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Advancements in Equine Reproduction Research

Two equine researchers from the University of Kentucky's (UK) Maxwell H. Gluck Equine Research Center, in Lexington, presented their study results about breeding and mare fertility during the 2014 American Association of Equine Practitioners (AAEP) Convention, held Dec. 6-10 in Salt Lake City, Utah. Here's a summary of their work:

Anti-Mullerian Hormone Helps Assess Aging Mares' Fertility

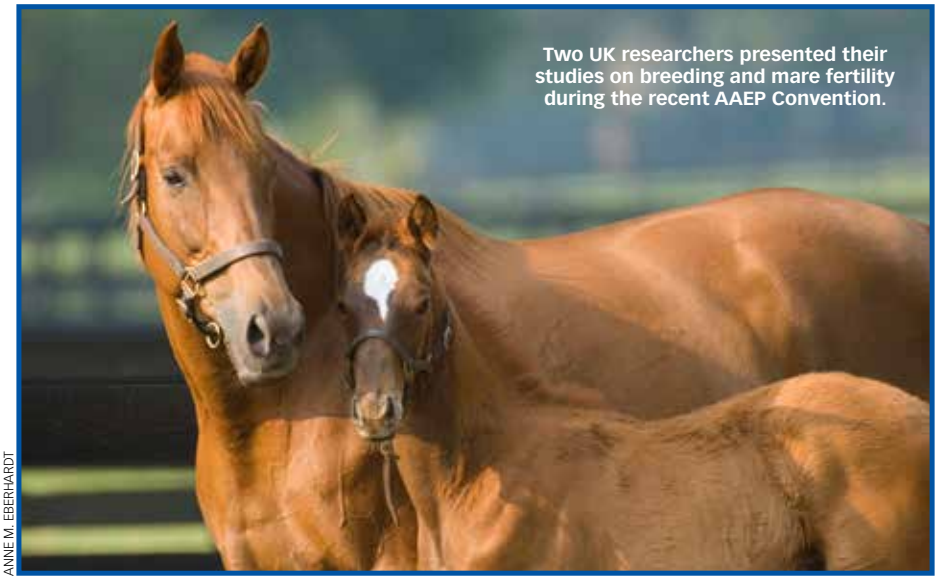
Equine researchers at UK have been chasing anti-Mullerian hormone (AMH, which is produced by cells in fetal testes as well as granulosa cells) for quite some time. They've determined they can use it to test for cryptorchidism in male horses as well as ovarian tumors in mares. Now, they're trying to see if the hormone can predict an aging mare's remaining follicle count.

"Mare fertility declines with age in association with reduced follicle count," said study co-author Barry Ball, DVM, PhD, Dipl. ACT, Albert G. Clay Endowed Chair in Equine Reproduction at the Gluck Center. In other species, such as cattle and mice, "AMH is highly correlated with antral follicle count (AFC, or the total number of follicles that can be counted on ultrasound)."

He hypothesized that AMH concentrations might help predict an aging mare's AFC, reproductive longevity, and fertility.

In the study, Ball and his colleagues looked at the relationship between AMH, AFC, and follicle reserve in mares of different age groups. They examined 10 young (3-8 years), 16 middle-aged (9-18 years), and 19 older (over 18) mares using transrectal ultrasound and ELISA tests. In their results they found a strong relationship between AMH and AFC in older mares but not in young ones. They also discovered that mares with lower AMH concentrations had smaller follicles.

Additionally, Ball said they found that AMH concentrations in older mares that maintained pregnancies were significantly higher than in those that did not. "We're in the process of expanding on this," he added.



Two UK researchers presented their studies on breeding and mare fertility during the recent AAEP Convention.

ANNE M. EBERHARDT

"Follicular reserve declines with age," Ball concluded. "Our goal is to be able to use AMH concentrations to examine reproductive longevity in older mares, but we need larger numbers to better understand how this can be applied clinically."

Estrogen Concentrations' Effects on Pregnancy Outcome

During pregnancy, mares experience elevated estrogen levels. Why? Well, that's largely unknown. What researchers do know is that when mares lose a pregnancy late in gestation, their estrogen levels are quite low. So a team of researchers lead by Ball recently tried to find out what the relationship is between estrogen concentrations and pregnancy loss.

In their study, the team treated six mares with 500 mg of letrozole, an estrogen inhibitor, every four days from

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Day 240 of gestation to foaling. Six untreated mares served as controls. They evaluated the mares' estrogen and androgen (a male sex hormone) concentrations weekly and other parameters, such as fetal growth and the combined thickness of the uterus and placenta, via ultrasound biweekly.

Ball explained that the treated mares' androgen levels increased and their estrogen levels dropped 90% immediately after the first treatment. All six mares gave birth to healthy foals with no abnormalities.

"Gestational length was unchanged, neonatal viability was normal, but birth weights of foals born to letrozole-treated mares were reduced by 15%," Ball said.

Based on these results, he concluded that reduced estrogen in late pregnancy does not affect pregnancy outcome. Supplementing mares in late gestation with estrogen, therefore, is likely unnecessary, he added.

"Reduced estrogen associated with pregnancy loss likely reflects disruption of placental function, but is not the cause of abortion," Ball said.

Does Uterine Edema Affect Pregnancy Outcome?

Edema, or fluid swelling, is often a sign that something's wrong. Pulmonary edema in horses' lungs, for instance, can be fatal. In certain eye structures it can lead to vision loss. In mares in estrus, however, some uterine edema in response to estrogen secretion is commonplace. But is it also benign?

Researchers from the Gluck Center and Rood & Riddle Equine Hospital, in Lexington, recently studied uterine edema at ovulation to determine whether it affected pregnancy outcome. Ed Squires, PhD, Dipl. ACT (hon), professor at the Gluck Center, presented their results.

When examining a mare's uterus and ovaries during estrus, many veterinarians report seeing uterine edema as the mare approaches ovulation. The edema typically decreases just prior to ovulation. Some mares, however, continue to experience edema during or after ovulation, and no studies have been performed to determine whether this adversely affects fertility. Squires' team hypothesized that prolonged or excessive uterine edema would lower mares' pregnancy rates and increase incidences of early embryonic loss.

In the study, the team used ultrasound to examine 920 Thoroughbred mares for a total of 1,127 estrous cycles during the 2014 breeding season. Two days before ovulation as well as the day of, they recorded each mare's edema score on a scale of 0 to 4, with 0 indicating no edema and 4 being excessive, along with all other findings. They then classified the mares into three age groups—young (2 to 9 years), middle-aged (10 to 16 years), and old (17 and up)—and also noted their reproductive status (foaling, maiden, or barren) at the time of breeding.

Squires said they found that:

- Older mares had lower pregnancy rates (38%) than young (71%) or middle-aged (63%) mares;
- Pregnancy rates were similar among barren (66%), foaling (65%), and maiden (71%) mares;
- Barren mares older than 11 had lower pregnancy rates than younger barren mares;
- Barren mares had a greater incidence of early embryonic loss between Days 14 and 50 of gestation (13%) compared to foaling (8.7%) and maiden (5.5%) mares;
- Mares that had undergone a uterine lavage had a greater incidence (13%) of early embryonic loss than those not lavaged (7%). "This is probably an indication that mares that needed a lavage were likely those with fluid, older mares, or those with some other reproductive problem," Squires said;
- Mares with uterine fluid greater than 1 cm had an increased incidence of early embryonic loss (17%) compared with mares that had fluid less than 1 cm (8%). "This is probably because older mares have more fluid accumulation," Squires said;
- Only 6.5% of mares had excessive edema (scores 3 or 4);
- Higher edema grades correlated with greater amounts of uterine fluid; and
- Edema, antibiotic use, or other treatments did not significantly affect pregnancy rates.

"The fact that excessive edema did not lower pregnancy rates or increase embryonic losses was unexpected," Squires said. "Others have suggested that excessive edema at ovulation or after ovulation may be an indication of subclinical endometritis or perhaps an endocrine imbalance."

Mares' reproductive status and age's

MASTHEAD

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The Horse: Your Guide to Equine Health Care

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effect on pregnancy loss, however, was not surprising, as several previous studies had confirmed these correlations.

"In summary, maximum or excessive uterine edema near the time of ovulation did not adversely affect pregnancy rates or the incidence of early embryonic loss," Squires said, meaning that, based on this study's results, owners and veterinarians have little reason for concern when it comes to this type of swelling.

"Further studies are needed with more mares having grade 3 and 4 edema at ovulation," he added, "and data on the presence of bacteria in the uterus of mares with grade 3 and 4 edema would be useful in determining what is causing this excessive uterine edema." UK

>Alexandra Beckstett is the managing editor at *The Horse: Your Guide to Equine Health Care*.

Know Your Pasture Grass

Grass is grass, right? Only if a horse is a horse, of course. Just like horses, all grasses are not created equal. Each grass species is slightly different from all others. Saying tall fescue and bluegrass are the same is like saying Quarter Horses and Thoroughbreds are the same. Knowing what's in your pastures and what you're planting is key to successful pasture management. In this article we will talk about determining the kinds of grasses you have, variety selection, establishing new grasses, and grazing tolerance.

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Clockwise from top: Orchardgrass, tall fescue, white clover, and bermudagrass are some of the common types of grasses you might find in horse pastures.

What Grasses Do I Have?

To begin improved pasture management, know what you have to work with. Take a walk through your pasture and determine what grasses you have. Some of the most common grasses in horse pastures include:

Kentucky bluegrass, a cool-season grass (grows in the spring and fall) that has a dark, fine blade with a tip shaped like the front of a boat. Bluegrass forms a tight sod and grows close to the ground. It survives well even under close grazing, which is why it is a perfect grass for horse pastures in temperate regions of the United States.

Orchardgrass, a cool-season grass. It has a bluish/green color, is soft to the touch, and is flat at the base of each grass blade. Orchardgrass is palatable to horses and will provide higher yields than Kentucky bluegrass. However, it grows in bunches and will not persist when grazed or clipped close to the ground on a regular basis. Never graze or clip orchargrass shorter than 3-4 inches, and provide rest periods between grazing events.

Tall fescue, another cool-season grass. It has a dark green color and prominent veins on the leaves. Tall fescue will feel rough to the touch, as the edges of the leaf blades are serrated like a knife. This grass is also a bunch-growing grass, but is much tougher than orchardgrass and can tolerate frequent grazing. Naturally occurring tall fescue is likely infected with a fungal endophyte that can be toxic to broodmares. Avoid grazing late-term broodmares on this grass.

White clover, which is actually a legume, not a grass. It's an excellent forage for horses, grows close to the ground, and can tolerate close, frequent grazing, especially when conditions are cool and wet.

Bermudagrass, a warm-season grass that grows best in the South. This wiry grass forms a tight sod and is highly productive when fertilized adequately. Bermudagrass also makes great hay for horses.

Nimblewill, a low-growing native warm-season grass seen in horse pastures in Kentucky and surrounding states; however, horses will not eat it (nor will cattle or goats). Thus, pasture managers usually consider it a weed. There are no herbicides labeled for pastures that will control nimblewill without also harming other grasses. Maintaining a good grass cover and not grazing close is the best way to prevent nimblewill from overtaking your pastures.

This list covers some of the most common horse pasture grasses, but there are many more species. For more information about identifying pasture grasses, read the "Forage Identification and Use Guide" (AGR-175) at uky.edu/Ag/Forage/ForagePublications.htm, or check with your local county extension agent.

Establishing New Grasses

Now that you know what grasses you have, you might be satisfied with them, or you might want to make improvements. Grasses can

Pasture Grass

be seeded into existing pastures or recently killed pastures. Regardless, the establishment process is the same. There are six key steps to successful pasture establishment:

Soil fertility. Before beginning establishment, soil sample your pastures and add any needed fertilizers and lime. Good soil fertility is important for seedlings as well as for established grasses.

High-quality seed. This is where you get what you pay for. Purchasing certified seed ensures it will have high germination and low contamination from other grasses and weeds. Select seed of improved varieties that are best adapted for your area (see section below).

Plant enough and at the right time. Seeding rates and dates are important. Seeding rates will vary based on the seed species or mixture you are planting, but will be somewhere between 20-40 pounds of seed per acre (more seed never hurts, other than the cost). Cool-season grasses are best seeded late summer or early fall in the majority of the Untied States, but can also be seeded in the early spring if needed (for Central Kentucky, this would be Aug. 15-Sept. 15 or March 1-April 1). Only seed bermudagrass in the late spring after the risk of frost has passed. For more information on seeding windows in your area, read the previous month's article, "An Equine New Year's Resolution: Better Pasture Management," at TheHorse.com/35210.

Use the best seeding method. For most situations, this will mean using a no-till drill to place the right amount of seed at the correct depth. Most seeders will have instructions for setting the seeder correctly; however, many things can affect this placement, such as seed mixture, pasture condition, and soil moisture. It is important to check frequently that you're placing the correct amount of seed at the correct depth, usually ¼ to ½ inch below the soil surface for most cool-season grasses. Seed bermudagrass at ⅛ to ¼ inch, since the seed is extremely small.

Controlling competition. Seedlings will use energy stored in the seed to grow and break through the soil surface. However, seeds are small, and by the time they get to the surface, there isn't much energy left. Having an open soil surface for seedlings to absorb light is critical for establishment success. Controlling competition might mean applying herbicide before or after seeding (always read the label and use as directed). Most herbicides cannot be applied immediately before or after seeding, so plan ahead. When seeding into established pastures, mow close before seeding to open up the soil surface and allow seedlings to catch up with mature grasses (and weeds) that might otherwise shade them out.

Rest. Now that you have spent time (and money) on pasture establishment, you must give it time to grow. New seedlings have very shallow roots and are more nutritious (and tasty) than mature plants. Horses will target young grasses and will likely pull them out of the ground when grazing (hoof traffic is also

STUDENT SPOTLIGHT

GABRIEL MONTEIRO DAVOLLI

From: **Rio Grande do Sul, Brazil**

Degrees: **Medical Veterinarian (DVM equivalent) Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil**

Gabriel Davolli was involved in equine reproduction in a research environment during veterinary school in Brazil. He visited Lexington and the University of Kentucky Gluck Equine Research Center during this time, and after graduation he came back to pursue a research project through the Gluck Center as a master's student.

"I looked forward to being responsible for the different stages of a research project—from planning to execution and analysis, under the guidance of experts in the field," Davolli said.

Davolli has conducted research regarding hormonal therapy under the supervision of Ed Squires, PhD, Dipl. ACT (hon.), professor at the Gluck Center. Specifically, he has worked with hormones in stallions to suppress undesirable behavior.

When asked how this research will contribute to the field of equine science, Davolli said, "It has potential applications as a behavior modulator, which could be used as a substitute to castration in aggressive stallions, and as treatment of stallions persistently infected with equine arteritis virus (EAV, a virus that causes equine viral arteritis [EVA], an upper respiratory tract and reproductive disease in horses). This virus depends on testosterone to survive within the reproductive tract of carrier stallions and is cleared after prolonged testosterone depletion. These carrier stallions are known for disseminating EAV through infective semen (fresh, cooled, or frozen), leading to EVA outbreaks across states and overseas."

Davolli has also been closely involved with several research projects conducted by other doctoral students at the Gluck Center. For example, he worked with Anthony Claes, PhD, DVM, who is now an assistant professor at Utrecht University in The Netherlands, on ovarian and hormonal changes in geriatric mares. He also worked on several projects with Igor Canisso, PhD, DVM, who is now an assistant professor at the University of Illinois, involving the use of colostrum changes as a sign of impending foaling in mares and other projects related to placentitis.

"I was also lucky to collaborate in projects of other students and in preliminary trials of products to be used at the time of breeding and for semen processing," Davolli said. "Finally, I was part of an experiment investigating the effects of the supplementation of DHA (an omega-3 fatty acid) to stallions and its effects on semen quality."

Being involved with investigations of basic biology, as well as applied studies of interest to the industry, has been a valuable learning experience, Davolli said.

"It is neat to understand that many times one project can accomplish both jobs if there is good planning, execution, and sound interpretation of the data," he said. "On the other hand, it also teaches you to accept the inherent limitations of an experiment and how far the information can be stretched, which is where a follow-up experiment comes in."

After finishing his master's program, Davolli plans to begin a six-month internship with Park Equine Hospital in Lexington for the foaling season. Looking to the future, Davolli said that a residency involving the holistics of reproduction would be an excellent way to see where scientific knowledge is lacking and think of potential research ideas. 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.

Table 4. Dry matter yields, seedling vigor, maturity, and stand persistence of Kentucky bluegrass varieties sown September 12, 2012, at Lexington, Kentucky.

Variety	Seedling Vigor[1] Oct 16, 2012	Maturity[2] 2013 May 21	Maturity[2] 2014 May 6	Percent Stand 2012 Oct 16	Percent Stand 2013 Mar 20	Percent Stand 2013 Oct 22	Percent Stand 2014 Apr 9	Percent Stand 2014 Oct 27	Yield (tons/acre) 2013 Total	Yield (tons/acre) 2014 May 6	Yield (tons/acre) 2014 Jun 16	Yield (tons/acre) 2014 Oct 27	Yield (tons/acre) 2014 Total	2-year Total
Commercial Varieties—Available for Farm Use														
Kenblue	2.9	62.0	58.0	98	100	100	100	100	3.27	1.22	0.55	1.25	3.02	6.29*
Ginger	3.5	62.0	58.0	98	98	98	99	100	3.11	1.35	0.55	0.94	2.85	5.95*
BigBlue	3.0	59.5	53.0	100	100	100	100	100	2.31	0.86	0.48	1.16	2.50	4.81
Barderby	3.6	61.5	57.0	100	100	100	100	100	2.82	0.81	0.39	0.65	1.85	4.67
Park	5.0	60.5	53.0	78	100	100	100	100	2.56	0.93	0.46	0.59	1.97	4.53
Experimental Varieties														
RAD-2018	1.3	60.5	58.0	97	97	99	100	100	3.00	1.59	0.59	0.85	3.03	6.03*
RAD-1448	3.4	54.5	29.0	100	100	100	100	100	2.98	1.07	0.68	0.90	2.65	5.63*
RAD-1458	3.5	45.0	29.0	100	100	100	100	100	2.97	0.89	0.57	0.92	2.39	5.36
RAD-1445	2.6	47.8	54.0	97	98	99	100	99	2.21	0.71	0.48	0.55	1.74	3.94
Mean	3.2	57.0	50.0	96	99	99	100	100	2.80	1.05	0.53	0.87	2.44	5.25
CV,%	26.0	3.8	1.7	16	2	2	1	0	8.08	14.24	27.02	27.14	16.19	10.05
LSD,0.05	1.2	3.2	1.3	22	3	3	1	1	0.33	0.22	0.21	0.34	0.58	0.77

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Maturity rating scale: 37 = flag leaf emergence, 45 = boot swollen, 50 = beginning of inflorescence emergence, 58 = complete emergence of inflorescence, 62 = beginning of pollen shed. See Table 2 for complete scale.
* Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

hard on young grasses). Give a recently seeded pasture four to six months before turning horses back out on it.

Reseeding or overseeding pastures can greatly improve their productivity, but must be done correctly to be successful. For more information, see "Establishing Horse Pastures" (ID-147) at uky.edu/ag/forages under the publications link.

Variety Selection

Variety selection is something that few people think about, but it can make a big difference in a pasture's long-term success and productivity. Consider this analogy: If you wanted to get involved in cutting, you wouldn't buy the highest priced eventing horse. Choose a horse—or a grass—that is bred to do exactly what you want it to do.

Many states offer forage variety testing as part of their research and extension work. These tests are designed by planting several varieties of the same grass species next to one another. All plots are treated the same, and performance results are recorded and reported at the end of the year. These reports can be valuable and will usually include information such as seedling vigor, growth rate, and yield. While each university will set up its tests differently, most will include this basic information. For the rest of this section, we will look at Kentucky bluegrass performance, found in the "2014 Timothy and Kentucky Bluegrass Report" from UK, as an example of how to read and interpret the information found at uky.edu/Ag/Forage/ForageVarietyTrials2.htm.

This report focuses on tests performed in Lexington, Kentucky, although some grass species are tested at multiple locations and reported separately.

Table 4 above provides a representative table of forage test variety information, so we'll explain how to interpret it in some detail. There are five commercial varieties listed that were tested beginning in 2012 and four experimental varieties. Because experimental varieties are not commercially available, we will not look at these. This test was planted Sept. 12, 2012 and has been sampled several times each year since then.

When buying forage seed, check the seed tag and only buy seed that shows a high germination percentage.

The first column of data shows seedling vigor. This is a measure (from 1 to 5) of how vigorously (or quickly) the seedlings began growing. These measurements were taken by visual estimation on Oct. 16. Park had the highest seedling vigor, and Kenblue had the lowest seedling vigor. If you are planting later than normal or under adverse establishment conditions, you might consider a variety with higher seedling vigor that is more likely to establish quickly.

Maturity is a measure of how mature each variety is at the same time point. Some varieties mature (produce seedheads) more quickly than others. This might be useful if you want to alter when grasses are most productive on your farm or select grasses that will mature at different stages. For both 2013 and 2014, Kenblue and Ginger were more mature at the time of the rating while BigBlue and Park were the least mature (see table footnote for maturity rating scale).

Percent stand tells us how much of the ground was covered by the desired grass at the time of the rating. This can tell us how quickly a stand will fill in as well as whether it's likely to thin over time. Notice that all data points, except for Park in 2012, are at or close to 100% one month after planting. Park had the highest seedling vigor but the lowest initial percent stand, which tells us that individual plants grew quickly, but seed germination was lower so there weren't as many plants to start with. When buying forage seed, check the seed tag and only buy seed that shows a high germination percentage.

Yield is what most farm owners will look at when selecting a variety. Several times throughout the year, these plots were harvested and the yield of each

Table 3. Seedling vigor, grazing preference and stand persistence of forage grasses sown September 1, 2010 in a horse grazing tolerance study at Lexington, Kentucky.

Variety	Species	Seedling Vigor[1] Oct 26, 2010	Grazing Preference[2] 2011 May 2	2012 May 2	2013 May 8	2014 May 6	Percent Stand 2010 Oct 26	2011 Mar 15	2011 Nov 9	2012 Mar 22	2012 Oct 12	2013 Mar 27	2013 Oct 15	2014 Apr 8	2014 Oct 20
Commercial Varieties—Available for Farm Use															
BarOptima PLUS E34	tall fescue	2.2	3.7	1.2	3.0	5.0	97	99	99	84	97	97	100	100	100*
KY31+[3]	tall fescue	2.8	1.2	1.0	2.0	4.0	99	100	100	100	99	99	99	99	100*
Jesup MaxQ	tall fescue	1.9	1.0	1.0	1.2	3.7	96	97	99	100	99	99	99	99	99*
Select	tall fescue	2.8	1.0	1.0	1.3	3.7	98	98	99	85	98	98	98	99	99*
Jesup EF	tall fescue	3.2	1.0	1.0	1.8	3.3	99	100	100	100	99	99	99	99	99*
Benchmark Plus	orchardgrass	4.3	1.7	1.7	4.8	4.7	100	100	84	99	99	99	96	94	95*
Persist	orchardgrass	3.2	1.7	1.2	4.2	4.5	99	99	99	99	99	99	95	79	84
Tekapo	orchardgrass	3.3	2.7	3.0	6.5	6.3	85	100	100	100	100	99	89	67	83
Profit	orchardgrass	3.2	2.8	3.3	6.5	6.3	99	99	97	98	97	98	77	71	72
Ginger	KY bluegrass	0.9	5.2	1.8	4.7	5.3	71	71	67	57	61	73	52	63	58
Power	perennial ryegrass	5.0	6.7	9.0	8.3	9.0	100	100	98	99	96	95	78	24	42
Grand Daddy	perennial ryegrass	4.3	6.0	8.3	8.2	7.8	99	99	96	97	95	94	71	15	39
Climax	timothy	1.9	5.8	4.2	5.7	6.2	95	94	77	76	53	51	27	13	9
Experimental Varieties															
AR 1521	tall fescue	2.3	1.2	1.0	1.8	2.8	96	98	99	100	99	98	99	99	100*
KY31- [3]	tall fescue	3.3	1.0	1.0	1.7	2.8	99	100	100	100	99	99	99	99	99*
TM 0502G	timothy	0.8	7.0	4.0	7.2	6.7	36	44	34	40	33	33	19	13	9
Mean		2.8	3.1	2.7	4.3	5.1	92	93	90	89	89	89	81	71	74
CV,%		27.6	28.8	32.5	21.5	24.1	13	8	13	15	12	10	13	15	15
LSD,0.05		0.9	1.0	1.0	1.1	1.4	13	9	14	16	12	10	12	12	13

[1] Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.
[2] Preference score based on a scale of 1 to 9 with 9 indicating all forage was grazed. Grazing time before rating; 2011-12 days, 2012-13 days, 2013-12 days, 2014-11 days.
[3] KY 31- is the variety KY31 from which the toxic endophyte has been removed. KY31+ contains the toxic endophyte. Jesup MaxQ and AgR 1521 contain a non-toxic endophyte. BarOptima PLUS E34 contains a beneficial endophyte. The other fescue varieties in this test do not contain an endophyte.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

plot was calculated. This gives an idea of each variety's likely productivity. This table reports a total for 2013, yield for each of three harvests in 2014, a total yield for 2014, and a two-year total. Notice that in June 2014 all yield numbers are much lower than in May or October. Bluegrass is a cool-season grass that grows best in the cool parts of the year (spring and fall) and is less productive in the summer months. The two-year total at the far right shows that Kenblue and Ginger were the most productive varieties in this test. The asterisk indicates that while there might be a numerical difference in these two varieties' yield, there is no statistical difference.

At UK, all grass variety tests are kept in production for three years. Therefore, for any given year there should be three active tests reported.

Reports similar to these are available for orchardgrass, tall fescue, red and white clovers, and other forages.

Grazing Tolerance

While seedling vigor and yield are important to consider when choosing varieties, grazing tolerance (how well a particular grass holds up to the grazing and foot traffic of the animals it supports) is also an important factor. Several states offer grazing tolerance studies with cattle, but Kentucky offers horse grazing tolerance reports as well.

In the "2014 Cool-Season Grass Horse Grazing Tolerance Report" (PR-685), we can see how several varieties have performed under continuous horse grazing. These tests are planted as one large block with all species and varieties randomized together. Horses are allowed free access to graze the entire area. It is best to make comparisons within a species only instead of across species, as factors like maturity date can affect palatability differently. Table 3 above contains the results from a study planted in 2010 and maintained for four years. In addition to rating seedling vigor, grazing preference and percent stand are also reported.

Percent stand in this test tells us how the varieties performed under the pressure of continuous grazing. Notice in Table 3 that all of the tall fescue varieties performed very well. However, after four years of grazing, orchardgrass varieties showed differences in stand survival. For example, Benchmark Plus performed better than all other orchardgrass varieties. Notice that the perennial ryegrass varieties performed well through 2012, but began to thin out after that. Perennial ryegrass establishes quickly, but typically begins to thin after two years. The timothy variety began to thin dramatically after only one year. Timothy is best suited for hay production and doesn't perform as well under grazing.

Summary Reports

Summary reports provide a historical perspective of many years of data collection in forage variety trials. In the "2014 Long-Term Summary of Kentucky Forage Variety Trials" (PR-687), we can find a wealth of information. In this report, years of variety trials are summarized into one table per forage species so that quick comparisons can be made. All tables are set up so that any number over 100 indicates above-average yield performance. All Forage Variety Trial reports, including the Long-Term Summary, can be found at uky.edu/ag/forages under the Forage Variety Trials link.

Pasture Grass

Table 8 of this report, to the right, summarizes all of the Kentucky bluegrass trials that have been conducted in Lexington. The far right column contains the variety's average performance for all tests it was in, with the number of tests in parenthesis. Notice that Lato performed far above average (116%) but was only in two tests; therefore, this information might not be as reliable as for Ginger, which was in eight tests and performed at 111%. Notice that Common is listed as well and performed far below average at only 68%. Common, or Variety Not Stated (VNS), is not a variety, but is a bag of seed where the variety is unknown; therefore, there is no way to know this seed's adaptation or yield. This illustrates why purchasing quality seed of improved varieties is so important. Often, prepackaged pasture mixes will contain the common seed of each species and will likely be far less productive than purchasing improved varieties and custom mixing.

Table 8. Summary of Kentucky Bluegrass Yield Trials at Lexington 1996-2014 (yield shown as a percentage of the mean of the commercial varieties in the trial).

Variety	Proprietor/KY Distributor	96[1,2] 3yr[4]	03 2yr	04 3yr	06 4yr	07 3yr	08 3yr	09 3yr	10 3yr	11 3yr	12 2yr	Mean[3] *(#trials)*
Adam 1	Radix Research			98								–
Barderby	Barenbrug USA					94		101	91	98	89	95(5)
Big Blue	Rose-AgriSeed							82			92	87(2)
Common	Public				71	66	68					68(3)
Ginger	ProSeeds Marketing		89		118	119	114	118	112	107	113	111(8)
Kenblue	Public	90		102	133				96	95	120	106(6)
Lato	Turf Seed Inc.	110				122						116(2)
Park	Public										86	–
RAD-5	Radix Research				103							–
RAD-339	Radix Research				101							–
RAD-643	Radix Research				94							–
RAD-731zx	Radix Research				87							–
RAD-762	Radix Research				94							–
RAD-1039	Radix Research						118					–
Slezanka	DLF International Seeds		111									–

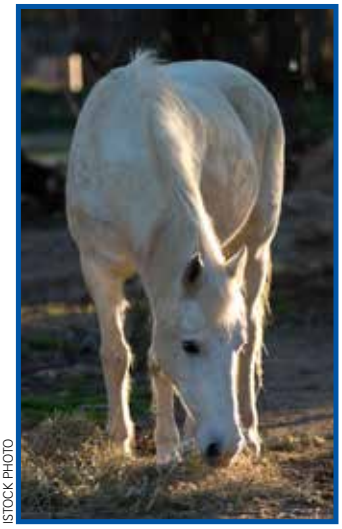
[1] Year trial was established.
[2] Use this summary table as a guide in making variety decisions, but refer to specific yearly reports to determine statistical differences in forage yield between varieties. To find actual yields, look in the yearly report for the final year of each specific trial. For example, the Lexington trial planted in 2004 was harvested 3 years, so the final report would be "2007 Timothy and Kentucky Bluegrass Report" archived in the KY Forage website at <www.uky.edu/Ag/Forage>. The 96 and 03 Lexington results are in the appropriate Tall Fescue Reports.
[3] Mean only presented when respective variety was included in two or more trials.
[4] Number of years of data.

Conclusion

Overseeding existing pastures or establishing new ones can increase pasture productivity dramatically and can often reduce the need for stored feeds such as hay and grain. Selecting the right species and varieties will further increase your pasture's success and long-term survivability. Before doing any pasture improvement, make sure to follow the steps for successful pasture establishment and select varieties that are known to perform consistently well in your area. UK

>Krista Lea, MS, assistant coordinator of UK's Horse Pasture Evaluation Program; Ray Smith, PhD, professor and forage extension specialist at UK; and Gene Olson, MS, state forage variety testing coordinator, all within UK's department of Plant and Soil Sciences, provided this information.

Nutrient Digestibility in Healthy Adult and Senior Horses



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Healthy aged horses are able to digest various nutrients similarly to horses in their prime.

Sure, age is just a number, but human doctors know that's not necessarily the case when it comes to nutrition and nutrient digestibility. So do aged horses follow this same pattern? Does aging correlate with a reduced ability to digest vital nutrients even in healthy horses? That's what an international research team recently sought to find out.

Sarah Elzinga, MS, now a PhD candidate at the University of Kentucky Gluck Equine Research Center, in Lexington, worked with colleagues from the Michigan State University Department of Animal Science, in East Lansing, and the WALTHAM Center for Pet Nutrition, in Leicestershire, U.K., to compare nutrient digestibility in mature and senior horses. The team employed 17 healthy stock-type mares—nine adults (5-12 years old) and eight aged (19-28 years old). The team matched each adult and aged mare by body condition and randomly assigned each pair to consume a diet consisting of either:

- Mixed timothy hay (HAY);
- Mixed timothy hay with a high-fiber, high-fat, low-starch concentrate (FF); or
- Mixed timothy hay with a low-fat, high-starch concentrate (CHO).

The mares consumed each diet for six weeks before being reassigned so that each mare ultimately ate all three diets. The team evaluated how well the mares digested a variety of parameters including digestible energy, dry matter, calcium, phosphorus, energy, neutral detergent fiber (an estimate of how much "bulk" forage [cellulose, hemicelluloses, and lignin] a horse can consume), crude protein, and fat.

Ultimately, the team identified no differences between healthy adult and aged mares with regard to any of the parameters measured. These results indicate that, while

Nutrient Digestability

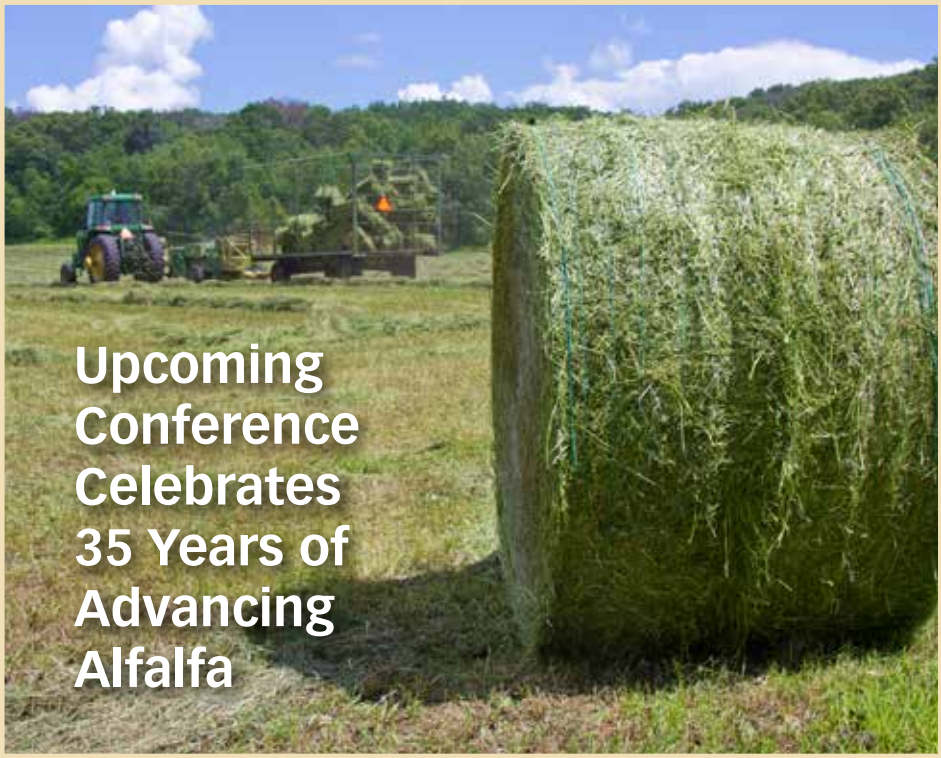
older horses might have health concerns that warrant specialized diets, there's no need to change a healthy senior horse's diet just because he reaches a certain age.

Although all the aged mares in this study had normal dentition, the authors cautioned that poor or missing teeth could negatively impact nutrient digestion.

"The aged horse population is growing, with horse owners increasingly concerned with how to care for these animals," said Elzinga. "Our research shows that the healthy aged horse is able to digest various nutrients similarly to a horse in its prime."

"Comparison of Nutrient Digestibility Between Adult and Aged Horses" was published in the *Journal of Equine Veterinary Science*. UK

>Kristen Janicki, MS, PAS, is a performance horse nutritionist based in Nicholasville, Kentucky.



ISTOCK PHOTO

Upcoming Conference Celebrates 35 Years of Advancing Alfalfa

For the past 35 years, the Kentucky Alfalfa Conference has offered alfalfa and animal producers and enthusiasts the chance to get the latest information on the most pressing topics during a one-day event. This year's conference on Feb. 26 at the Cave City Convention Center will continue that tradition.

Participants will hear from industry experts, specialists from the University of Kentucky (UK) College of Agriculture, Food and Environment, and some of the state's top alfalfa producers. Discussion topics include requirements to break Kentucky's beef per acre record; red meat, health, and alfalfa; alfalfa and the environment; and perspectives about hay quality from Garry Lacefield, UK extension forage specialist and a panel of five Kentucky producers.

In addition, attendees can participate in the conference's annual silent auction.

The conference begins at 8 a.m. and ends at 3:30 p.m. CST.

Program organizers have applied for continuing education units for Certified Crop Advisers.

Preregistration is not required. Participants can pay the $15 registration fee ($5 for students) the day of the conference.

Conference sponsors include the UK College of Agriculture, Food and Environment, the UK Cooperative Extension Service, and the Kentucky Forage and Grassland Council.

More information on the conference and directions to the convention center are available on the UK Forage Extension website at uky.edu/Ag/Forage. UK

>Katie Pratt is an agricultural communications specialist within UK's College of Agriculture, Food and Environment.

UK Equine Showcase and Kentucky Breeders' Short Course Held Jan. 23-24

Nearly 180 people attended the 4th annual University of Kentucky (UK) Equine Showcase and 6th annual Kentucky Breeders' Short Course held on Jan. 23 and 24, respectively.

Equine research specialists from UK presented lectures on Jan. 23 on topics including molecular composition of *Sarcocystis neurona* and its application for controlling equine protozoal myeloencephalitis (EPM); an update on equine proliferative enteropathy and *Lawsonia intracellularis*; the physiology of aging; and amino acid requirements in horses.

The following topics, which were also presented Jan. 23, were filmed by TheHorse.com and will be available on the website soon under "Videos and Photos": an update on the illicit use of cobalt in racehorses; an update on moxidectin poisoning; parasites and growth rates in foals; practical pasture and forage diagnostic tools; and understanding the toxin ergovaline's stability in tall fescue.

Topics presenters discussed on Jan. 24 included old and new approaches for lighting programs in mares; parasite control in young horses; plasma for foals; angular limb deformities in foals; omega 3 fatty acids in mares and stallions; genetic tool box: beyond answering the question "Who's your (horse's)

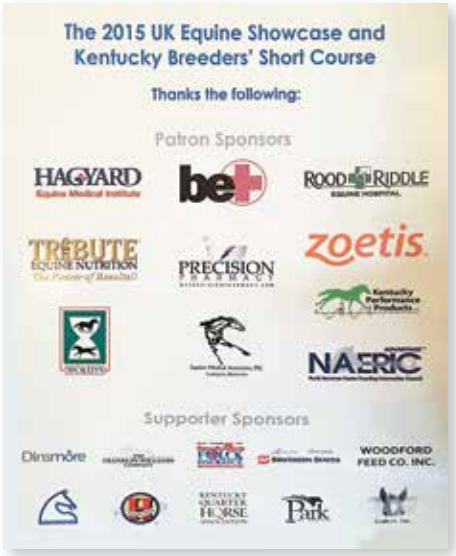
UK Equine Showcase

daddy?; what goes wrong with the geriatric mare; vaccination strategies for equine viral arteritis (EVA) and managing the EVA carrier stallion; improving the survival of stallion sperm; and a placentitis update.

The event was made possible through the generosity of corporate sponsors, including patron-level sponsors BET Reproductive Labs, Equine Medical Associates, Hagyard Equine Medical Associates, Kentucky Performance Products, McCauley Brothers Inc., North American Equine Ranching Information Council (NAERIC), Precision Pharmacy, Rood & Riddle Equine Hospital, Tribute Equine Nutrition, and Zoetis. Supporter-level sponsors included Animal Reproductive Systems, Dinsmore, Foalert, Folck Insurance, Franklin Williams Company, Hallway Feeds, Kentucky Quarter Horse Association, Park Equine Hospital, Southern States Co-op, and Woodford Feed Co. Inc.

More detailed summaries of specific talks will be highlighted in upcoming issues of the Bluegrass Equine Digest. To be added to the list for future Showcase and Short Course announcements, email Jenny Evans at jenny.evans@uky.edu. UK

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



Pinworm Suspicion

Q Is it possible to detect pinworms in a fecal egg count test? One of my horses rubs his rump on the stall wall at every opportunity, and he begs me to scratch him under his tail whenever I am close by. I know *Oxyuris equi* worms are difficult to eliminate, but I feel bad that he itches so much!

We live in the Central Sacramento Valley of Northern California, where it can freeze in winter, but not for long, and where it rarely, if ever, snows. It can get pretty warm in summer—over 100°F—but generally it reaches the 90s. We have 15 acres of pasture, run cows in the same fields as the horses, and clean the loafing areas, stalls, and corrals one to two times daily when in use.

Generally, my horses are wormed two times per year, usually with an ivermectin-type product. (And I shave off all the bots eggs I find in the fall.)

I administered the Panacur five-day double-dose fenbendazole regimen last winter, but did not conduct a fecal count before or after treatment. However, I wonder if that would be accurate or conclusive; in my opinion it's easy for vets just to say, "Oh, yeah, worm them." Any suggestions?

GINNY PASCHKE, VIA E-MAIL

A Pinworms (*Oxyuris equi*) are common in horses, but they usually do not cause much harm. Some horses scratch their tails, but bear in mind that this can be due to many other conditions as well. Occasionally, we find pinworm eggs in the feces—the eggs are very characteristic and cannot be confused with any other egg type in the horse. However, as a rule, pinworms lay their eggs outside the intestinal tract. In fact, the females stick out their posterior ends and deposit their eggs around the anus. This is the reason for the itching we sometimes see. A more reliable method for detecting pinworm infection is the so-called Scotch-tape technique, where the tape is first applied to the perianal skin, then it is viewed under the microscope. Often many pinworm eggs can be seen this way. Another method to collect pinworm eggs is to simply scrape off the perianal skin with a lubricated wooden tongue depressor.

Your parasite control program appears to be well thought-out, but I strongly recommend you run some fecals to get information on parasite levels and drug efficacy. UK

>Martin Krarup Nielsen, DVM, PhD, Dipl. EVPC, ACVM, an assistant professor at the University of Kentucky Gluck Equine Research Center, provided the expert advice.

Reproduction in Geriatric Mares

Barry Ball, DVM, PhD, Dipl. ACT, the Albert G. Clay endowed chair in equine reproduction and a professor in the department of veterinary science at the Gluck Equine Research Center, spoke about reproduction in the geriatric mare during the 6th Annual Kentucky Breeders' Short Course.

Older mares experience several uterine changes. Ball focused on pregnancy and ovarian, oviductal, and uterine factors.

Unlike humans, mares do not undergo menopause, although their eggs do deplete eventually. Ball emphasized that a mare's actual age and reproductive age are not the same. The reproductive age is dependent on the number of oocytes (eggs) populated in the mare's ovary at birth. Therefore, fertility decreases as the antral follicle count, or ovarian reserve, diminishes. Ovarian senescence refers to an ovary with no antral follicles or a depleted ovarian reserve.

Ball said there will eventually be a marker to determine older mares' reproductive age. This would allow individuals to predict how fast a mare will age reproductively.

Anovulatory hemorrhagic follicles (AHF) are follicles that do not ovulate but fill with a blood clot. AHF incidence is directly correlated to increasing age in mares and is also associated with a prolonged estrous cycle, or days between ovulation, if a mare is bred but does not ovulate. This causes low fertility

In the oviduct, the geriatric mare has a higher risk for oviductal plugs. W.R. Twink Allen, BVSc, PhD, ScD, DESM, MRCVS, director at the Paul Mellon Laboratory of Equine Reproduction, in

Geriatric Mares

the United Kingdom, developed technology using a hormone called prostaglandin E (PGE2) to manage these mares. Using PGE2 as a topical treatment for relaxing the oviduct's smooth muscle looks to be a possible solution for releasing these plugs from the oviduct, Ball said.

The geriatric mare has an increased risk of uterine problems such as endometritis (inflammation of the uterine lining), endometrial cysts (fluid-filled structures in the uterine lining), and endometriosis (when the uterine lining grows outside the uterus).

Older mares experience a reduced oocyte (egg) reserve and increased early pregnancy loss and are also more susceptible to uterine diseases.

A mare older than 10 years who has not previously given birth might have issues with cervical changes and adhesions, which can cause fluid accumulation in the uterus and delayed uterine clearance of fluid. Endometritis can result in early embryonic loss.

Fertility declines when mares are between the ages of 10 and 13. As age increases, the rate of embryonic loss continues to increase as well. Other pregnancy problems include retarded fetal growth, placental insufficiency, uterine artery rupture, and prepubic tendon rupture.

Ball concluded by restating that older mares experience a reduced oocyte reserve and increased early pregnancy loss. They are also more susceptible to uterine diseases such as endometriosis, angiosis, lymphatic cysts, and placental insufficiency. 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.

Parasite Control in Young Horses

Martin Nielsen, DVM, PhD, Dipl. EVPC, ACVM, assistant professor in the University of Kentucky Department of Veterinary Science at the Gluck Equine Research Center, lectured on parasite control in young horses at the 6th annual Kentucky Breeders' Short Course.

Nielsen emphasized the significance of anthelmintic resistance during his presentation and highlighted the various dewormers that have the greatest and poorest effect today.

Traditionally, farm managers have opted to apply year-round treatments at regular intervals, often referred to as rotational deworming. Veterinarians and caretakers believed this technique provided continual protection from parasites. Nielsen referenced a study conducted by the National Animal Health Monitoring System in 1998 that showed United States horse farms using an average of four or more treatments per year. Similar international studies show South African and British farms using an average of five to seven treatments per year.

"But change is coming," Nielsen said. "We did not eradicate a single parasite species. We have instead encountered the dreaded 'R' word—resistance. There is no single drug that guarantees full effect."

Strongyles and ascarids have become resistant to many of the dewormers used today. All of the drugs labeled for equine use (ivermectin, moxidectin, fenbendazole, and pyrantel) have lost efficacy to at least one type of equine parasite.

Parasite Control

"At the same time, all drugs still have efficacy against some parasites," Nielsen said. "But they have lost efficacy against others. Instead of being broad-spectrum, drug classes are now complementary to each other."

Nielsen used a jigsaw puzzle as an analogy. To obtain the best parasite control possible, farm managers must employ different drugs that work together to provide a broad range of control. For example, benzimidazoles (fenbendazole and oxibendazole) have strong efficacy against roundworms and large strongyles, but small strongyles have become widely resistant to this drug class.

Instead of using rotational deworming, the latest guidelines recommend performing fecal egg counts and treating according to results. An egg count can be used to evaluate the level of ascarid and strongyle egg shedding in a horse and determine the level of dewormer efficacy against each one. Knowing the relative presence of ascarids and strongyles in a horse can help owners or managers to identify the appropriate dewormer.

During his talk Nielsen focused on parasite control in foals. Foals experience their highest ascarid levels between 4 and 5 months old, after which time the strongyles take over. Tapeworms can occur after 6 months old. The first deworming should therefore focus on the ascarids at about 2 to 3 months old. At weaning, both parasite types might be present, and an egg count will reveal if ascarids are still the dominant type. At 8 to 9 months old, a weanling should be treated primarily for strongyles and possibly tapeworms. When a horse is a year old, another treatment should target strongyles and possibly tapeworms.

Nielsen stressed that a foal should receive four to five treatments within its first year of life. Treating less than this is not recommended due to the risk of parasite-associated disease, whereas more frequent treatments would need considerable justification due to parasite resistance.

You can find more information in Nielsen's book, co-authored with Craig Reinemeyer, DVM, PhD, "Handbook of Equine Parasite Control." It focuses on the biology of parasites, the general principles of parasite control, and the assessment tools for interpreting laboratory information. UK

>Jackson Wells is an equine science and management undergraduate student and communications intern for UK Ag Equine Programs.

ISTOCK.COM

Foals should receive four to five dewormer treatments in their first

UPCOMING EVENTS

Feb. 24

Kentucky Journal of Equine, Agriculture, and Natural Resources Law Symposium. Topic: Improving or Impeding? The Local & National Effects of State & Federal Regulations, UK College of Law Courtroom.

Feb. 26, 8 a.m.-3:30 p.m. CST

Kentucky Alfalfa Conference, Cave City Convention Center, Bowling Green, Kentucky, uky.edu/Ag/Forage

March 17, 6 p.m.

Horse College, Wolfe County Extension Service

Why Do Horses Need Amino Acids in Their Diets?

Kristine Urschel, PhD, associate professor of equine science in the University of Kentucky's (UK) animal and food sciences department, gave a talk about horses' amino acid requirements at the 4th Annual UK Equine Showcase.

Amino acids are one of the most significant pieces of the puzzle in a horse's diet, she explained. They benefit all of a horse's vital processes, as they are used to build all the protein in the body.

Horses require a total of 20 amino acids to build their body's proteins. The horse's own body can make 11 of those amino acids but does not have the ability to create the remaining nine it needs. Some amino acids can only be made by plants and micro-organisms. These are called the essential amino acids, and a horse must obtain them from food.

"Most mature horses will meet all requirements for their amino acids by being fed a good-quality forage and concentrate and by following the specific feeding instructions for that particular feed," Urschel said.

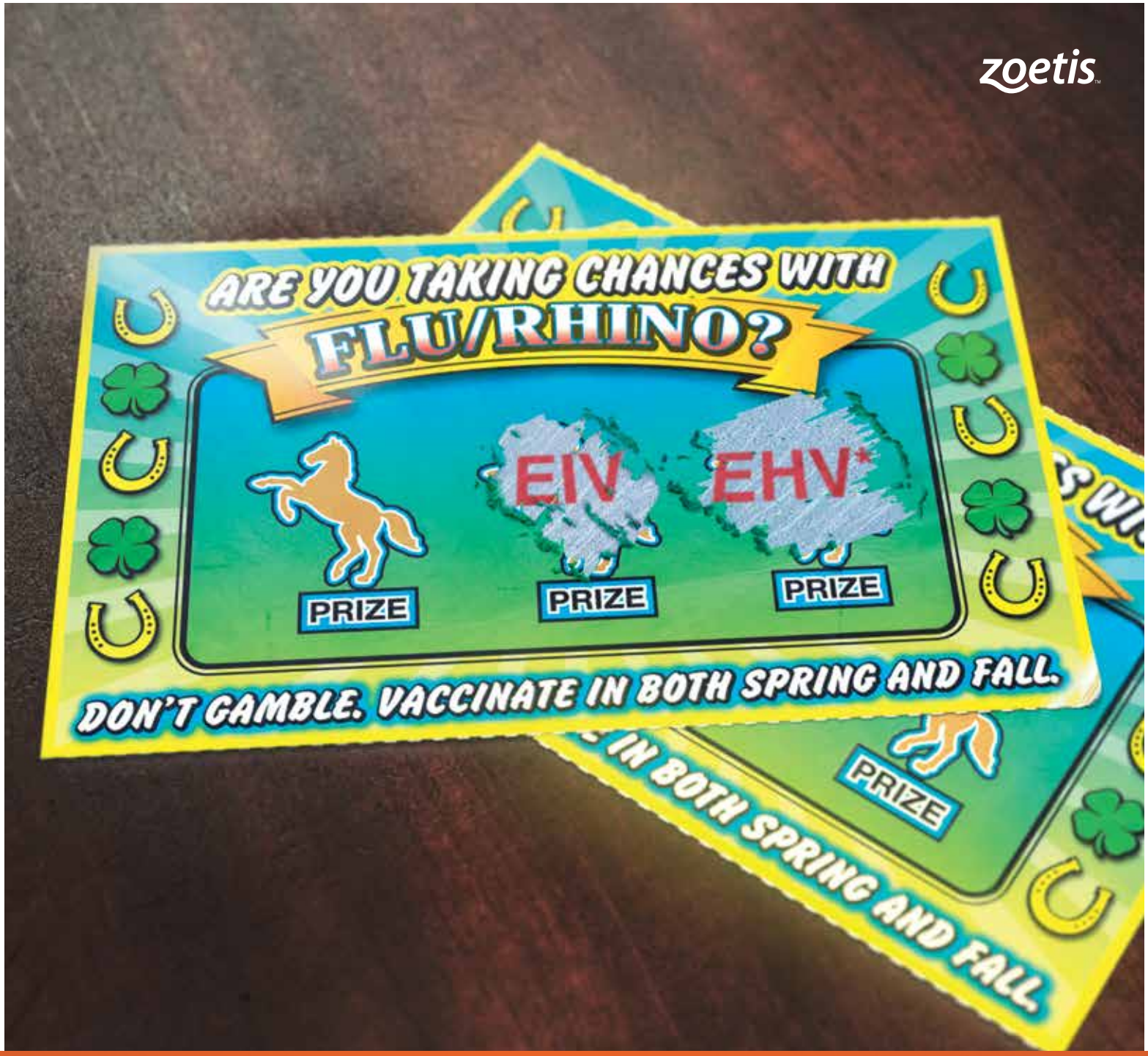
Amino acids that most commonly fall below the equine body's required amount are called limiting amino acids. The amino acids most likely to be limiting in a horse's diet are lysine and threonine, which determine how well a horse can use all other amino acids. Amino acids cannot be substituted for each other, and if all amino acids are not present, protein synthesis is limited.

In a recent study, Urschel found that limiting amino acid problems occurred more frequently in younger, growing horses than in mature horses.

If you're worried about whether your horse is receiving enough limiting amino acids, Urschel said you should "read the labels on most horse feeds; you'll see that they already have some amount of free lysine included into the mix to meet requirements."

The study of amino acids in horses is ongoing. In future studies Urschel would like to look at limiting amino acids in lactating mares, during gestation, and during intense exercise. UK

>Alexandra Harper, MBA, is the operations and communications coordinator for the UK Ag Equine Programs.



Equine influenza virus (EIV) and equine herpesvirus (rhinopneumonitis) cause the most common respiratory diseases in horses — and without a second vaccination, the risk increases.[1,2] Don't take the gamble. Help protect your at-risk horse by vaccinating with FLUVAC INNOVATOR® EHV 4/1 every six months. Download the Equine Influenza Calculator on iTunes® or learn more at **FluvacInnovator.com/calculator**.

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/eqstable

EQStable™ available in the Apple® App Store®

*EHV-1 and EHV-4

[1] Fretz PB, Babiuk LA, McLaughlin B. Equine Respiratory Disease on the Western Canadian Racetracks. *Can Vet J* 1979;20(2):58-61.

[2] Manley L, Caceres P. Retrospective Cohort Study of an Equine Influenza Outbreak in the Chilean Army in the Metropolitan Region of Santiago, Chile, during 2006, in *Proceedings*. 12th Symposium of the International Society for Veterinary Epidemiology and Economics, Durban, South Africa 2009:64.