

Phosphorus in My Horse's Diet: What is it Good For?



Mares and foals have higher phosphorus requirements than mature sedentary horses

UNIVERSITY OF KENTUCKY COLLEGE OF AGRICULTURE, FOOD AND ENVIRONMENT PHOTOS

Most horse owners know their horses need dietary calcium (Ca) and phosphorus (P) in the right amounts to maintain a healthy skeleton. Phosphorus in bones not only provides structural support for the skeleton, but it also acts as a reserve of P for other bodily functions. Phosphorus is important in cell membranes and in reactions requiring cellular energy. Phosphorus also helps form the backbone of DNA and contributes to the pH and electrolyte balance in body fluids. In a nutshell, P is an essential nutrient that animals cannot live without.

Dietary P comes from many common feed ingredients, including forages, oats, corn, and soybean meal. The P found naturally in grains and forages is considered organic; feed manufacturers might also add inorganic P to commercial horse feeds. Inorganic P sources are most often listed on a feed label as monosodium phosphate; mono-, di-, and tri-calcium phosphate; and defluorinated phosphate. These inorganic phosphates come from

mining and processing rock phosphate to make them acceptable for animal consumption.

Adding inorganic phosphate to feeds to ensure adequate P intake might seem good for the horse, but it's potentially harmful for the environment. Currently, only a handful of rock phosphate mines remain in the world, and the raw supply of phosphate is dwindling. Because P reserves are decreasing, more attention is being placed

on conserving this nonrenewable resource. Further, P excreted in animal manure can be an environmental issue. Phosphorus from animal manure can run off or leach into nearby water bodies where P-hungry algae consume it and grow excessively.

Consequences of these algae "blooms," or eutrophication, include reduced oxygen for aquatic life, the death of oxygen-requiring species, and ecological disruption. To reduce eutrophication due to P runoff, farmers are being encouraged to reduce their animals' P excretion and implement a variety of other best management practices. Most of the concern about P in animal manure has focused on cattle and swine operations, but the potential for P runoff exists in areas of dense horse population, as well.

Why is inorganic P added to horse feeds?

Research conducted in the 1970s concluded that horses could not absorb the P from grains and grain byproducts as effectively as they could P from inorganic sources (Hintz et al., 1973). Consequently, feed manufacturers began adding inorganic (rock) phosphate to concentrates to make sure horses received enough dietary P. However, if a horse has too much P in its diet, it will just excrete it into the environment. Researchers at the University of Kentucky (UK) are focused on finding a balance between feeding enough P for optimal health and production (growth, lactation,

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Phosphorus ...

reproduction, performance, etc.) without overfeeding P, thus conserving this resource while reducing the environmental footprint of horse operations.

Can horses effectively utilize P from diets not containing inorganic P?

Results from a recent study conducted at UK has challenged the belief that horses cannot efficiently utilize organic sources of P (Fowler et al., 2015). In the study, a group of yearlings and a group of mature horses consumed a diet consisting of forage and a pelleted concentrate formulated to meet daily recommended P intakes with only the organic P found in the feed and no added inorganic P. The researchers collected feces from these horses to calculate digestibility of P. They found that horses were able to digest and absorb enough P to meet their requirements, even without the addition of dietary inorganic P.

The researchers also measured the degradability of a compound called phytate that binds P (phytate-P). Phytate-P is a common organic form of P found in many grains and grain byproducts that cannot be digested by simple-stomached animals. However, some gut bacteria are capable of releasing P from phytate for absorption. In this study, phytate-P was almost completely degraded (95% disappearance) in the feces, indicating that horses and their microbial communities can liberate much of the P associated with this molecule. Researchers concluded that both growing and mature horses can effectively utilize P from organic sources and may not need inorganic P added to their feeds to meet their requirements.

Based on this research, supplementing horses with inorganic P might be unnecessary if other feed ingredients already contain adequate concentrations. However, it is important to realize that some horses, such as breeding and performance horses, have relatively high P requirements and that the P content of common equine feeds can vary greatly. For example, beet pulp and soybean hulls, common feed ingredients found in low-starch feeds, contain relatively low P (~0.1%). On the other hand, wheat bran and rice bran can have P concentrations upwards of 1.2%.

The diet's forage component can also provide varying amounts of P. Certain



Researchers collected study horses' feces to measure their phosphorus levels.

areas of the United States, such as the northern and northwestern states, have low soil P, and forage grown in these areas also contains low P. Conversely, forage grown in areas with high soil P, such as states in the Southeast, will have greater P concentrations. The P concentration of the diet components ideally should match the P requirement of the horse. Mature nonbreeding horses have relatively low P requirements compared to lactating mares and growing horses. The P requirements of many mature nonbreeding horses can be met with the appropriate forage; additional concentrate is often not necessary. However, horses with high P requirements should receive feed concentrates with the appropriate P concentration to ensure they receive adequate phosphorus.

Currently, it appears that some horses can be fed diets without added inorganic P. However, more research is needed to examine whether horses with relatively high requirements truly need inorganic P added to their diets. If P needs can be met with organic sources of P, we can minimize the use of diminishing rock phosphate reserves and reduce excessive excretion of P into horse manure. **UK**

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The Horse: Your Guide to Equine Health Care

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Crowdfunding Studies Instrumental in Securing Five-Year USDA Grant

The first research crowdfunding project launched at the University of Kentucky helped secure an approximate \$2.1 million, five-year, multiple species United States Department of Agriculture (USDA) grant.

In January 2014, Martin Nielsen, DVM, PhD, Dipl. EVPC, ACVM, an equine parasitologist, veterinarian, and assistant professor at the UK Gluck Equine Research Center, launched the crowdfunding project “Let the germs get the worms: Testing a novel probiotic compound for treatment of equine parasites.” The project generated more than \$12,000. Crowdfunding is a relatively new term that describes reaching out to the general public to meet a fundraising goal. Success in attaining the goal often depends on many individuals making smaller donations through a website.

As the name of the crowdfunding campaign implies, Nielsen’s research project focused on developing a novel bacterial agent for parasite

control. Parasite populations are becoming widely resistant to commercially available dewormers, and there is a critical need for new and alternative treatments. The money raised in the campaign allowed Nielsen and his collaborators to conduct a number of laboratory tests with the bacterial products and equine strongyle parasites, and the results were very promising. The data was included in the proposal for the USDA grant and helped make an appealing case for an expanded research project.

“This shows exactly how crowdfunding can play a significant role in getting research funding,” Nielsen said. “In addition to the publicity generated during the active campaign, crowdfunding provided a stepping stone for getting a larger grant. With the limited amount of grants available for equine research, we need to be more entrepreneurial in our fundraising efforts. Crowdfunding represents one such strategy.”



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Last year, Dr. Martin Nielsen launched an equine parasite-related crowdfunding project.

David Horohov, PhD, chair of the Department of Veterinary Science, director of the Gluck Center, and Jes E. and Clementine M. Schlaikjer Endowed Chair, commended Nielsen for his initiative and efforts: “It is gratifying to see how the novel initiative by one of our younger faculty members to use crowdfunding as a means of generating preliminary data has resulted in a significant award from the USDA for his research program,” Horohov said. “Dr. Nielsen should be credited not only for this accomplishment, but for the initiative and entrepreneurship he showed in procuring these funds.”

Raffi Aroian, PhD, professor at the University of Massachusetts Medical School, is the principle investigator of the USDA grant. Nielsen, along with researchers from Virginia Tech University and USDA Beltsville, are co-principle investigators. The aim of the research project is to develop and evaluate a new bacterial agent for parasite control of farm animals (sheep/goats, horses, cattle, and pigs) as well as humans. Nielsen’s laboratory will evaluate this treatment modality in the horse while other collaborators will evaluate it in the other animals.

Intestinal parasites cause significant loss of health, productivity, reproduction, life, and profits associated with large farm animals. In addition, more than 1.5 billion people are infected by parasites. Consequences in children include malnutrition, growth stunting, lower cognitive skills, and immune defects; impact on adults can include poor pregnancy outcomes, lethargy, and lower productivity. **UK**

>Jenny Evans, MFA, is the interim executive director of the Gluck Equine Research Foundation and marketing and promotion specialist senior at the Gluck Equine Research Center.

Understanding Round vs. Square Bale Hay for Horses: Part 2

Hay for horses can be purchased in many forms, but the two most common are round bales and small square bales. Both have significant advantages and challenges and can be a source of quality forage for horses when managed correctly. In the second of this two-part series, we will explore square bales and how to best use them. (Read last month’s article focusing on round bales at TheHorse.com/36871.)

Before purchasing or putting up hay, it is important to consider that forage

quality is not dependent on size or shape. High-quality (or low-quality) hay can be packaged in round or square, large or small bales. Forage quality is at its peak when harvested at the correct stage of maturity. The extent of quality loss is related primarily to time, management, and weather conditions. Once baled and stored properly, forage quality losses are minimal over a long period of time. Improper feeding of hay can also cause significant quality and quantity losses.

Continued on next page



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Hay racks and mangers can help reduce hay losses when feeding.

Round vs. Square Bale ...

Small Square Bales

Small square bales are the most common form of hay for horses—and for good reason. They are conveniently sized, easy to handle, and are typically higher in quality than round bales (mainly because more care is usually put into harvesting and storing them), but these perks come at a price, as small bales are more expensive than large round ones.

Making Baling forage into small square bales is time-consuming and labor-intensive. Unless you purchase a hay accumulator, bales must be picked up from the field and stacked in a barn by hand. Whether you are making your own hay or purchasing it, labor will increase the forage's overall cost.

Size Small square bales are just that—small. Traditionally they are about 3 feet long by 18 inches wide and just over 1 foot tall and can range from 35-70 lbs, with an average of 50 lbs. Hay producers prefer bales to be denser to save room when stacking in a storage facility and for transport. However, many horsemen prefer lighter bales that are easier to handle.

Storage Because of the added labor and, thus, cost involved with square bales, they are almost always stored indoors. Their flat surface would collect water and cause them to deteriorate rapidly if left uncovered. If stored inside, forage quality remains stable for a prolonged period with minimal changes. Storage losses are usually minimal when bales are tied tight. Loose or broken strings, however, often result in lost material.

Handling This is another area where small square bales have an advantage. Unless you are moving a large number of bales or traveling a long distance, you can maneuver bales by hand. Small farms might purchase a couple of bales at a time and transport them in a truck, horse trailer, or even an SUV. Small square bales are easily fed in stalls and ideal if intake needs to be limited.

Feeding Losses As with round bales, feeding losses with square bales can be significant and vary widely. When



Small square bales are easy to store, handle, and feed.

feeding in a stall, some horses will drag their hay around, resulting in much higher losses. Some people will shake hay out into a pile, making it harder to spread around. Using hay feeders, such as mangers, racks, or nets, will reduce feeding losses either in a stall or in a paddock. Using feeding pads in paddocks will also reduce feeding losses by keeping hay out of mud. Most horses will choose to graze over consuming hay, so some is likely be wasted if fresh forages are available.

Summary Small square bales are easy to store, handle, and feed. This convenience comes at a price; small square bales will likely be much more expensive than similar quality round bales. Storage is usually not an issue with these bales, but hay feeders are essential for reducing feeding losses.

Many equine operations find that a combination of round bales and small square bales work best. Round bales are more economical for feeding groups of horses in a pasture setting while small square bales are far easier for individual feeding. Regardless of what type or size of hay you choose, feeding losses can

add up quickly and cost your operation substantially. Investing some time and money into reducing these losses will ultimately pay off in the long run. Hay is an important aspect of managing horses, but pasture is always less expensive than hay of any size or shape. **UK**

>Krista Lea, MS, coordinator of UK's Horse Pasture Evaluation Program; Ray Smith, PhD, professor and forage extension specialist; and Tom Keene, hay marketing and production specialist, provided this information. All three are part of the University of Kentucky College of Agriculture, Food and Environment's Department of Plant and Soil Sciences.



Haynets also reduce feeding losses.

UK Study Vital in Leptospirosis Vaccine Development

Leptospirosis is a costly disease for livestock and pet owners. Causing problems such as abortion, premature birth, blindness, and more, the disease spreads easily through nose, mouth, and eye contact. A vaccine has been available for several years for cattle, swine, sheep, and dogs, but until recently, horses were left unprotected.

Researchers at the University of Kentucky Veterinary Diagnostic Lab (VDL), in Lexington, recently celebrated the culmination of many years of work with the release of a vaccine for equine leptospirosis.

In building a case for the vaccine, a process that took 10 years, VDL director Craig Carter, DVM, PhD, Dipl. ACVPM, and his colleagues approached Zoetis, a global animal health company, with their research. They recruited 29 state laboratories in the United States and one in Ontario, Canada, to gather blood from 1,495 horses.

"What we found confirmed our suspicions," Carter said. "Horses are exposed to leptospirosis across the country. It's one of those bugs that are everywhere. It's a unique, coiled bacteria that persists in moist environments."

Carter said the bacteria inhabit the kidneys of mammals.

"Rodents, skunks, raccoons, and opossum are all carriers of the



ANNE M. EBERHARDT/THE HORSE

Zoetis released its leptospirosis vaccine in late 2015.

Leptospirosis Vaccine ...

bacteria," he said. "It's very difficult to control, which makes it a perfect candidate for a vaccine."

Zoetis repeated the UK VDL study and came up with the same outcomes. As a result, they prioritized developing the vaccine. After safety and efficacy studies, the company released the vaccine in late 2015. The official name is Lepto EQ Innovator.

Many farms are moving to vaccinate their horses, and the UK VDL will begin to track the effectiveness of the vaccine in Kentucky.

"Now everything starts all over in a way," Carter said. "Now we need to further evaluate the efficacy and duration of immunity provided by the product."

Carter sees an economic benefit to stopping leptospirosis. During the 2006-2007 breeding season, the UK VDL confirmed 39 leptospirosis-induced abortions. About half the owners felt comfortable sharing the expected value of the lost foals. The average foal loss was around \$189,000. Carter looked back at the abortion cases from 1993 to 2012 and put a loss value on those 541 foals at about \$102 million.

"And that's just here in the Bluegrass, and the estimates are based only on the abortion cases submitted to our laboratory," he said. "There are about 5 million horses in the United States."

Of the many types of leptospirosis, two are associated with foal loss. Carter said, based on the horses tested in the study, about 45% of horses have been exposed to leptospirosis. Depending on the level of exposure and immune response of the horses, they either get sick or clear the infection.

"Although there's still work to do, we're really hopeful this will mark the end of leptospirosis as a major disease (in horses)," Carter said. "Our hope is that vaccinated horses will be protected from the abortion syndrome, the renal syndrome, and uveitis, also known as moon blindness."

Currently, Zoetis recommends vaccinating healthy horses six months or older and administering a booster three to four weeks after the initial vaccine. As with any immunizations, owners should contact their veterinarian about vaccinating pregnant mares.

More information about the vaccine is available online, including video interviews with Carter, at zoetisus.com/products/horses/lepto-eq-innovator/index.aspx. **UK**

>Aimee Nielson is an agriculture communication specialist in the UK College of Agriculture, Food and Environment.

THE GRASS GUIDE

BERMUDAGRASS (*Cynodon Dactylon*)

Life cycle: Warm-season perennial

Native to: Southeast Africa

Uses: Pasture and hay

Identification: Smooth or rough leaf blades attached to the stem with a hairy collar, seed head has three to six spikes with triangular seeds

Like other warm-season perennial grasses, bermudagrass grows best in hot, humid climates, making it an important species in the Deep South.



Bermudagrass leaf blades attach to the stem with a hairy collar.



The seed head of Bermudagrass.

Bermudagrass shows increased winter kill north of Tennessee and Missouri, but commercial breeding has improved winter hardiness in some varieties. This grass has average nutrient quality, but its persistence even in close grazing or cutting makes it an ideal forage for horse pastures.

Due to high forage yields and average quality, bermudagrass also makes excellent horse hay. It can also handle traffic and can be used for erosion control in hilly pastures.

To the untrained eye, bermudagrass shares a striking resemblance to another warm-season perennial, nimblewill, which is common in Kentucky, West Virginia, and Virginia. Nimblewill is bitter and will not be grazed by livestock, so be sure to properly identify the plant before making significant management decisions. **UK**

>Krista Lea, MS, coordinator of UK's Horse Pasture Evaluation Program within the Department of Plant and Soil Sciences; and Ray Smith, PhD, professor and forage extension specialist within UK's Department of Plant and Soil Sciences, provided this information.



GRAD STUDENT SPOTLIGHT

MORGAN PYLES

**From: Central Florida and Wyoming
Degrees and institutes where received:**

**Central Wyoming College, associate's degree in applied science in horse management, along with credentials in teaching riding and equine training technologies
University of Kentucky, BS in Equine Science and Management**

Morgan Pyles decided to pursue further education after discovering her passion for education during her time as a teaching assistant at Central Wyoming College. Through family connections, Pyles was introduced to Bob Coleman, PhD, associate professor in equine extension, and quickly determined that the University of Kentucky (UK) was the school for her.

"After talking with Dr. Coleman, I knew that UK would be the best choice," Pyles said. "Not only is Central Kentucky a great place to study equine nutrition, but the quality of the research and teaching in the equine program was exactly what I was looking for."

After completing her bachelor's degree, Pyles spent a summer working with Ed Squires, PhD, and Barry Ball, DVM, PhD, on a stallion study through the UK Gluck Equine Research Center. Through that study, Pyles met Laurie Lawrence, PhD, professor in the Department of Animal and Food Sciences, who is now advising Pyles as she pursues her master's degree in equine nutrition.

"My current research, funded by a Specific Cooperative Agreement (SCA) in collaboration with Michael Flythe, PhD, (Microbiologist for USDA's Forage-Animal Production Research Unit) will hopefully further the current knowledge about colonization of intestinal bacteria in foals and some factors that may influence the process of colonization," Pyles said.

Pyles' master's research project looks at the effects of maternal diet on the colonization of intestinal bacteria (which plays a vital role in breaking down roughage in the hindgut) in the foal. During the study, mares were fed two different diets, one corn-based and the other oat-based. The colonization of intestinal bacteria was evaluated by culturing fecal samples.

"Foals are born with a sterile gastrointestinal (GI) tract, meaning they are born with no microbial community in the GI tract; however, we know that their GI tract is rapidly colonized after birth," Pyles said. "We know that different starch sources (oats or corn) can affect the microbial community in adult horses, and we wanted to see if there would be an effect on the colonization in the foal."

In addition to her main research project, Pyles also led a study that looked at the effects of two probiotics on fecal bacteria during antibiotic use in adult horses. Pyles also assisted Ashley Fowler, MS, in her research focused on phosphorus excretion in horses.

"Throughout my time in graduate school I have learned the value of lab technicians and my lab mates, or maybe I should say how priceless they are," Pyles said. "I honestly would not have been able to complete these projects without their help and support."

After completing her master's, Pyles plans to continue her education and pursue a doctorate degree with the ultimate goal of finding a faculty position and teaching. **UK**

>Hannah Forte is a communication intern with the UK Ag Equine Programs and Gluck Equine Research Center and undergraduate student majoring in community and leadership development at UK.



Horohov Featured Guest During "UK at the Half"

David Horohov, PhD, chair of the Department of Veterinary Science at UK, director of the Gluck Equine Research Center, and Jes E. and Clementine M. Schlaikjer Endowed Chair at the Gluck Equine Research Center, was the featured guest during the "UK at the Half" that aired during the University of Kentucky vs. Louisiana State University basketball game, broadcast on the radio Jan. 5.



Horohov spoke about his research interests past and present and the goals for the future of the Gluck Center.

"UK at the Half" airs during the half-time of each UK football and basketball game broadcast and is hosted by Carl Nathe of UK Public Relations and Marketing. To listen to the interview, [click here](#). **UK**

>Jenny Evans, MFA, is the interim executive director of the Gluck Equine Research Foundation and marketing and promotion specialist senior at the Gluck Equine Research Center.

UK Researcher Explores the Effects of Climate Change on Soil Microbes

Soil microbes transform nutrients in the soil into a usable form for plants. A University of Kentucky College of Agriculture, Food and Environment researcher recently studied the effects that climate change could have on these essential organisms.

During the one-year study, Lindsey Slaughter, a UK graduate student, studied an area of typical Central Kentucky cool-season pasture and took soil samples to see how the microbes would react to year-round temperatures that were warmer by 3°C and to a 30% increase in precipitation during the growing season. These figures are

Climate Change ...

what scientists predict might occur in Kentucky as a result of climate change.

Slaughter found that the soil in the warmed plots, as well as the plots that were managed for both higher temperatures and precipitation, contained more microbes year-round. During the winter, these warmer microbes also consumed more carbon than normal, resulting in less available food for them to transform into nutrients for plants when they need it during the growing season.

"Areas that have less organic material are usually less productive," she said. "Maintaining a healthy amount of soil carbon is really important to long-term soil productivity and health."

She compared the simulated climate change effects to the seasonal effects that occurred during 2011, the year of the study. That year featured near-average temperatures and precipitation for the area.

"During that year, the pastures had more microbes during the spring and winter, but a larger active microbial community during the summer," she said.

Slaughter said scientists need more long-term studies before they can fully understand the effects of climate change on soil microbes. Her study occurred during the third year of a larger, five-year study led by UK grassland agroecologist Rebecca McCulley, MS, PhD, that looked at the effects of climate change on forages.

"The effects of climate change on microbes were really small in this study, but I'm not sure if my results are the starting or ending point of the effects of climate change," she said. "If it's the start, these changes could escalate over the years, which could affect the health of the soil and the pasture's future productivity."

Slaughter's results were published in the *Soil Science Society of America Journal*. [UK](#)

>Katie Pratt is a communication specialist with UK's Ag Communication



COURTESY JIM NELSON/MCCULLEY

Lindsey Slaughter took cool-season pasture soil samples over the course of a year to see how microbes would react to rising temperatures and precipitation.

An Equine New Year's Resolution: Better Pasture Management

The beginning of a new year is a great time to set priorities for the rest of the year. Focusing some of our efforts on improved pasture management could potentially have positive impacts on our horses, our wallets, and the environment. Like many resolutions, it is a yearlong undertaking that requires advanced planning.

Benefits of Improved Pastures

Improving pastures has many benefits that justify the time, effort, and potential cost involved. Pastures that have desirable grass cover provide safe footing for horses and, in many cases, all of the nutrition needed to maintain them.

"The most economical way to feed a horse is on pasture," said Tom Keene, forage agronomist at the University of Kentucky College of Agriculture, Food and Environment.

Stored feeds, such as grain mixes and hay, are significantly more expensive than maintaining a healthy and productive pasture. Weed control in pastures improves the quality and quantity of forage produced, is more aesthetically appealing, and reduces toxic plant growth. Finally, a healthy pasture reduces manure and fertilizer runoff into nearby waterways and slows soil erosion.

Planning Ahead

Improving pastures in an economical way requires knowing "the what," "the how," and "the when" concerning pasture management. Knowing when to carry out specific practices can sometimes be difficult due to climate differences across the United States. To address this, we asked three forage extension specialists to describe management practices and timing in their respective areas. Marvin Hall, PhD, at Pennsylvania State University in central Pennsylvania, said his region is dominated by cool-season grasses (those that grow best when temperatures are between 60°-80°F). Jennifer Johnson, PhD, at Auburn University in south central Alabama, said she relies heavily on warm-season grasses (those that grow best when temperatures are 85°-95°F). And Ray Smith, PhD, at the University of Kentucky in Central Kentucky, is located in the "transition zone," an area where farms can utilize both warm- and cool-season grasses (see map on the next page).

Winter

The goal of winter pasture management is to minimize the traffic's impact on the pasture. This usually means removing horses from pastures or limiting their access, especially during wet periods. Keep horses in a "sacrifice area" during winter months, as heavy traffic will damage most grasses that are now dormant. Exceptions include grazing stockpiled tall fescue or bermudagrass or annual ryegrass.

Stockpiling refers to setting aside grazing areas in the late summer or early fall and allowing forage to accumulate for grazing in the early winter, therefore reducing the need for feeding as much hay. Think of stockpiled forage as hay still standing in the pasture rather than stacked in the barn. Harvesting, baling, transporting, and storing hay is an

KEEP YOUR HORSE IN THE PICTURE.

Although not well-known, *Leptospira interrogans* serovar Pomona can cause devastating problems. *L. pomona* can colonize in the kidneys, be shed in the urine and the horse can become septicemic, which can potentially lead to abortion, uveitis and acute renal failure. LEPTO EQ INNOVATOR[®] is the first *Leptospira* vaccine developed specifically for horses to help prevent leptospirosis caused by *L. pomona*. It also helps prevent infections of the blood, which could, but has not been demonstrated to, help reduce the potential risk of equine recurrent uveitis, abortion or acute renal failure caused by *L. pomona*.^{*} An efficacy trial demonstrated LEPTO EQ INNOVATOR safely helps prevent *L. pomona* infections and urinary shedding.¹ A safety trial showed it was 99.8% reaction-free.^{2,3} To learn more, visit LEPTOEQINNOVATOR.com.

^{*}Currently, there are no vaccines available with USDA-licensed label claims against equine abortions, uveitis or acute renal failure due to *L. pomona*.

¹ Data on file, Study Report No. B850R-US-12-011, Zoetis Inc.

² Data on file, Study Report No. B951R-US-13-043, Zoetis Inc.

³ Data on file, Study Report No. B951R-US-13-046, Zoetis Inc.

Better Pasture Management ...

expensive process; grazing stockpiled grasses allows the horse to harvest the forage in the field, saving you money and time. Grasses such as bermudagrass and tall fescue are excellent for stockpiling because they hold their nutritive value after a killing frost and will survive winter grazing well (when managed properly). Pastures dominated by grasses such as orchardgrass and bahiagrass are not good candidates for stockpiling, as freezing temperatures lower their quality, and winter grazing easily damages them.

Frost seeding clovers into pastures improves forage quality and production. Perform frost seeding in late winter. Broadcast clover seeds four to six weeks before the last frost into pastures that have been either grazed heavily or mowed close. As the ground freezes and thaws, it will expand and contract, working seeds into the soil. These seeds will germinate in early spring. Do not frost-seed grasses and other legumes such as alfalfa, as their success rates are low. Whenever seeding, always use quality seed of improved varieties ideal for your area.

Spring

Spring is all about balancing quality with quantity. Pastures dominated by cool-season grasses will be extremely productive and begin producing seedheads during the spring. Forage quality and maturity are inversely related, meaning that as the plants mature, yield increases while forage quality decreases. Many farms produce more forage in the spring than their horses can keep up with. In these situations, mow or divert excess forage into hay production. Mowing will also remove seedheads, keeping grasses in a vegetative state and improving the pasture's forage quality.

Seeding is another springtime task. For southern areas, spring and early summer are the only times to seed warm-season grasses such as bermudagrass. Seed or plant bermudagrass via vegetative propagation (planting sprigs). Any planting's success rests on proper preparation, including weed control and fertility. You can also seed cool-season grasses in the spring, but ideally seed them in the fall, especially in the transition zone and the southern United States. The chart above contains a list of common cool-season and warm-season grasses for different areas.

Naturally occurring tall fescue (usually KY 31+) is known to be infected with an endophyte that can produce chemicals toxic to broodmares. This is a significant concern in the transition zone where tall fescue is dominant and large broodmare herds are common. If significant tall fescue is present in pastures, remove broodmares from it during their last trimester. Have the fescue analyzed for endophyte and ergovaline (the toxic chemical) presence in the late spring/early summer, when ergovaline levels peak.

Summer

Summer is all about managing warm-season grasses. This is the time of highest production for warm-season grasses. Horse farms in the south will typically be grazing pastures heavily during this season and haying excess forage. Bermudagrass is very responsive to nitrogen applications; if maximizing yield is important (such as when making hay) add nitrogen applications in the summer. However, if there are not enough horses to consume the forage produced, reduce your nitrogen

Common Horse Pasture Grasses		
	Cool Season Grasses	Warm Season Grasses
Northern U.S.	Bromegrass Orchardgrass Timothy Perennial Ryegrass Tall Fescue	N/A
Transition Zone	Tall Fescue Orchardgrass Kentucky Bluegrass Perennial Ryegrass	Crabgrass* Bermudagrass
Southern U.S.	Tall Fescue Annual Ryegrass*	Bermudagrass Crabgrass* Bahagrass Dallisgrass
*annuals		

applications.

In northern locations, most warm-season grasses are considered weeds. Crabgrass is one warm-season grass that is very nutritious for horses (and they like it). However, it and other warm-season grasses are not desired in cool-season pastures because they die back in the fall, leaving bare areas that problem weeds can fill in. For cool-season pastures, summer is a time to reduce grazing pressure to prevent warm-season grasses from invading. Additional supplementation might be needed in the transition zone, where summer temperatures can persist for extended periods of time and cool-season grass production is low.

Summer is also the time to start planning and preparing for late summer or early fall pasture establishment. Some farms choose to kill pastures completely and re-establish new pastures to greatly improve forage quality and quantity. This usually requires one to two applications of glyphosate to remove all vegetation. High rates of glyphosate are best when controlling difficult grasses such as tall fescue and nimblewill (a warm-season perennial grass that livestock do not consume). Space glyphosate applications about six weeks apart; apply the first application in the late summer to set up for a proper seeding window in the fall. After the second application, you can reseed grasses one week later due to glyphosate's low residual effects. When using herbicides, always read and follow all label recommendations.

Fall

Fall is all about planning for the future. This is the best time to seed cool-season grasses, re-establish pastures that were killed over the summer, and overseed by drilling into existing stands. Overseeding perennials into thin cool-season stands



Better Pasture Management ...

will thicken the stand while overseeding annuals (such as oats, cereal rye, or annual ryegrass) into warm-season grass will provide fall and spring grazing. See “Seeding Windows” below for recommended seeding dates. Grasses are best established using a no-till drill. Seeding rates will vary by species and mixture; seeding too little can result in thin stands and high weed pressure while seeding too much is a waste of seed (and money).

Nitrogen is the most important nutrient for grass production. Late summer through fall is the best time to fertilize cool-season pastures with nitrogen. This will allow grasses to be productive longer into the winter without the excess production that is common with spring applications. You can split nitrogen applications into two applications (primarily in the transition zone) six weeks apart. Nitrogen applications in late summer are especially important when stockpiling forages for winter.

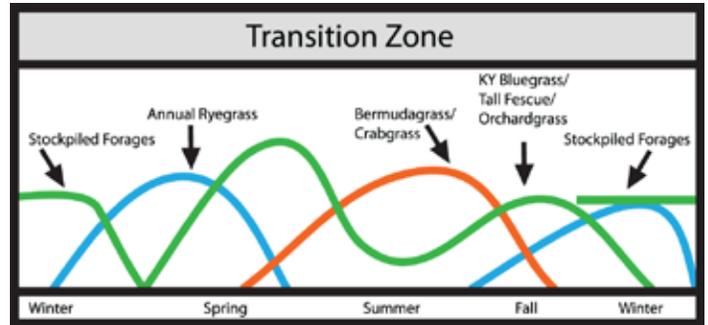
Do not graze tall fescue or bermudagrass pastures that are being stockpiled in the early fall. These pastures will accumulate forage (aided by nitrogen applications) and can be used when needed in the winter.

Year-Round Practices

Rotational grazing can benefit pastures throughout the grazing season. Horses are spot grazers, meaning that they will repeatedly graze the same location over and over again while ignoring other areas. By rotating horses and clipping pastures after horses are removed, you can reduce spot grazing’s impacts. Rotational grazing is simple: Move horses from one pasture to another and back again every few weeks. Use temporary fencing to divide pastures, if needed.

You can sample soil and apply fertilizer (excluding nitrogen) anytime the weather is conducive. Ideally, sample pasture soil every two to three years, and apply lime and fertilizer based on soil test recommendations. Local county extension agents and agribusinesses are great resources for soil testing recommendations.

A good pasture management strategy will focus on providing and utilizing quality grazing throughout most of the year. The figure above illustrates yield distribution for grasses that

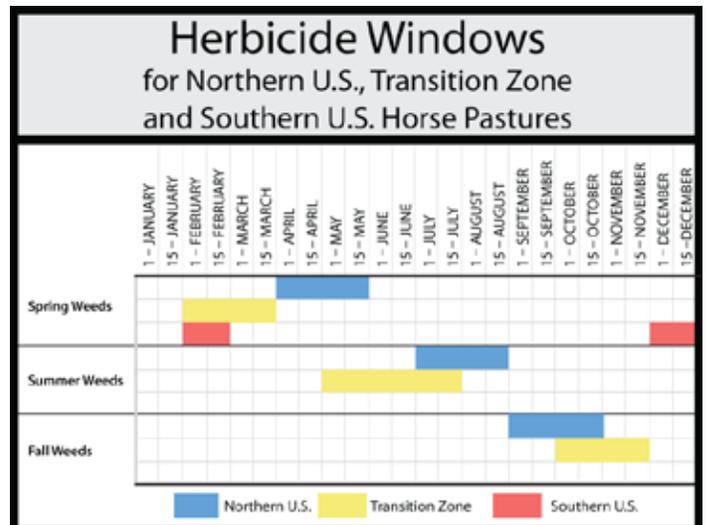
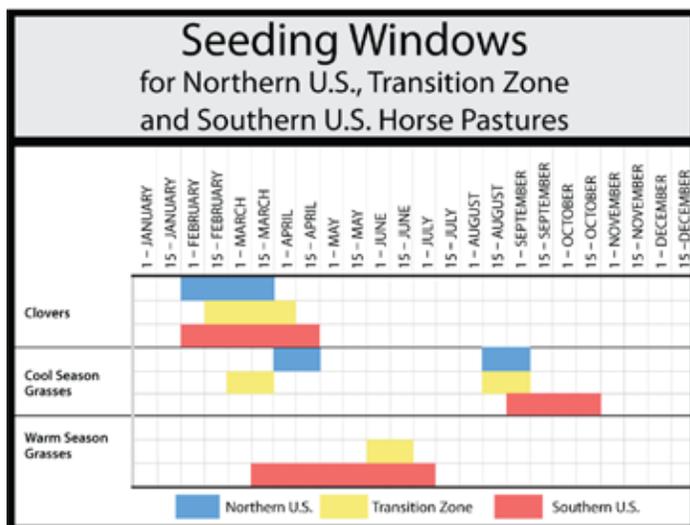


farm owners can plant in the transition zone. Pastures dominated by cool-season grasses (such as tall fescue and orchardgrass) will be most productive in the spring and the fall. During summer, horses will be grazing warm-season grasses, like crabgrass. Late fall and into winter, feed them stockpiled tall fescue. Seed annual ryegrass in early spring until cool-season perennials become active again. Provide hay if needed in the late winter or peak summer months when forage production does not meet your horses’ nutrient requirements.

Weed Control

Unfortunately, weed control is not a once-a-year event. It’s highly dependent on the weeds present. Generally, weeds are best controlled in a young, vegetative state; however, they often go unnoticed until they are big and strong. Like grasses, different weeds dominate pastures during certain times of the year. Spring weeds include buttercup, chickweed, purple deadnettle, henbit, and yarrow. Summer weeds include pigweed, wild carrot, cocklebur, tall ironweed, and ragweed. Fall weeds include plantain and dandelion.

The key to successful herbicide control of weeds is applying the correct herbicides for the target weed at the correct time. This means some pastures could require more than one application per year until weed populations decrease. Herbicides that are safe for established grasses are often not safe for new seedlings; you might need to focus on weeds one year and worry about grass establishment the next (or vice versa). “Herbicide Windows” below contains recommended treatment windows for groups of weeds throughout the various



Better Pasture Management ...

climate zones. Always follow label instructions when using any herbicide.

Many pasture management practices will also impact weed control. Mowing weeds before they produce seeds can reduce future populations. Maintaining proper fertility will give grasses the best chance to outcompete weeds. Overgrazing pastures will open up bare areas in the pasture, giving weeds the chance to establish and spread.

Determining Your Needs

Not every pasture needs all the management practices discussed in this article every day. Walk through pastures

periodically to help determine how and what to focus your attention on. Contact your local county extension agent or agribusiness representative for assistance and planning of pasture management.

Find more information by visiting the following Forage Extension websites:

- Northeast: <http://extension.psu.edu/plants/crops/forages>
- Transition Zone: uky.edu/Ag/Forage/ForagePublications.htm
- South: AlabamaForages.com. **UK**

>Krista Lea, MS, assistant coordinator of UK's Horse Pasture Evaluation Program; Ray Smith, PhD, professor and forage extension specialist at UK; Marvin Hall, PhD, professor and extension specialist at Pennsylvania State University, and Jennifer Johnson, PhD, assistant professor and extension specialist at Auburn University, provided this information.

Blister Beetles and Alfalfa: A Potentially Lethal Mix

Blister beetles belong to a family of plant-feeding insects (Meloidae) that produce cantharidin, a toxic defensive chemical. Contact with it in the blood of live or dead beetles causes blistering of the skin or mucous membranes of sensitive mammals, especially horses. Cantharidin is stable and remains toxic in dead beetles for a long time, so animals can be poisoned by eating crushed beetles in cured hay.

The severity of the reaction depends upon the amount of cantharidin ingested and the size and health of the animal. The lethal dose for livestock is estimated to be 0.45 to 1.0 mg of the chemical per kilogram of body weight.

Clinical signs associated with poisoning usually appear within hours and include irritation and inflammation of the digestive and urinary tracts, colic, urinary straining, and frequent urination. This irritation can also result in secondary infection and bleeding. In addition, calcium levels in horses might be drastically lowered and the heart can be damaged. Since animals can die within 72 hours, it is imperative to contact a veterinarian

as soon as blister beetle poisoning is suspected.

Meloids in the genus *Epicauta*, especially the striped blister beetle group (*E. occidentalis*, *E. temexia*, and *E. vittata*) are most commonly associated with poisoning of equids. Blister beetles are attracted to flowering alfalfa, or other blooming plants, and can be trapped and crushed in hay during harvest.

Blister beetles can be found in the Central and Eastern United States (see Figure 1). In addition to their high cantharidin content (approximately 4 mg/beetle), striped blister beetles tend to congregate in large clusters

along field margins. This can result in high concentrations of beetles in baled hay. Additional blister beetle species have been identified in poisonings in other areas of the United States.

Reducing the Potential for Blister Beetles in Hay

Tips for Hay Producers:

Learn to recognize blister beetles and understand their behavior. An effective preventive program will reduce potential problems. There is no efficient way to inspect baled hay carefully enough to ensure that it is free of blister beetles or cantharidin.

Blister beetles usually are not active when the first cutting of alfalfa hay is made; harvest at the late bud stage or when the first flowers open for high-quality horse hay.

Blister beetles are attracted to blooms. Manage harvest intervals to minimize flowering of alfalfa or weeds in hay fields. Practice good broad-leaf-weed management.

Check hay fields for blister beetles before cutting from July through early September. They prefer blooming plants and tend to cluster in masses near field edges. Avoid harvesting areas where beetles are present.

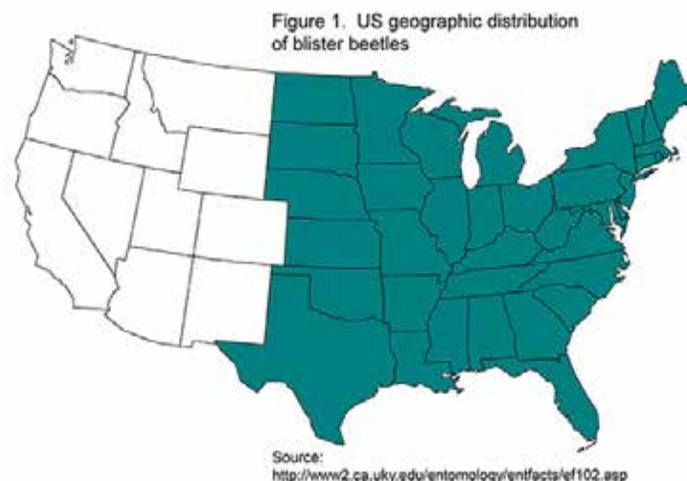
Avoid crimping hay during harvest. Straddle cut swaths to avoid crushing beetles with tractor tires.

Tips for Horse Owners

- Reduce the risk of feeding blister beetles to horses by understanding blister beetle basics, and by taking appropriate precautions.
- If practical, grow your own alfalfa to ensure proper preventive management practices.
- Develop a relationship with your hay producer or broker so that you know their production practices and hay quality.

CONTACT—Lee Townsend, PhD—859/257-7455—Lee.townsend@uky.edu—University of Kentucky Department of Entomology, Lexington, Kentucky

This is an excerpt from *Equine Disease Quarterly*, funded by underwriters at Lloyd's, London.



Follow us on Social Media!

The University of Kentucky College of Agriculture, Food and Environment has several equine-related social media pages featuring the latest news and events information.

Follow the UK Ag Equine Programs on Twitter at UKAgEquine. The UK Maxwell H. Gluck Equine Research Center is also on Twitter at UKGluckCenter.



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University of Kentucky Ag Equine

Programs: UK Ag Equine Programs is an overarching framework for all things equine at the University of Kentucky, including the undergraduate degree program, equine-related student organizations, equine research, and outreach activities.

University of Kentucky Maxwell H. Gluck Equine Research Center: The mission of the Gluck Center is scientific discovery, education and dissemination of knowledge for the ben-

efit of the health and well-being of horses.

University of Kentucky Horse Pasture Evaluation Program: The University of Kentucky Horse Pasture Evaluation Program is a service program offered to horse farms in Kentucky with the goal of overall improved pasture management. Regardless of breed or discipline, the programs goals are to: provide detailed pasture management recommendation to horse farm owners and managers; help improve pastureland to increase quality and quantity of pasture as a feed source and reduce the need for stored feeds such as hay and grain; and assess the potential risk of fescue toxicity of individual pastures to pregnant broodmares.

Saddle Up SAFELY: Saddle Up SAFELY is a rider safety awareness program sponsored by UK HealthCare, UK College of Agriculture, Food and Environment and many community organizations. It aims to make a great sport safer through education about safe riding and horse handling practices.

UK Extension Agents Host 9th Annual Pastures Please!!

University of Kentucky Cooperative Extension Service agents and UK Ag Equine Programs will host Pastures Please!! at 6 p.m. February 11 at the KCTCS System Office, 300 North Main Street, in Versailles, Kentucky. The free annual event is open to the public, particularly horse owners and farm managers interested in the latest information about horse pasture management.



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"Pastures Please!! is our annual winter horse program and provides information for farm managers and horse owners to start off pastures right, setting the stage for a productive season," said Ray Smith, PhD, UK professor and forage extension specialist. "We understand that Kentucky's horse industry is extremely varied, so we put together a program that will give everyone something they can take home and use."

This year's program, sponsored by McCauley's Brothers Inc., will feature talks from UK researchers that include understanding the nutritional value of pasture, the economics of grazing versus haying for horse operations, integrated parasite control, and novel endophyte tall fescue and broodmares.

A handful of Central Kentucky extension agents launched the annual educational program in 2007 to provide timely and practical information for area horse owners. It has expanded, and now includes participation from Bourbon, Clark, Fayette, Jessamine, Mercer, Scott, and Woodford counties. Each year a different county hosts the event.

Those interested in attending should RSVP to UK at 859/257-2226 or equine@uky.edu. **UK**

>Holly Wiemers, MA, APR, is communications director for UK Ag Equine Programs.

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Upcoming Events

February 9, 6 p.m.

Distinguished Industry Lecture Series featuring Misdee Wrigley-Miller, Gluck Equine Research Center Auditorium.

Wrigley-Miller, a fourth-generation horsewoman who owns and operates Hillcroft Farm with her husband in Paris, Kentucky, and Sarasota, Florida, was named a United States Equestrian Federation Equestrian of Honor in 2015, recognizing her accomplishment as the first rider to win the three-gaited "Grand Slam" with her American Saddlebred horses in 2015. Wrigley-Miller also competes in combined driving and represented the United States at the 2014 Alltech FEI World Equestrian Games in Normandy. She has competed and won at a national level with Arabian horses, as well. More information about the event can be found at <https://equine.ca.uky.edu>.

February 11, 6 p.m.

Pastures Please!!, KCTCS System Office, 300 North Main St., Versailles, KY

February 16, 6 p.m.

Kentucky Equine Networking Association (KENA) Meeting, Fasig-Tipton, Lexington, KY. kentuckyhorse.org/kena

February 25, 4 p.m.

UK Department of Veterinary Science Equine Diagnostic and Research Seminar Series. James Schumacher, DVM, University of Tennessee, will speak about navicular diseases at the UK Veterinary Diagnostic Laboratory.

PASTURES PLEASE !!

PASTURE MANAGEMENT FOR THE HORSE OWNER

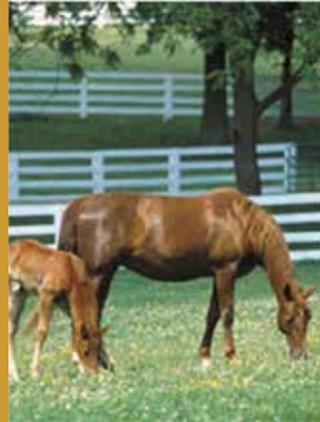
Please contact your county extension agent to reserve a spot at the meeting.

The 2016 Pastures Please meeting is sponsored by the UK Cooperative Extension Service and the UK Ag Equine Programs.

PASTURES PLEASE!!
PLANNING
COMMITTEE:

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ROB AMBURGEY
ADAM PROBST
LINDA McCLANAHAN
MICHELLE SIMON
DAVID DAVIS
NICK CARTER
KRISTA LEA
DR. BOB COLEMAN
DR. RAY SMITH

The Cooperative Extension Service of Jessamine, Woodford, Clark, Mercer, Scott, Fayette and Bourbon Counties invite you to attend an informative meeting on the management of horse pastures. Through this program, we try to present some of the latest information geared specifically toward the horse owner/manager. We have some of the top experts in the area lined up for this meeting.



February 11, 2016 - 6:00 p.m.

KCTCS System Office
300 North Main Street
Versailles, KY 40383

6:00pm - Refreshments
Sponsored by McCauley's

6:30pm - Program Begins
Dr. Laurie Lawrence
Understanding the Nutritional Value of Pasture

Dr. Kenny Burdine
Grazing vs Haying for the Horse Operation

Dr. Martin Nielsen
Integrated Parasite Control

Dr. Karen McDowell
Novel Endophyte Tall Fescue and Broodmares

FOR MORE INFORMATION:
CONTACT YOUR LOCAL
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