nutrition right, this is a step in the right direction and is something you can have some control over,” she said.

*By Heather Smith Thomas*

mined to be big, and he won’t become big. He will probably just become fat.

“It doesn’t really matter if your foal is below or above the average curve, as long as the growth rate is consistent and follows that curve. If you see a deviation, however, like growth rate falling off, take a closer look at that foal to see if there is something wrong. If you see a growth spurt this would be a good time to look at the diet and make adjustments if the foal is getting too much feed,” she said.

“This is a good way to make sure the foal is maintaining desired moderate steady growth. Even if you don’t have the standard growth curve to compare to, if you do the monthly measurements and graph it with Excel, you can see if there are deviations—such as spurts or falling off in growth rate.”

Crandell recommends measuring height and weight.

“You could have a foal with steady growth in weight but not in height, which means he’s getting fatter instead of taller or you could have the opposite problem—with a foal that’s getting very tall but is thin and not gaining proper weight,” she said. “It’s important to look at both height and weight.”

You can use a scale, which is most accurate, or a weight tape if you don’t have a scale.

“You can feed and push a foal that genetically isn’t predetermined to be big, and he won’t become big. He will probably just become fat.”

*— Dr. Kathleen Crandell*

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# HEALTH ZONE

## Foal Health

### PROTAZIL

ANTIPROTOZOAL PELLETS (1.56% diclazuril)

#### FOR ORAL USE IN HORSES ONLY

For the treatment of equine protozoal myeloencephalitis (EPM) caused by *Sarcocystis neurona* in horses.

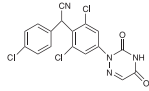
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#### DESCRIPTION

Diclazuril, (±) 2,6-dichloro-α-(4-chlorophenyl)-4-(4,5-dihydro-3,5-dioxo-1,2,4-triazin-2(3H)-yl) benzeneacetonitrile, has a molecular formula of C<sub>17</sub>H<sub>10</sub>Cl<sub>3</sub>N<sub>4</sub>O, a molecular weight of 407.64, and a molecular structure as follows:



Diclazuril is an antiprotozoal (antiprotozoal) compound with activity against several genera of the phylum Apicomplexa. PROTAZIL® (diclazuril) is supplied as oral pellets containing 1.56% diclazuril to be mixed as a top-dress in feed. Inert ingredients include dehydrated alfalfa meal, wheat middlings, cane molasses and propionic acid (preservative).

#### INDICATIONS

PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets are indicated for the treatment of equine protozoal myeloencephalitis (EPM) caused by *Sarcocystis neurona* in horses.

#### DOSE AND ADMINISTRATION

**Dosage:** PROTAZIL® (1.56% diclazuril) is administered as a top dress in the horse's daily grain ration at a rate of 1 mg diclazuril per kg (0.45 mg diclazuril/lb) of body weight for 28 days. The quantity of PROTAZIL® necessary to deliver this dose is 64 mg pellets per kg (29 mg pellets/lb) of body weight.

**Administration:** To achieve this dose, weigh the horse (or use a weight tape). Scoop up PROTAZIL® to the level (cup mark) corresponding to the dose for the horse's body weight using the following chart:

Weight Range of Horse (lb)	mLs of Pellets	Weight Range of Horse (lb)	mLs of Pellets
275 - 624	20	1275 - 1524	60
525 - 774	30	1525 - 1774	70
775 - 1024	40	1775 - 2074	80
1025 - 1274	50	-	-

One 2-lb bucket of PROTAZIL® will treat one 1100-lb horse for 28 days. One 10-lb bucket of PROTAZIL® will treat five 1100-lb horses for 28 days.

#### CONTRAINDICATIONS

Use of PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets is contraindicated in horses with known hypersensitivity to diclazuril.

#### WARNINGS

For use in horses only. Do not use in horses intended for human consumption. Not for human use. Keep out of reach of children.

#### PRECAUTIONS

The safe use of PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets in horses used for breeding purposes, during pregnancy, or in lactating mares has not been evaluated. The safety of PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets with concomitant therapies in horses has not been evaluated.

#### ADVERSE REACTIONS

There were no adverse effects noted in the field study which could be ascribed to diclazuril. To report suspected adverse reactions, to obtain a MSDS, or for technical assistance call 1-800-224-5318.

#### CLINICAL PHARMACOLOGY

The effectiveness of diclazuril in inhibiting merozoite production of *Sarcocystis neurona* and *S. falcatula* in bovine turbinate cell cultures was studied by Lindsay and Dubey (2000). Diclazuril inhibited merozoite production by more than 95% in cultures of *S. neurona* and *S. falcatula* treated with 0.1 ng/mL diclazuril and greater than 95% inhibition of merozoite production (IC<sub>50</sub>) was observed when infected cultures were treated with 1.0 ng/mL diclazuril. The clinical relevance of the in vitro cell culture data has not been determined.

#### PHARMACOKINETICS IN THE HORSE

The oral bioavailability of diclazuril from the PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets at a 5 mg/kg dose rate is approximately 5%. Related diclazuril concentrations in the cerebrospinal fluid (CSF) range between 1% and 5% of the concentrations observed in the plasma. Nevertheless, based upon equine pilot study data, CSF concentrations are expected to substantially exceed the in vitro IC<sub>50</sub> estimates for merozoite production (Dirikolu et al., 1999). Due to its long terminal elimination half-life in horses (approximately 43-65 hours), diclazuril accumulation occurs with once-daily dosing. Corresponding steady state blood levels are achieved by approximately Day 10 of administration.

#### EFFECTIVENESS

Two hundred and fourteen mares, stallions, and geldings of various breeds, ranging in age from 9.6 months to 30 years, were enrolled in a multi-center field study. All horses were confirmed EPM-positive based on the results of clinical examinations and laboratory testing, including CSF Western Blot analyses. Horses were administered PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets at doses of 1, 5, or 10 mg diclazuril/kg body weight as a top-dress on their daily grain ration for 28 days. The horses were then evaluated for clinical changes via a modified Mayhew neurological scale on Day 48 as follows:

- Normal, neurological deficits not detected.
- Neurological deficits may be detectable at normal gaits; signs exacerbated with manipulative procedures (e.g., backing, turning in tight circles, walking with head elevation, truncal swaying, etc.).
- Neurological deficit obvious at normal gaits or posture; signs exacerbated with manipulative procedures.
- Neurological deficit very prominent at normal gaits; horses give the impression they may fall (but do not) and buckle or fall with manipulative procedures.
- Neurological deficit is profound at normal gait; horse frequently stumbles or trips and may fall at normal gaits or when manipulative procedures were utilized.
- Horse is recumbent, unable to rise.

Each horse's response to treatment was compared to its pre-treatment values. Successful response to treatment was defined as clinical improvement of at least one grade by Day 48 + conversion of CSF to Western Blot-negative status for *S. neurona* or achievement of Western Blot-negative CSF status without improvement of 1 alaxia grade.

Forty-two horses were initially evaluated for effectiveness and 214 horses were evaluated for safety. Clinical condition was evaluated by the clinical investigator's subjective scoring and then corroborated by evaluation of the neurological examination videotapes by a masked panel of three equine veterinarians. Although 42 horses were evaluated for clinical effectiveness, corroboration of clinical effectiveness via videotape evaluation was not possible for one horse due to missing neurological examination videotapes. Therefore, this horse was not included in the success rate calculation.

Based on the numbers of horses that seroconverted to negative Western Blot status, and the numbers of horses classified as successes by the clinical investigators, 28 of 42 horses (67%) at 1 mg/kg were considered successes. With regard to independent expert masked videotape assessments, 10 of 24 horses (42%) at 1 mg/kg were considered successes. There was no clinical difference in effectiveness among the 1, 5, and 10 mg/kg treatment group results. Adverse events were reported for two of the 214 horses evaluated for safety. In the first case, a horse was enrolled showing severe neurological signs. Within 24 hours of dosing, the horse was recumbent, bled, and exhibiting signs of dementia. The horse died, and no cause of death was determined. In the second case, the horse began walking stiffly approximately 13 days after the start of dosing. The referring veterinarian reported that the horse had been fed grass clippings and possibly had laminitis.

#### ANIMAL SAFETY

PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets were administered to 30 horses (15 males and 15 females, ranging from 5 to 9 months of age) in a target animal safety study. Five groups of 6 horses each (3 males and 3 females) received 0, 5 (5X), 15 (15X), 25 (25X) or 50 (50X) mg diclazuril/kg (0.22 mg/lb) body weight/day for 42 consecutive days as a top-dress on the grain ration of the horse. The variables measured during the study included: clinical and physical observations, body weights, food and water consumption, hematology, serum chemistry, urinalysis, fecal analysis, necropsy, organ weights, gross and histopathologic examinations. The safety of diclazuril top-dress administered to horses at 1 mg/kg once daily cannot be determined based solely on this study because of the lack of an adequate control group (control horses tested positive for the test drug in plasma and CSF). However, possible findings associated with the drug were limited to elevations in BUN, creatinine, and SGOT and less than anticipated weight gain. Definitive test article-related effects were decreased grain/top-dress consumption in horses in the 50 mg/kg group.

In a second target animal safety study, PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets were administered to 24 horses (12 males and 12 females, ranging from 2 to 8 years of age). Three groups of 4 horses/sex/group received 0, 1, or 5 mg diclazuril/kg body weight/day for 42 days as a top-dress on the grain ration of the horse. The variables measured during the study included physical examinations, body weights, food and water consumption, hematology, and serum chemistry. There were no test article-related findings seen during the study.

#### STORAGE INFORMATION

Store between 15°C to 30°C (59°F to 86°F).

#### HOW SUPPLIED

PROTAZIL® (1.56% diclazuril) Antiprotozoal Pellets are supplied in 2-lb (0.9 kg) and 10-lb (4.5 kg) buckets.

#### REFERENCES

- Lindsay, D. S., and Dubey, J. P. 2000. Determination of the activity of diclazuril against *Sarcocystis neurona* and *Sarcocystis falcatula* in cell cultures. *J. Parasitology*, 86(1):164-166.
- Dirikolu, U., Lehner, F., Natrass, C., Bentz, B. G., Woods, W. E., Carter, W. E., Karpisnik, W. G., Jacobs, J., Boyles, J., Harkins, J. D., Grandstrom, D. E., and Tobin, T. 1999. Diclazuril in the horse: Its identification and detection and preliminary pharmacokinetics. *J. Vet. Pharmacol. Therap.* 22:374-379.

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“While weight tapes can give you a way to periodically monitor growth, they are not 100% accurate,” she advised. “Tapes tend to underestimate weight, although it depends somewhat on the brand of tape or the equation being used for calculating weight from the measurements. It is not uncommon for a farm that uses weight tapes to have individual foals that are consistently under the standard curve for growth, and then they buy a scale and find out that those foals may actually be above the standard curve. For this reason, care should be taken when using weight tapes to not over-feed the foal (trying to catch up to the standard growth curve) since rapid growth can be one of the influencing factors in developing orthopedic diseases.

“Weight tapes are useful to help us see relative change—whether a foal is gaining, staying the same, or losing (being able to see a trend, rather than worrying about the actual number),” Crandell said. “Yet the caveat of using weight tapes is that it should be done by the same person who will put it in the same place on the foal each time, reading the tape the same way. If you have different

people doing it, they may put it on a different way and it won't be meaningful.”

Crandell recommends monitoring foal growth from birth through weaning and yearling age—all the way up until a weaning or yearling sale.

“Things can happen at any point from birth until 18 months, so you want to keep an eye on those foals and make sure they have steady growth,” she said.

Some farms find it inconvenient to weigh foals, but on most farms the mares and foals are brought in from pasture periodically for various reasons anyway.

“They are often brought up once a month for feet trimming, deworming, or some kind of handling,” she noted. “This could be timed with weighing/measuring the foals.”

It pays to trim foals' feet regularly to keep them properly balanced, and also to handle their feet and develop good manners for the farrier. There's a lot you can teach the foals just by handling them periodically and this provides an opportunity to check height and weight.

The regular handling for weights and height measurements is also a very good training experience.



Yearling being weighed

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<sup>1</sup> Hunyadi L, Papich MG, Pusterla N. Pharmacokinetics of a low-dose and DA-labeled dose of diclazuril administered orally as a pelleted top dressing in adult horses. *J of Vet Pharmacology and Therapeutics* (accepted) 2014, doi: 10.1111/jvp.12176. The correlation between pharmacokinetic data and clinical effectiveness is unknown

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“The weight tape gets a young horse accustomed to something around the girth and the feel of a little pressure,” Crandell said. “Foals stepping onto the scale helps prepare them for stepping into a trailer. They are already used to stepping up onto something that sounds and feels different under their feet.”

## NUTRIENTS FOR FOALS: FORAGE

“We can control the amount of concentrate (and ingredients and nutrients in a concentrate) that we feed a foal, but we can’t control grass consumption unless access is severely limited,” she said. “Many Thoroughbreds are raised on grass, which is ideal, since grass is the best forage for them. A recent study showed foals that were out on pasture 24/7 had significantly lower incidence of osteochondrosis than foals spending 100% of their time confined in stalls or stalls with turnout (spending as much time in the stall as turned out).”

A foal that is only brought into a stall for an hour or two each day would be considered a pastured foal. Benefits from being at pasture not only include the forage consumed, but also the exercise. The movement at pasture and concussion from exercise is more normal and natural, and healthier for the growing foal for future soundness.

“The ideal is to obtain optimal growth rather than maximal growth.”

— Dr. Kathleen Crandell

“In earlier literature from the 1600s through 1800s discussing horse raising, those authors didn’t put much emphasis on foal nutrition because it was assumed the mares were going to be turned out to grass, foaled out on pasture, and were only brought in for weaning,” Crandell said. “Then the foals were back out on grass after weaning, until they were about 2, when they were brought in to start working with them. Pasture grass was their nutrition, and they probably had much lower incidence of osteochondrosis and other developmental orthopedic problems than our modern horses because they were allowed to grow at a slower rate.”

Grass in those days may have been a little more nutritious in terms of necessary minerals. Animal manure was used as fertilizer, returning nutrients to the soil.

In modern times intensive farming (taking crops off, without adding much back except for the nutrients in chemical fertilizers) has depleted some soils of micronutrients—so the hay and pasture grown on those soils may need supplementation.

“Grasses today have been selected to be high in carbohydrates and sugars but may not be as high in certain minerals as we need them to be,” Crandell said. “Often our horses need some kind of supplement that supplies the necessary minerals in proper balance.”

## ENERGY AND PROTEIN

“The foal needs adequate energy in the diet, which he gets from structural (fiber in forages) and non-structural carbohydrates (starches and sugars) as well as fats,” she said. “The amount of energy in the diet is a key determinant of growth for the foal. The more energy the foal gets, the faster he will grow. The ideal is to obtain optimal growth rather than maximal growth. Controlling the amount of energy in the diet is important for maintaining optimal growth.”

“A study done in the 1990s looked at the influence of energy versus protein intake on the development of osteochondrosis,” she said. “The researchers found that when comparing foals fed 100% of the energy requirement with foals fed 129% of the energy requirement, and foals that received 100% of the protein requirement versus foals receiving 129% of the protein requirement that the additional protein (above the necessary requirement) did not increase the incidence of osteochondrosis more than in the control horses. However, the foals fed excessive energy grew faster and the number of foals in that group developing osteochondrosis was significantly

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higher. Only one foal in the high-protein group and one foal in the control group developed osteochondrosis, whereas six out of the seven foals in the high-energy group developed osteochondrosis. Thus we realize that too much energy can be one of the factors that may lead to development of orthopedic diseases.

"This does not negate the fact foals need protein, and the right amount of protein and quality of protein," she continued. "Proteins are made up of amino acids. We know the important amino acids for quality protein include lysine because this one is growth-limiting if there is inadequate amount in the diet. If the foal doesn't have enough lysine in the diet, he won't grow very well.

"The second important amino acid that we know is limiting for growth is threonine, and possibly proline," she said. "At this time, we don't really have a

## ULCERS AND PARASITES

**G**astric ulcers are actually quite common in young horses.

"Because they are so prevalent we wonder if it might be something normal that these youngsters go through, but we don't know," said Dr. Kathleen Crandell, equine nutritionist for Kentucky Equine Research. "Severe ulcers can be a factor in how well the foal grows, however. If the foal is not thriving, not growing well, ulcers might be something to look at. Deworming is also important and checking parasite loads."

It's important to have foals healthy at weaning time. How well they handle the weaning can be influenced by whether they have ulcers or are suffering from a heavy parasite load. Reducing stress level is always helpful, weaning in the least-stressful way possible.

"A lot of foals develop ulcers from weaning," she said. "This can be due to multiple factors which would include stress and change of diet." *By Heather Smith Thomas*

good handle on whether any of the other essential amino acids are important in growth."

If there is sufficient energy in the diet but not enough protein, the foal won't have optimum growth.

"If you have enough total protein but not enough lysine you won't see good growth," she said. "You must have enough of the important nutrients to have a good balance. Fortunately lysine is easy to obtain because there is a good

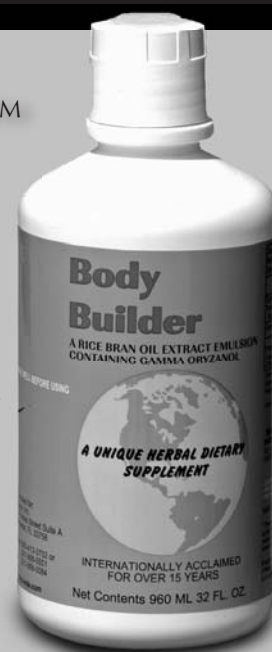
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Horses heading in to be weighed

amount in grass, particularly green grass,” she said.

“Good quality commercial concentrate products also contain adequate lysine, particularly if you select a feed that is formulated for the growing horse. It’s not a good idea to feed a maintenance product to a young, growing horse because it may not contain the proper

levels of high-quality protein.”

Milk proteins, soybeans, and alfalfa are good sources of quality protein, along with green grass. A foal that’s still nursing, getting good pasture or a little alfalfa hay, will have adequate protein.

“After weaning you will have to provide the properly balanced diet for the foal,” Crandell said. “Weaning often co-

incides with diminishing pasture quality in the fall or winter. To maintain a weanling through the winter you need to make sure there is quality protein in the diet. If weanlings are just getting grass hay, then a concentrate should be added, and the protein quality and amount in the concentrate becomes even more important. If you can provide an alfalfa-grass hay this helps and takes some of the pressure off the concentrate to provide so much of the protein.

“To ensure a steady supply of protein going into the foal, it helps to provide smaller, more frequent meals,” she said. “Over the 24-hour period it would be the same amount of protein in two feedings versus four feedings, but the foal will get more good from it. The body can use the protein better with a steady rather than sporadic supply. Then the excess protein isn’t being broken down and excreted as waste.”

## MINERALS AND VITAMINS

Another limiting factor in terms of growth would be certain minerals that are necessary for building tissue, particularly bones.

“The important minerals include calcium, phosphorus, magnesium, copper, zinc, and manganese,” Crandell said. “Also important are certain vitamins—especially vitamin A, D, and E. All of these vitamins and minerals are important for bone health and growth.

“The right balance is crucial, and not just the amounts. You need the right amounts but also a correct relationship between them, such as with calcium and phosphorus. The feed should contain about 1.5 to two parts calcium to one part phosphorus, in that kind of ratio. The zinc/copper ratio also needs to be correct, at about three to five parts zinc to one part copper. If those important minerals aren’t there, or the ratios are not correct, you may not have good growth even if you have the right amount of energy and protein in the diet.”

The diet must contain the proper building blocks for the growing foal,

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Growing horses need high-quality forages in addition to pasture

especially for the bones, at that age.

“If a foal is experiencing rapid compensatory growth or has a severe case of physitis, you need to cut back just on the calories rather than all the other elements of diet,” she said. “Cutting the calories will slow the growth, but the foal will still be growing a little—and needs the right amount of protein, minerals, and vitamins for developing strong bones.

“A foal suffering from a severe case of physitis, for example, might need to be cut back to just a ration balancer and some good quality grass hay, rather than being fed larger amounts of concentrates,” she said. “The ration balancer would contain the necessary protein (amino acids), minerals, and vitamins essential to health and proper growth without adding a lot of calories that would fuel more rapid growth.” **BH**



# performance

[per-fawr-muh ns] *noun*

1. The execution of an action.
2. Something accomplished.

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