BLUEGRASS EQUINE DIGEST

UK University of Kentucky College of Agriculture Equine Initiative

UK University of Kentucky College of Agriculture Gluck Equine Research Center

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Bluegrass Equine Digest: 2009 Year in Review

The University of Kentucky's Equine Initiative and Gluck Equine Research Center released the Bluegrass Equine Digest in June. Presented by TheHorse.com and sponsor Pfizer Animal Health, the monthly e-newsletter informs readers about equine-related research findings in the College of Agriculture, including the Gluck Center and Livestock Disease Diagnostic Center (LDDC).


BLUEGRASS EQUINE DIGEST

Brought to you by the UK Equine Initiative and Gluck Equine Research Center

Welcome to the Bluegrass Equine Digest

Welcome to the first issue of *Bluegrass Equine Digest*, a new monthly electronic newsletter dedicated to providing free up-to-date information on equine research from the University of Kentucky's College of Agriculture.

Bluegrass Equine Digest brings together several entities, as content is brought to you by the UK Equine Initiative and Gluck Equine Research Center and the e-newsletter is brought to you by TheHorse.com and sponsor Pfizer Animal Health.

This newsletter will feature equine news, tips, and research findings from UK's College of Agriculture, including the Gluck Equine Research Center, the Livestock Disease Diagnostic Center, and a wide range of departments at UK that conduct equine research.

The *Bluegrass Equine Digest* will include short news items that will bring you up-to-date information on happenings in the research labs and from the field, plus in-depth articles from world-renowned experts to help you understand current "hot" topics. There will also be tips to help you better care for your horses and your property, and business advice from a team of experts.

Each month's newsletter, which will be e-mailed at the end of the month, will include updates on some or all of the following: people, places and things, research and lab highlights, infectious disease and immunology, reproduction, pathology, musculoskeletal, pharmacology/therapeutics/toxicology, genetics and genomics, parasitology, agricultural economics, nutrition and animal science, biosystems and agricultural engineering, entomology, landscape architecture, plant and soil sciences, community and leadership development, human environmental sciences, and a calender of events.

TheHorse.com will also produce a printable PDF each month to accompany the monthly e-newsletter.

For more information on Gluck Equine Research Center visit www.ca.uky.edu/gluck, and for more information on UK's Equine Initiative visit www.ca.uky.edu/equine.

If you received this newsletter from a friend you can sign up now at TheHorse.com/Enewsletter/ by checking the box for *Bluegrass Equine Digest* at the right side of the page and enter your name and e-mail address to receive this monthly electronic newsletter for FREE.

ARTICLES OF INTEREST

Early Embryonic Loss and Genetics
Visiting Scientist: Parasitology
Articular Cartilage Maturation
Equine Carcass Disposal
Botulism Fact Sheet
Weed of the Month
Tall Fescue Control
Soil-Cement
Carter Army Ceremony
New COA Online Giving Site
Changing Faces in COA
Upcoming Events

ca.uky.edu/equine / TheHorse.com JUNE 2009 / 1

The University of Kentucky's Equine Initiative and Gluck Equine Research Center released the first Bluegrass Equine Digest in June 2009.

With the intent of giving horse owners information they need to care for their horses and property, the Digest covers research topics such as infectious diseases and immunology, pathology, musculoskeletal conditions, pharmacology/toxicology, genetics and genomics, economics, nutrition, environmental management, reproductive health, pasture and weed management, and many others. These topics reflect the goal of UK's Equine Initiative to provide a full range of programs to support Kentucky's signature industry.

The Digest also covers news and announcements about the people and programs that make up the UK's Equine Initiative and Gluck Center.

Here is a recap of the stories from the first year.

Pasture Management Research

June

The first issue of the Digest reported on soils and equine pastures, starting with a study by William Witt, PhD, on tall fescue control in horse pastures (TheHorse.com/14406). Fescue is known to contain a fungus that causes late-term pregnancy problems in mares, but according to Witt, it can be greatly reduced in pastures using glyphosate or imazapic treatments. Also appearing was a story on using soil-cement to reduce mud in high-traffic areas in horse pastures. The story instructed readers on how to make soil-cement and how to use it on commercial or small horse operations (TheHorse.com/14411).

ARTICLES OF INTEREST

(YEAR IN REVIEW ...)

July

Bob Coleman, PhD, PAS, associate director of undergraduate studies in equine management, submitted a story on the benefits of bermudagrass in horse pastures, particularly due to its hardiness in cold weather. The article outlined the studies done with bermudagrass at UK, along with tips on extending the length of the grazing season on bermudagrass (TheHorse.com/14502).

Water is another important topic when it comes to pasture management. A how-to piece on adapting natural springs to be a source of water for horses appeared the same month (TheHorse.com/14592).

August

Another pasture treatment article approached the topic of applying nitrogen to pastures in the fall (TheHorse.com/14783 by Ray Smith, MS, PhD). Researchers completing studies on Lexington-area horse farms suggested applying nitrogen in September and again in November will significantly increase forage cover by the following March.

Another article on fescue endophyte toxicity noted research on the effect of endophyte on horses' body temperature after exercise. The study concluded that the effect was minimal but present for horses working at low-intensity levels, suggesting a need for further research on this commonly fed forage (TheHorse.com/14720).

Finally, the LDDC received more calls than usual about mushrooms due to the wet summer experienced in Central Kentucky. The LDDC released a statement acknowledging that while mushrooms can cause toxicosis in many small animals and should be eliminated when possible, the percentage of mushroom species poisonous to horses is quite small (TheHorse.com/14689).

September

An article highlighted the benefits of the cool, wet summers in Kentucky for hayfields. Researchers said to begin planting fall forages in early September after testing soil and controlling weeds for maximum forage production (TheHorse.com/14884).

Reproduction Research

Several articles on equine reproduction and breeding topics were published in 2009, the first of these appearing in July.

July

The Digest featured a study on contagious equine metritis (CEM), a sexually transmitted disease in horses, and the effectiveness of antibiotic treatments on semen collected and used for artificial insemination. Since stallions do not show clinical signs of the disease (it's difficult to detect carriers), the researchers concluded that diluting semen in extenders containing antibiotics is an effective way to reduce the incidence of the disease in inseminated mares (TheHorse.com/14552).

Studies on Lexington-area horse farms suggested application of nitrogen in September and again in November will significantly increase forage cover by the following March.

August

The Digest published news that Mare Reproductive Loss Syndrome-associated foal losses increased in 2009. The change from 2008's foal crop is thought to been caused by an increase in Eastern tent caterpillar populations (TheHorse.com/14713).

The Digest profiled endometritis (inflammation of the uterine lining) in the mare, and the impaired ability to clear fluid from the uterus after breeding might cause the disease (TheHorse.com/14683).

Genetics Research

June

Teri Lear, PhD, concluded in a story genetics might be to blame for early embryonic losses,

(YEAR IN REVIEW ...)

saying that a rare type of genetic mutation can cause a mare to lose many or all of her foals prematurely, and she might also pass the mutation on to surviving offspring (TheHorse.com/14027).

August

The next story on genetics detailed the hereditary traits being studied at the Gluck Center, such as parrot mouth and coat color genetics. Since the sequencing of the equine genome in 2006, researchers have been able to map genes for Paint, Appaloosa, and dilute coat colors, as well as contracted foal syndrome, junctional epidermolysis bullosa, swayback in Saddlebreds, and dwarfism in Miniature Horses (TheHorse.com/14727).

September

On a similar note, the Digest featured a story about the services offered at the Animal Genetics Testing and Research Laboratory. Horse owners can submit blood samples to this lab to be tested for blood typing, which could help identify genetic mutations (TheHorse.com/14727).

Other Areas Of Research

June

The Digest reviewed the causes and symptoms of botulism, a potentially deadly disease often caused by spoiled hay (TheHorse.com/14419).

The first parasitology story profiled Martin K. Nielsen, DVM, PhD, a visiting scientist from Denmark. Nielsen studied the detection of the bloodworm *Strongylus vulgaris* (TheHorse.com/14027).

WEEDS OF THE MONTH

Common names: Henbit, Lamium amplexicaule L.
Purple deadnettle, Lamium purpureum L.
Life Cycle: Winter annual
Origin: Europe
Poisonous: No

Purple deadnettle

Henbit

Henbit and purple deadnettle are winter annual species of the same genus, and people frequently confused the two. Both species are often called henbit. These weeds germinate in the fall and sometimes in the spring. They are found throughout the eastern United States. These weeds thrive in both cool-season and warm-season forage grasses. Both species also grow in fine turf, orchards, gardens, landscapes, and cultivated crops.

Henbit flowers are pink to red and occur in clusters of 6 to 10 inches tall in the upper leaf stalks. Purple deadnettle flowers occur near the tops of the plant and are less purple than henbit flowers. The most striking difference is the upper leaves and stems of purple deadnettle are very red in appearance.

These weeds are relatively easy to control with several herbicides; however, mowing is ineffective. Consult your local Cooperative Extension Service personnel for herbicidal control in your area. UK

William W. Witt, PhD, a researcher in Plant and Soil Sciences, provided this information.

The equine musculoskeletal research group provided a story on joint cartilage maturation in foals. They suggested a link between genetics and the development of joint cartilage, which, if not formed properly, might lead to joint disease and lameness later in life (TheHorse.com/14395).

Some of the more hands-on management topics featured this year included equine carcass disposal and the control of ammonia in horse stalls. The author of the carcass disposal story explained

(YEAR IN REVIEW ...)

the environmental impact of equine carcasses, including a call for further research into determining the most efficient and safe method available (TheHorse.com/14385).

July

This issued featured an article about poisoning in horses from various sources, not limited to plants and mushrooms, but also including feeds, herbal supplements, metals, minerals, pesticides, pollution, and venomous animals (TheHorse.com/12815).

The Digest published a story about research by David Horohov, PhD, the William Robert Mills Chair in Equine Immunology at the Gluck Center, on immune function in aging horses and its relationship to chromosome length. The conclusion of his studies suggested that shorter chromosome length was important, but not the only factor in the decline in the immune system of older horses (TheHorse.com/14543).

In the area of agricultural economics, researchers published a report about the economic impact of horse shows on the state of Kentucky. Jill Stowe's study highlighted the importance of the nonracing horse industries to the state's economy (TheHorse.com/14574).

September

Another visiting scientist, Mariana Ionita, DVM, PhD, of Romania, was profiled for her parasitology research (TheHorse.com/14965).

A commonly asked question about infectious disease diagnostics is "Why take nasal swabs?" and the author of an article on the subject answered that question, reporting that swabbing is the only way to confirm an influenza outbreak and is a necessary part of assessing what the content for the next flu season's vaccine should be (TheHorse.com/13888).

"This facility augments a program that is of highest significance to a region which represents the equine reproduction capital of the world," said Dr. Nancy Cox at the equine reproduction facilities groundbreaking ceremony Oct. 26, 2009.

October

Information was offered on the ammonia-absorbing product Sweet PDZ in dirt-floored stalls, and while it did not completely eliminate ammonia in the air or at ground-level, researchers found concentrations were lowered significantly by the product (TheHorse.com/15077).

The Digest printed an announcement about the Saddle Up Safely campaign, which is a partnership between UK Healthcare and the Equine Initiative to increase awareness of safety in riding and handling horses (TheHorse.com/15085).

The cover story discussed the characteristics of Kentucky's horse industry that make it an economic cluster, and therefore a unique entity within the state and national horse industry (TheHorse.com/15099).

November

A story featured the benefits of therapeutic riding for physically and mentally challenged riders (TheHorse.com/15302), detailing the research of Margi Stickney, MS, on the perceived benefits of riding on participants and their families.

Grants

August

The cover story in August announced that more than $1.1 million in grants was awarded for equine research (TheHorse.com/14710). The two grants, one from the National Science Foundation, and another from the Morris Animal Foundation were awarded to Jamie MacLeod, VMD, PhD, for work with equine genetics. Other grants were awarded to Chuck Issel, DVM, PhD, the Wright-Markey Chair in Equine Infectious Diseases at the Gluck Center, for study on the equine infectious anemia vaccine, and Kristine Urschel, PhD, to study aging (TheHorse.com/15078).

(YEAR IN REVIEW ...)

September

It was announced that Horohov received a $200,000 grant from the USDA-Cooperative State Research, Education and Extension Service (USDA-CSREES) to study the development of immunological responses in foals (TheHorse.com/14882).

October

Dan Howe, PhD, received $500,000 from the USDA-CSREES to conduct a *Sarcocystis neurona* genome project, with hopes of discovering new ways to treat equine protozoal myeloencephalitis (EPM) (TheHorse.com/15101).

The same month it was announced that a grant funded by the Morris Animal Foundation and Pfizer Animal Health will allow Allen Page, DVM, to study *Lawsonia intracellularis*, a little-known bacterium that causes intestinal disease. The grant was matched by the Goodman Foundation (TheHorse.com/15079).

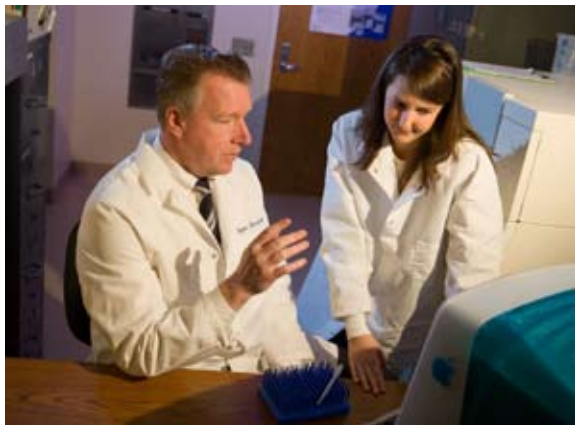
Events

June

The first of many equine-related UK events was the inaugural all-equine field day in June (TheHorse.com/14594). The field day drew nearly 125 people to learn about various equine topics from UK's faculty.

October

The next featured event was the inaugural Distinguished Industry Lecture Series in November. Nick Nicholson, Keeneland Race Course president and chief executive officer, spoke and answered student-driven questions before an audience of about 150 (TheHorse.com/15100).



Dr. David Horohov (pictured with Dr. Amanda Adams) received a $200,000 grant to study the development of immunological responses in foals.

The groundbreaking ceremony for the equine reproduction facilities on UK's Maine Chance Equine campus was at the end of October. Two barns on the farm are being converted to house mares and stallions and provide facilities to study fertility and reproductive disease (TheHorse.com/15309).

November

Finally, a story on the efforts by the Tracy Farmer Center for Sustainability and the Environment to make the 2010 World Equestrian Games more environmentally-friendly appeared in the November issue. The Tracy Farmer Center is strategizing on ways to recycle materials used during the Games and stimulate native plant life around Lexington (TheHorse.com/15297).

News and Announcements

The College of Agriculture made a number of announcements in 2009.

June

Readers were informed about the new College of Agriculture giving site (https://giveto.uky.edu/AG_p/ag.htm). The secure site allows donors to select which of 40 program areas (including the Equine Initiative and Gluck Equine Research Center) will receive their gift.

July

News of the $28.5-million expansion of the Livestock Disease Diagnostic Center (LDDC) (TheHorse.com/14513), a project that began this summer and will double the size of the existing facility, was announced. The LDDC also received national accreditation from the American Association of Veterinary Laboratory Diagnosticians for all species in August (TheHorse.com/14735).

September

The front page story announced the induction of four scientists into the University of Kentucky Equine Research Hall of Fame, including UK's own Peter Timoney, FRCVS, PhD. The other three inductees were Douglas F. Antczak, VMD, PhD,

(YEAR IN REVIEW ...)

of Cornell University, I.G. Joe Mayhew, DVM, of Massey University, and Alan J. Nixon, BVSc, MS, Dipl. ACVS, of Cornell University (TheHorse.com/14838).

The Digest informed readers of a way to contribute to the Gluck Center through The Horseman's Card, a credit card that donates to the Gluck Center with every use at no extra cost to the cardholder (TheHorse.com/14961).

October

Details on the inaugural Kentucky Breeder's Short Course on Jan. 20-21 at Fasig-Tipton Sales Pavilion in Lexington, Ky., were featured (TheHorse.com/15135).

LDDC officials also announced their transition to using the Laboratory Information Management System (LIMS) computer system, which will track incidence of equine disease across the state (TheHorse.com/15087).

The Digest announced the continued sponsorship of the Department of Veterinary Science by Lloyd's of London, which made a $45,000 donation to support the publication of Equine Disease Quarterly (TheHorse.com/15100).

November

There was an update on the LDDC renovation, which is anticipated to be complete in February 2010 (TheHorse.com/15266). Finally, Dan Rosenberg of Rosenberg Thoroughbred Consulting was the recipient of the 2009 Friend of the Equine Initiative Award, which recognizes members of the public who have provided extraordinary advocacy, funding, and support for the equine programs at UK (TheHorse.com/15307).

People

The Bluegrass Equine Digest also recognized individuals for their achievements within the equine programs at UK.

June

The Digest introduced Mats Troedsson, DVM, PhD, Dipl. ACT, as director of the Gluck Center and the department of veterinary science, as well as various new faculty members and researchers at the Gluck Center, LDDC, and College of Agriculture (TheHorse.com/14415).

Craig Carter, DVM, PhD, Dipl. ACVPM, the director of the LDDC, was featured throughout 2009. In June he was awarded the Legion of Merit and Joint Service Commendation Medal at an army retirement ceremony (TheHorse.com/14413). Then, in July, Carter received attention (TheHorse.com/14595) for authoring a book on James H. Steele, DVM. Carter and Steel signed the book at the American Veterinary Medical Association (AVMA) meeting. In November Carter was named the Kentucky Veterinarian of the Year by the Kentucky Veterinary Medical Association (TheHorse.com/15260).

July

Thomas Tobin, MVB, MRCVS, PhD, Dipl. ABT, received the 2008 Industry Service Award from the National Horsemen's Benevolent and Protective Association at the group's July meeting. Tobin was recognized for his work on drug testing and therapeutic regulation. (TheHorse.com/14529)

October

Dr. David McNear

David McNear, PhD, was featured for being awarded the Presidential Early Career Award for Scientists and Engineers for his work with endophyte-infected tall fescue. The award was given this fall by President Barack Obama at the White House (TheHorse.com/15079).

November

Nancy Cox, MS, PhD, associate dean for research in UK's College of Agriculture, was recognized with the Bluegrass Tomorrow Vision Award for her work on the Equine Initiative (TheHorse.com/15327). UK

Natalie Voss is a UK equine communications intern and undergraduate student in equine science.

GESTATIONAL WEIGHT GAIN IN MARES

It's generally known that a mare gains weight during gestation, but University of Kentucky (UK) researchers are studying how much weight a normal mare should gain for the health of the fetus.

A 1,100-pound mare will produce a foal that weighs about 110 pounds, so a normal mare would be expected to gain at least 110 pounds during gestation. However, anecdotal observations suggest that many pregnant mares gain more weight than can be attributed to the developing foal alone. Bryan Cassill, MS, and Laurie Lawrence, PhD, in the Department of Animal and Food Sciences at the University of Kentucky collaborated with Stephen Jackson, PhD, of Bluegrass Equine Nutrition, to examine body weight changes in broodmares on a Thoroughbred breeding farm. Preliminary observations were reported at the 2009 Equine Science Society meeting, which was held in Colorado.

The average initial weight of the mares at breeding was 1,272 pounds, but there was a large amount of variation among the mares. The smallest mares weighed about 1,100 pounds and the largest mares weighed more than 1,400 pounds at the beginning of gestation. A previous study reported by UK researchers found that the average Thoroughbred broodmare weighs about 1,300 pounds.

Mares can increase their body weight by 13% to 14% by the end of gestation.

At the end of gestation, the average weight of the mares was about 1,448 pounds. Therefore, average weight gain was 176 pounds. The typical Thoroughbred foal weighed between 115 and 125 pounds, so the weight gained was more than predicted from fetal development alone.

A theoretical method for predicting weight gain in pregnant mares was suggested by the National Research Council in 2007. This method accounts for the development of other "products of conception," such as the placenta. The body weight gained by the mares in this study was almost the same as predicted from the theoretical equation.

The results of this study and the theoretical equation developed by the NRC suggest mares will increase their body weight by about 13% to 14% by the end of gestation. Therefore, a 1,100 pound mare will gain about 150 pounds while a 1,400-pound mare will gain about 190 pounds during gestation.

The goals of this study were to estimate total weight gain during gestation and document the amount of weight gained as mares progressed through the early, mid, and late stages of pregnancy. Estimates of typical weight gains in pregnant mares at different stages of gestation can be useful to horse owners who are monitoring the progress of a mare's pregnancy.

It has been reported that most fetal weight gain occurs in the last three months of gestation. Therefore, it would have been expected that body weight gain in mares would be concentrated in the last three months of gestation in this study. However, the results of this study showed this was not the case. Instead, most of the weight gained during gestation occurred between the fifth and ninth months of gestation.

At the end of the fifth month of gestation, mare body weight had increased by about 3%, and by the end of the ninth month, the increase was 11% of the initial weight. A previous study in which researchers studied Quarter Horses showed that mares tended to gain more weight during the middle of a pregnancy than during late pregnancy.

In this study there was no way to determine what types of tissues were being deposited when mares gained weight in early and mid-pregnancy. It is likely that the development of the placenta and the enlargement of the uterus occur during early and mid-pregnancy, but they would not account for the 11% increase in body weight that

(GESTATIONAL WEIGHT ...)

was observed. Instead, it is possible that the mares increased their own body mass during early pregnancy.

Mid-pregnancy in these mares would have coincided with the fall season (a time of year when many species augment body stores in preparation for winter). By increasing body stores in mid-pregnancy, mares might have been able to utilize those stores in late gestation to meet the nutrient demands of fetal development. It is also possible that the weight gained by mares during early and mid-gestation was retained in the mare after foaling. An increase in nonpregnant weight could occur due to growth in young mares, or to an increase in body fat content in mature mares.

It is also possible that those body stores are not used in late pregnancy, but are mobilized at foaling to meet the needs for initial milk production. The nutrient needs for milk production are much greater than the needs for pregnancy. Most mares will increase food consumption after foaling, but this increase may take several days and it may lag behind the nutrient needs for milk production.

Mares were weighed in the month after foaling to determine post-foaling weight, which was compared to the initial body weight. In this study, the post-foaling weight of young mares (younger than 8 years old) was greater than their initial weight. However, in mature mares (8 years old and older), post-foaling body weight not different from initial body weight. The younger mares increased total body weight by about 15% by the end of pregnancy, while the mature mares increased body weight by 13%.

Body condition is an important determinant of reproductive efficiency. Mares that are thin at foaling are more difficult to get back in foal. Therefore, routine body condition scoring of pregnant mares is an important reproductive management tool.

The most common body condition scoring system uses a 1-to-9 scale. A condition score of 5 is considered moderate; the horse's ribs can be easily felt but not seen. Mares that enter the breeding season with a condition score of 5 or greater have higher reproductive efficiency than mares that begin the breeding season with a condition score below 5. Therefore, pregnant mares should gain enough weight during gestation so they foal at a body condition of at least 5.

Allowing mares to gain weight in mid-gestation may be a way of ensuring they have adequate body condition at foaling.

Ultimately, further study is necessary to understand the optimal amount of weight a mare should gain during pregnancy. UK

Laurie Lawrence, PhD, is a professor in the University of Kentucky's Department of Animal and Food Sciences.

FELLOWSHIP BENEFITS UKRAINIAN RESEARCHER AT GLUCK CENTER

Limited funding prevented Tetiana Kuzmina, PhD, from completing her parasitology research in her native Ukraine. But after receiving the Albert and Lorraine Clay fellowship, the scientist was able to continue her research at the University of Kentucky's (UK) Gluck Equine Research Center.

"The fellowship benefits both the Gluck Equine Research Center and the visiting scientist," said Gene Lyons, PhD, at the Gluck Center. "The fellowship brings in scientists and incorporates work and an interchange of knowledge."

Kuzmina, whose doctorate is in zoology and parasitology, spent October and November in Lyons' laboratory at the Gluck Center. Using classical parasitological methods, she participated in Lyons' study of horse parasites. She also studied molecular methods of analysis of worms from five different equids, including domestic horses, donkeys, wild Przewalski's Horses, Turkmenian Kulans, and zebras, in the molecular laboratory of Daniel Howe, PhD.

"My goal was to find if there are any influences of different equids on their parasites," Kuzmina said. "The results are not easy to obtain, because there are many complicated moments in molecular studies. I hope we will be able to find out, are there any genetic differences in cyathostomes

(FELLOWSHIP ...)

Dr. Tetiana Kuzmina

from various hosts or not?"

With a classical parasitology background, some of her other main focuses during her visit were to master identification of strongylid nematodes by morphological criteria (under a light microscope) and to master the analysis of efficacy of the various anthelmintic drug compounds (any drug that acts against helminthic infections caused by parasitic worms) by critical test method.

Kuzmina said the critical test method and the other methods mentioned are not done in Ukraine. Prior to her visit to the Gluck Center, she had only read about it in articles by Lyons. Since coming to the Gluck Center, she said she now has a better understanding of the process.

"It's great to be here," Kuzmina said. "I never expected to see such an excellent experimental farm (at UK's Maine Chance Equine Campus). Unfortunately, no research institutions in Ukraine have such farms for their experimental studies."

Kuzmina joined the department of parasitology of the Institute of Zoology National Academy of Sciences of Ukraine in 1997. She said while Ukrainian researchers are interested in international study, funding is not always there. Often, researchers have to find additional resources by themselves.

"She's done an awful lot in her career," Lyons said. "There are very few people in the world still doing classical studies of parasitology."

Due to time limitations on the compilation of results, Kuzmina was not able to complete her study by the time she left for home. Still, she said, "I have obtained so much new information here." UK

Jenny Blandford is the Gluck Equine Research Foundation assistant at the Gluck Center.

REPAIR TISSUE IS SUBSTANTIALLY DIFFERENT THAN THE CARTILAGE IT REPLACES IN HORSES' JOINTS

When a horse sustains a serious injury to articular cartilage in one of its joints, a repair process occurs in the wound. The hope of the horse's owner is for the injury to sufficiently heal and restore normal joint function. Unfortunately, for much of the horse's life, there is a high probability that osteoarthritis will cause chronic pain and compromised joint function.

Through research performed at the Gluck Equine Research Center, Jamie MacLeod, VMD, PhD, and Michael Mienaltowski, DVM, PhD, studied the repair tissue that forms within full-thickness lesions of articular cartilage. This project was conducted in collaboration with equine orthopaedic surgeons David Frisbie, DVM, PhD, and Wayne McIlwraith, BVSc, PhD, FRCVS, DSc, DMV, Dipl. ACVS, at Colorado State University. The research was published in the open access journal BMC Medical Genomics (www.ncbi.nlm.nih.gov/pmc/articles/PMC2751772).

Researchers compared repair tissue from full-thickness lesions, on which surgeons performed arthroscopic debridement and microfracture treatment (a procedure performed to remove damaged tissue and create small holes into the underlying bone tissue to allow blood and cells access to the lesioned area), to normal articular

(REPAIR TISSUE ...)

cartilage of the distal femur (thigh bone) in horse stifles four months after surgery. When they examined the tissue microscopically, they noted the relatively normal cartilage surrounding the lesion looked clearly different from the repair tissue within the injury. Key differences were (see Figure 1):

- The repair tissue did not restore normal cartilage structure
- The edges of the repair tissue did not integrate well with the surrounding cartilage
- By special staining, in most cases, repair tissue seemed to be missing proteoglycan, a key molecular component of normal cartilage that helps provide compressive strength to cartilage
- The repair tissue did not restore a smooth articular surface

The research team used a powerful new scientific technique called microarray-based transcriptional profiling to compare gene expression of repair tissue and normal cartilage. The technique allowed them to study the expression of thousands of genes simultaneously. By following which groups of genes were active in each of the tissues, they were able to determine that the tissues have substantial functional dissimilarities. For example, transcript levels for all conventional biomarkers typically used to describe healthy articular cartilage were found at higher levels in normal cartilage relative to the repair tissue. In addition, the expression of many genes typically associated with scar tissue or fibrocartilage, which is much more rigid and less amenable to withstanding the forces encountered in a horse's joint, was detected at greater levels in repair tissue. Thus, the researchers saw that differences in expression patterns of many functionally important groups of genes were associated with repair tissue, providing new insight into why the healing process of full-thickness articular lesions is inadequate.

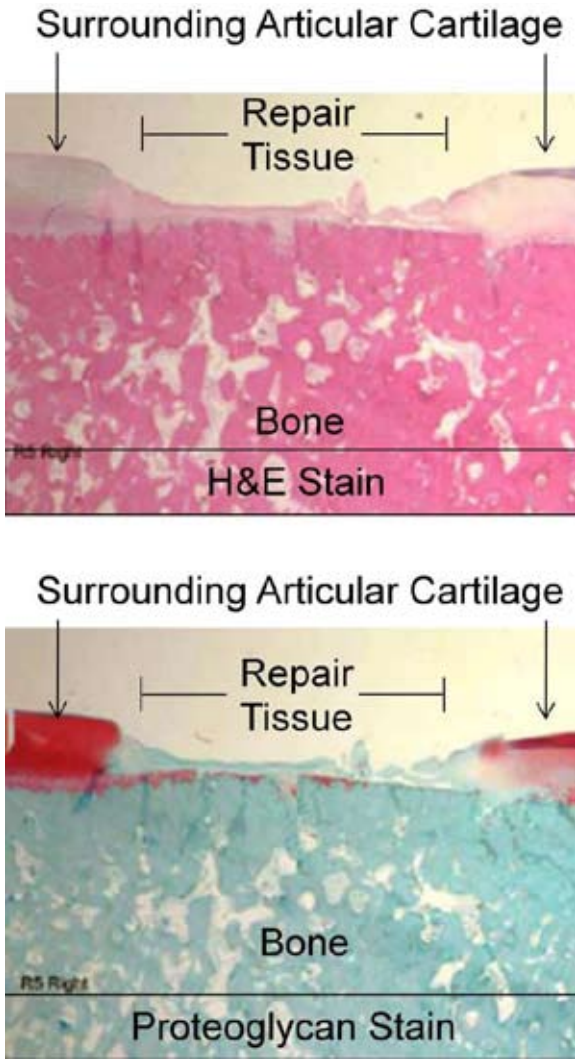


Figure 1 (left): Examining a lesion in horse cartilage under the microscope. A sample of tissue containing both normal cartilage and repair tissue was stained with chemicals used to help visualize cellular and tissue structure (H&E stain, top photo). A special stain was also used to detect proteoglycans in the sample; red staining indicated that the articular cartilage surrounding the lesion contains proteoglycans, while blue staining indicates deficiency within the repair tissue (Proteoglycan Stain).

In this study the research team concluded that repair tissue occupying full-thickness articular lesions is functionally very different from normal articular cartilage. The cells within repair tissue do not achieve a normal pattern of gene expression necessary to restore and maintain healthy articular cartilage structure and function. Future research should focus on how to direct the cells in repair tissue to function more like cells in articular cartilage. New treatment options could allow for better, more cartilagelike healing, which restores the structural and biomechanical integrity of the joint surface. UK

Michael Mienaltowski, DVM, PhD, a postdoctoral research fellow at the University of South Florida, Department of Orthopaedics & Sports Medicine and Department of Pathology & Cell Biology, completed his PhD research at the Gluck Equine Research Center, *supported in part by a grant from the Morris Animal Foundation.*

COMPOSTING: A VIABLE ALTERNATIVE FOR MORTALITY DISPOSAL

Proper livestock stewardship does not cease when an animal dies. Despite sound management, all horse producers will experience losses due to weather, disease, or other natural causes. Options for carcass disposal are dwindling due to enhanced regulation and decreased availability of rendering services. To address growing environmental and biosecurity concerns, many producers are investigating composting as a viable alternative to more costly options of mortality disposal. Considering the abundance of stockpiled muck, used bedding, and feedstuffs available on many horse farms, composting represents a feasible and effective method of dealing with fallen stock.

Composting is a simple, low-cost disposal method that is environmentally sound and yields a versatile product. The finished material can also be stockpiled and reused to help compost other mortalities. Composting takes advantage of the natural decomposition process conducted by microorganisms and can be controlled under managed conditions. This process reduces the size of carcass material by removing organic products, water, and energy in the form of carbon dioxide, vapor, and heat. In addition, many pathogens are destroyed by the high temperatures and beneficial bacteria generated during the decomposition process, yielding this method of disposal as an approved alternative, according to Kentucky's Office of the State Veterinarian.

Composting is a simple, low-cost disposal method that is environmentally sound and yields a versatile product.

Some producers may be hesitant to adopt this practice on their own farms because they may not have the time or equipment required. However, when done correctly, mortality composting requires minimal labor input and can take advantage of equipment already present on most horse farms. University of Kentucky trials have successfully demonstrated that horse mortalities can be reduced to a few large brittle bones in as little as six weeks. A properly managed pile will not create odors, attract scavengers, or lead to spread of disease.

This brief composting introduction was written as a guide for on-farm composting of horse mortalities and can assist in designing and troubleshooting composting systems.

Composting Equipment and Materials

Co-composting materials

A bulking agent will be needed to cover and insulate the carcass, wick up excess moisture that is released, and balance the carbon-to-nitrogen ratio (C:N). Horse carcasses usually contain a high concentration of nitrogen and water, so bulking agents high in carbon aid in keeping the C:N ratio at the desired range of 25:1 to 40:1.

Horse composting systems may utilize a variety of bulking agents as co-composting materials. A combination of fine and coarsely textured materials will work best to promote optimal conditions within the pile. Examples of bulking agents include sawdust, straw, muck, old bedding, wood chips, reused compost, and yard waste, just to name a few.

The use of finished or stable compost as an outer layer will help abate odor and gas release, maintain microbial activity, and prevent scavenger access. Finished compost also serves as a biofilter, which contains beneficial bacteria that will jump-start the composting process.

Equipment

Two pieces of equipment are necessary to manage composting facilities. A front-end loader is needed to place carcasses in the pile, transport

(COMPOSTING ...)

co-composting materials, and turn or move the pile contents. A temperature probe is desirable to monitor internal pile temperatures. A long-stemmed agricultural thermometer works great and is recommended for any mortality compost facility. Additionally, a compost log or notebook for recordkeeping might be necessary to document the temperature and record conditions during the composting process.

Site Selection

Choosing an appropriate site is the first step in successful mortality composting. Site selection, preparation, and runoff abatement are crucial for mortality composting facilities. When selecting a site consideration should be given to a number of factors, including water and soil quality protection; biosecurity; neighbor complaint and nuisance prevention; and minimization of operation and management challenges. Selected sites should be accessible in all weather conditions. Composting facilities should not be built in flood plains or within 300 feet of a water well, stream, sinkhole, pond, property line, or public road.

Constructing a Windrow Pile

Once a proper site is located, and the permit is acquired, it is time to begin the compost pile ("windrow"). All runoff needs to be collected and treated through an appropriate vegetated buffer or plumbed to an established waste storage facility. A requirement of the Kentucky Division of Water is that the site can collect and detain

Table 1. Managing/troubleshooting compost facilities: A troubleshooting guide for carcass composting.

Problem/ Symptom	Probable Cause	Suggestions
Improper Temperature	Too dry	Add water.
	Too wet	Add bulking agent and turn pile.
	Improper C:N ratio, or bulking agent used is too porous	Evaluate bulking agent, and adjust amount as necessary.
	Adverse environment	Ensure adequate cover with bulking agent to provide insulation.
Failure to Decompose	Improper C:N ratio	Turn pile and adjust amount of bulking agent.
	Carcasses layered too thickly	Single layer the carcasses.
	Carcasses placed on the outside edge of the pile	Maintain 1 foot of space between carcasses and outside edge of bins.
Odor	Too wet	Add bulking agent and turn pile.
	Too low C:N ratio	Evaluate type of bulking agent used. Add bulking agent.
	Air flow restricted	Maintain 1 foot of bulking agent near outside of bin. Turn pile.
	Inadequate cover over carcasses	Cover carcasses with 1 foot of bulking agent.
	Extended periods of low temperature in the pile	Maintain proper temperature in pile.
Flies	Inadequate cover over carcasses	Cover carcasses with 1 foot of bulking agent.
	Poor sanitation conditions	Avoid leaching from pile. Maintain a clean, debris-free area near the pile.
	Failure to achieve proper temperature	Maintain proper temperature in the pile.
	Too wet	Open/remove pile contents and add more bulking agent.
Scavenging Animals	Inadequate cover over carcasses	Maintain 1 foot of cover; avoid initial entry by establishing a fence or barrier.

Adapted from the National Pork Producers Council Swine Mortality Composting Module.

(COMPOSTING ...)

runoff from a 24-hour, 25-year storm. Moisture is one of the limiting factors in the composting process. The top of the pile should be sloped or mounded to allow rainwater to shed. Care needs to be taken to divert runoff, ensure proper insulation during the composting process, and prevent excess moisture from permeating the pile.

A compacted layer of impervious materials, such as a stack pad or heavy traffic pad with geotextile fabric, should be constructed to minimize liquid infiltration into groundwater supplies and aid in pile turning. Size considerations for stack pad construction should be based on the amount of material to be composted, which can be calculated using the average mortality rates for individual farms.

After securing an impervious surface you will need to create a base. The base should consist of a 2- to 3-foot-thick layer of bulking agent large enough to cover the entire surface. Horse carcasses should be placed in a single layer, centered on the base material, and they should not be placed within 8-12 inches of the edges of the compost pile.

Once you have centered the carcass on the pile, you will need to cover it with a 3 to 4 foot thick layer of bulking agent. Using sawdust or finished compost here will minimize odors, provide protection against scavengers, and maintain proper moisture and temperature conditions within the pile. Moisture can be determined by squeezing compost in your hand. If moisture drips from your hand, the pile is too wet after squeezing the compost. If your palm does not get wet, the pile is too dry. Optimum moisture is when the hand is wet. It is imperative that all parts of the carcass are completely covered to ensure proper decomposition and to prevent scavenger attraction to the pile.

The Composting Process

As previously mentioned, use a thermometer to accurately monitor internal pile temperatures and to ensure that optimal temperatures are being reached. Temperatures will increase within two to four days of loading carcasses in the pile with ideal temperatures ranging between 130° F to 160°F during active decomposition.

Once temperatures begin to decline, or a few months have passed, you may turn or move the pile with a front-end loader without the threat of releasing pathogenic bacteria. Turning helps aerate the pile, establish a more homogeneous mixture of materials, speeds up the overall composting process, and creates room to accommodate other mortalities.

Once the pile has been turned, continue to monitor temperatures, as they may increase again with further decomposition. When significant heating does not occur after turning, then the product is finished and ready to be stockpiled for future composting of mortalities or land-applied as a soil amendment. Compost should be tested for pathogen and nutrient content before land applying. If the material is to be land-applied, it should be applied to crop fields as a fertilizer source using the Natural Resource Conservation Service Standard for Nutrient Management.

Rules and Regulations

In order to legally compost mortalities, a permit is required, which is issued by the Office of the State Veterinarian. The cost of the permit is $25 and is renewed every five years. The permit application requires the name and address of the compost owner, location and description of the composting facility, and the composting procedure. All animal composting facilities are subject to inspection by the State Veterinarian or his or her representative. Any animal carcasses not composted should be disposed of in a manner consistent with KRS 257.160 (see ID-167, On-Farm Disposal of Animal Mortalities).

Kentucky law requires that reasonable and cost-effective efforts shall be taken to prevent odor, insects, and pests. Odors can be controlled by maintaining proper moisture, aeration, and carbon-to-nitrogen ratio during the composting process. To control pests and prevent transport of contagious diseases, all carcasses shall be inaccessible to scavengers, livestock, and poultry. Limiting odors, insects, and pests, and access of scavengers and other animals requires proper supervision and monitoring during the composting process. UK

Steve Higgins, PhD, is the director of environmental compliance for the University of Kentucky Agricultural Experiment Station. Emily Bruner is an agricultural extension assistant.

GLUCK CENTER GRAD STUDENT RECEIVES RESEARCH FELLOW AWARD

Jennifer Janes, DVM, a graduate student in the Department of Veterinary Science at the University of Kentucky, was selected as the 2009 recipient of the American Association of Equine Practitioners (AAEP) Foundation Past Presidents' Research Fellow award, which will support her project on orthopedic pathology and genetic association of wobbler syndrome (cervical stenotic myelopathy).

Janes received the award at the AAEP's 55th annual convention, which was held Dec. 5-9 in Las Vegas, Nev. Janes said her research project, in which she's studying Thoroughbreds, will provide information that will be applicable to all breeds. It is in its early stages and will take several years to complete. Wobbler syndrome is a devastating disease targeting the musculoskeletal and neurological systems of horses. Factors thought to contribute to the development of the disease include genetics, high planes of nutrition, trauma, rapid growth, and decreased copper/increased zinc levels. However, veterinarians do not understand the underlying cause and details of the disease's progression.

The research is "a collaborative effort to re-examine this disease," Janes said. She is working with Jamie MacLeod, VMD, PhD, the John S. and Elizabeth A. Knight Chair, professor of veterinary science at the Gluck Equine Research Center, and director of UK's Equine Initiative; Stephen Reed, DVM, Dipl. ACVIM, of Rood & Riddle Equine Hospital; and Neil Williams, DVM, PhD, Dipl. ACVP, associate director at the UK Livestock Disease Diagnostic Center (LDDC).

Wobbler syndrome impacts the athletic potential of affected Thoroughbreds. It is one of the most common causes of neurologic disease in Thoroughbreds and usually does not resolve with time and rest. Given the poor prognosis for recovery, the disease has a substantial emotional and financial impact on Thoroughbred owners and the industry.

Dr. Jennifer Janes

Janes plans to examine the continually unanswered questions about wobbler syndrome by using recent research developments and diagnostic technology. She will also examine the role of abnormal bone and cartilage formation in neck vertebrae, as well as identify regions of DNA and specific genes that are involved in the disease process.

"Results of the study will enhance our understanding of the cause and progression of wobbler syndrome, advanced imaging and DNA-based diagnostic technologies, and provide a scientific foundation for research on improved management and therapeutic practices for the prevalent and serious disease," Janes said.

A native of Illinois, Janes graduated from Vanderbilt University in 2002 with a Bachelors of Music, and she graduated from the University of Tennessee College of Veterinary Medicine in 2006. She completed a one-year internship rotation in medicine, surgery, theriogenology, and field service at Wisconsin Equine Clinic & Hospital. While there, Janes developed an interest in musculoskeletal diseases.

"[Wobbler syndrome] is a tough disease because of the implications of having a neurological horse," Janes said. "I felt like I wanted to ask more questions."

In July 2007 Janes accepted a position in the dual-degree program at the Gluck Center in MacLeod's Orthopaedics and Rheumatology Lab and a pathology residency position under the mentorship of Williams.UK

Jenny Blandford is the Gluck Equine Research Foundation assistant at the Gluck Center.

PLACENTITIS RESEARCH COULD HELP PREVENT LATE-TERM ABORTIONS

Placentitis, which often is caused by an ascending infection that enters the mare's uterus through the cervix, is the single most important cause of premature delivery of a foal. Placentitis accounts for nearly one-third of late-term abortions and fetal mortality in the first day of life. During the past six years, the University of Kentucky (UK) Livestock Disease Diagnostic Center has diagnosed 1,429 cases of placentitis.

Mats Troedsson, DVM, Dipl. ACT, is the chair of UK's Department of Veterinary Science and director of the Gluck Equine Research Center. Troedsson served as professor and service chief in theriogenology and director of equine research programs at the University of Florida's College of Veterinary Medicine before coming to the Gluck Center in 2008.

In the early 1990s, Troedsson began using ultrasound to examine placentas in clinical cases. That led to a study establishing normal values for transrectal ultrasound examination of the combined thickness of the uterus and placenta. During the last 10 years, Troedsson's research has had a different focus, and his contribution has been limited to evaluating the efficacy of different treatment regimens for placentitis and case reports of clinical cases in collaboration with Margo Macpherson, DVM, MS, Dipl. ACT, associate professor of theriogenology in Large Animal Clinical Sciences at the University of Florida.

Because there are still many unanswered questions about an accurate diagnostics, prognostics, monitoring of fetal well-being, and treatment in high-risk pregnancies, Troedsson plans to revisit this research topic with the reproduction group at the Gluck Center.

Efficient diagnosis relies upon cautious monitoring of mares in late stages of pregnancy. However, available treatment approaches are far from perfect and treatment outcome is hard to predict. Early intervention in treatment of placental infections is likely the key to treatment success.

In some chronic cases of placentitis accelerated fetal maturation will commence. Mares will deliver

2009 PRESTIGIOUS RESEARCH PAPER AWARD

Ernie Bailey (left), PhD; James MacLeod, VMD, PhD, John S. and Elizabeth A. Knight chair, professor of veterinary science and director of UK's Equine Initiative; and Teri Lear, PhD, received plaques for the "2009 Prestigious Research Paper Award" from Scott Smith (right), PhD, dean of UK's College of Agriculture, Dec. 10 during a Land Grant Research and Awards Program at the Gluck Equine Research Center. The award was given for their involvement as co-authors of the paper "Genome Sequence, Comparative Analysis, and Population Genetics of the Domestic Horse" in the journal Science.

Bailey, MacLeod and Lear shared the award with Stephen Coleman, graduate student in the department of veterinary science, and Jinze Liu, professor of computer science. The award recognizes faculty who have conducted research resulting in a peer-reviewed publication of the highest quality and prestige. It is awarded based on scientific merit, citation of the article, impact factor and prestige of the journal, and other factors that demonstrate its contributions to the advancement of science. UK

(PLACENTITIS ...)

these foals prematurely, but the foal will not be mature enough to survive outside the uterus after birth. Delaying premature labor long enough to allow accelerated fetal maturation to proceed full development may improve the chance of foal survival.

The most common clinical signs of placentitis in mares are premature udder development and vulvar discharge. Ultrasonography is an excellent tool for monitoring fetal and placental changes in mares affected by placentitis. But since serial ultrasonographic evaluations are not commonly employed in late-gestation mares, a veterinarian can miss diagnosis in subclinically affected mares. Subclinical disease might also result in subtle ultrasonographic changes that are not easily distinguished from normal findings. However, in spite of these hurdles, transrectal ultrasonography remains one of the best tools available for diagnosing equine placental infections.

Another type of ultrasonography, transabdominal, can be a useful tool for placental evaluation in mares with suspected placentitis. Using transabdominal ultrasonography, the clinician cannot image the caudal portion of the allantochorion (the part of the placenta that is attached to the back of the uterus close to the cervix), which prevents diagnosis of ascending placentitis in its early stages. However, placental thickening and partial separation of the placenta from the uterus using transabdominal ultrasonography in mares with placentitis originating from a hematogenous infection (infection spread to the uterus via the mare's blood).

Treatment strategies for mares with ascending placentitis are currently vague. Many treatment regimens have been extrapolated from research in other species, such as humans. Treatment efforts are directed at several targets including combating infection, reducing inflammation, and controlling uterine contractions.

According to Troedsson, the outcome of any treatment was previously found to be poor.

"We found that treatment of subclinical cases diagnosed by ultrasonography resulted in quite acceptable and much improved outcome of affected pregnancies," he said.

Common treatment for placentitis is broad-spectrum antibiotics, Regu-Mate (double dose) and pentoxifylline for the remainder of the pregnancy, and a non-steroidal anti-inflammatory agent. This treatment, however, is not 100% effective and often results in the birth of an underdeveloped and compromised foal.

"But while success is hard to achieve when treating placentitis in mares, having a live foal that has been delivered successfully and is healthy is a great reward," Troedsson said. UK

Alexandra Harper is a UK equine communications intern and undergraduate majoring in communications.

UPCOMING EVENTS

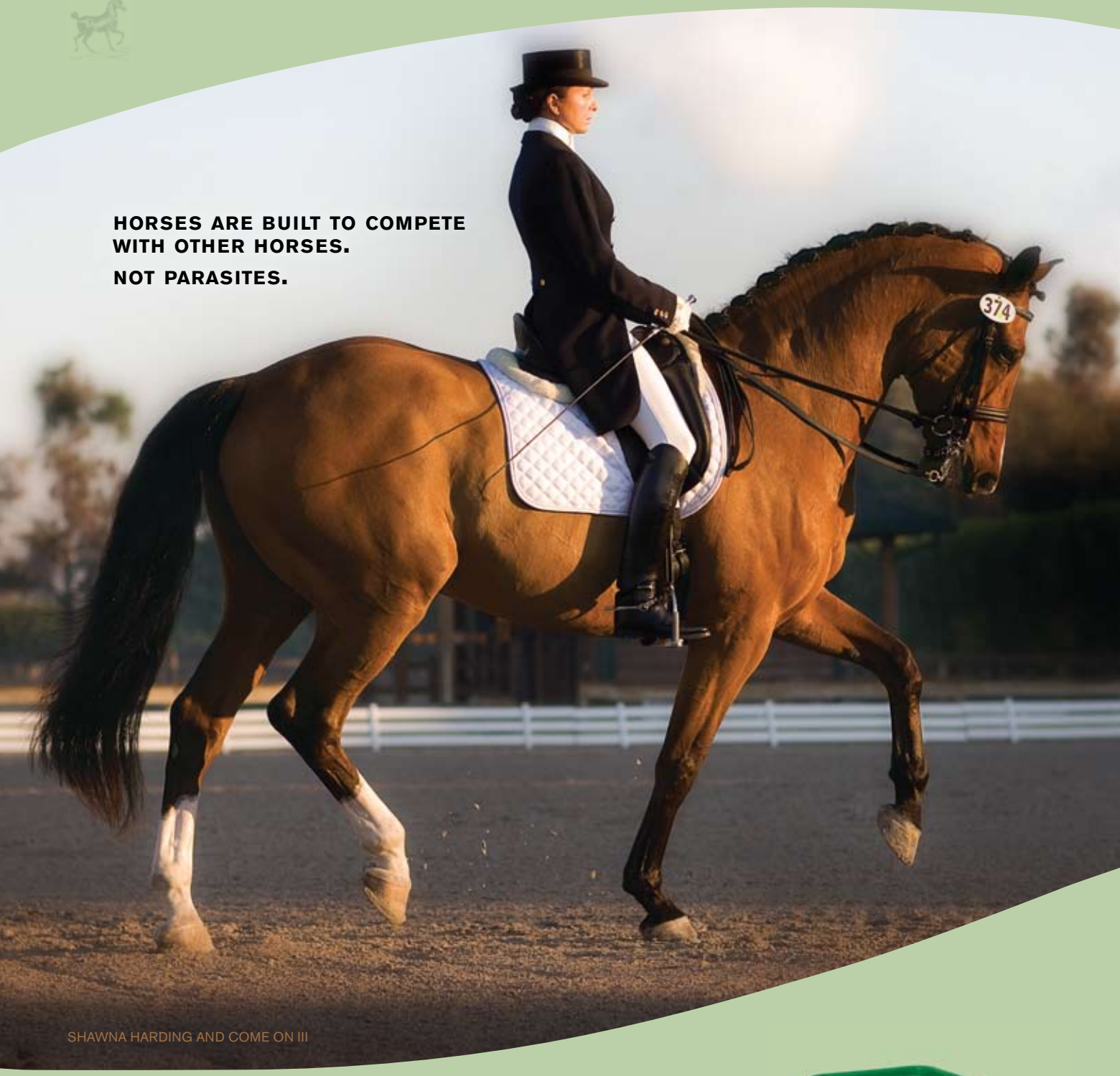
Jan. 13, UK Spring Semester begins

Jan. 20-21, 8 a.m.-5 p.m., Gluck Equine Research Center inaugural Kentucky Breeders' Short Course. The course is intended for owners and managers of all breeds and will feature lecturers on reproduction, nutrition, health, pasture management, economics, and marketing. Location: Fasig-Tipton Sales Pavilion. Note that this date is a change from Jan. 8 and 9, as originally announced. The registration form and schedule are available at www.ca.uky.edu/gluck.

Jan. 28, 4 p.m., Horse Behavior, Sue McDonnell, PhD, University of Pennsylvania School of Veterinary Medicine. This is part of the Department of Veterinary Science Equine Diagnostic and Research Seminar series. Location: TBD. 4 p.m.

Jan. 31, 8:30 a.m., Third Annual Breeders' Seminar, hosted by the Kentucky Quarter Horse Association and the UK Equine Initiative. Crowne Plaza Hotel, Louisville Airport, 830 Phillips Lane, Louisville, Ky.

UK Equine Initiative and/or Gluck Center faculty and/or staff are participating in all of these events.



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