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Purina Veterinary Conference

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Only 20 miles from downtown St. Louis, Mo., is a 1,200-acre research farm owned by the nutrition company Purina Mills. On Oct. 3-5, 140-plus veterinarians and another 50 Purina Mills representatives gathered to tour that research facility and hear speakers lecture on various topics during the Purina Mills Veterinary Nutritional Conference.

Three of the speakers were of international caliber, two with credentials in the field of reproduction and one in the field of foal health. They were Michelle LeBlanc, DVM, Dipl. ACT, of Rood and Riddle Animal Hospital in Lexington, Ky.; Terry Blanchard, DVM, MS, Dipl. ACT, of Texas A&M University; and Wendy Vaala, VMD, Dipl. ACVIM, of B.W. Furlong and Associates in Oldwick, N.J. Each presented two lectures scheduled for one hour each, but which carried beyond that because of the chorus of questions posed by the audience during and after the presentations.

Purina also offered its own formidable array of lecturers and researchers, including Karen Davison, PhD; Katie Young, PhD; Randel Raub, PhD; Ray Geor, BVSc, PhD, Dipl. ACVIM; and Kent Lantner, MBA. The Purina official in charge of it all and who served as everything from tour guide to troubleshooter to speaker was Scott King, DVM, product manager for Equine Senior and Purina Mills Equine Supplements.

Equine Digestive Physiology

An upbeat Davison got things started with her talk on "Equine Digestive Physiology" on the first evening. "What a topic right after you've finished eating," she quipped.

As a non-ruminant herbivore Davidson said that the horse did quite well for years by being a wandering, grazing creature whose prime need for survival was speed to run from predators. As the vast open ranges with their seas of grass dwindled, the horse's nutritional needs and demands changed.

"When a horse is confined to small acreage or total confinement, where the selection of forages is limited, or it is placed under performance demands seen in modern competitions, the non-ruminant herbivore meets with some nutritional challenges," said Davison. "First of all, confinement practices prevent the horse from benefiting from his ability to be a highly selective grazer, grazing only on young, immature forages that his system can digest and utilize efficiently. Second, the modern demands placed on the horse increase his nutrient requirements and horsemen must figure out how to meet those higher nutrient needs in an amount of feed a horse can safely consume and utilize."

Davison then discussed the various elements in feedstuffs consumed by horses and where they are digested. Starches, she pointed out, should be completely digested before they reach the cecum.

She posed and answered this rhetorical question: "Is starch and carbohydrate the same thing? Basically, all starches are carbohydrates, but not all carbohydrates are starches. Carbohydrate include sugars, starches, and fibers."

She added that in horses, "It is very important that the dietary starch is digested pre-cecally and does not reach the hindgut for microbial fermentation. Hindgut fermentation of soluble carbohydrates changes the end products of carbohydrate digestion and can be detrimental to the microbial population in the cecum."

The feed itself and the form in which the feed is ingested, she told the group, has a bearing on the rate of digestion before the cecum is reached. She related an experiment where crimping of oats and sorghum was compared to micronizing (reducing to a powder) the same two feeds.

"Micronized oats had the highest pre-cecal starch digestion and crimped sorghum the lowest," she said. "In fact, the major site of starch digestion when horses were fed crimped sorghum was the large intestine."

She added a closing word of caution on the subject or starch in the diet of performance horses: "On a practical note, some horsemen and some researchers are promoting high-fat/high-fiber diets for performance horses. While that type of diet does address concerns with starch digestion and metabolism, it may very well fall short of providing sufficient starch for adequate muscle glycogen stores to support top-level performance."

Fat in the Diet

Fats were not considered a viable part of a horse's diet for some time, she said, because the horse has no gall bladder. Because of this, it was thought that the horse would be unable to digest fat.

However, research during the past 20 years, much of it concentrated at Davison's alma mater of Texas A&M University, has shown that fat not only is digestible by the horse, but can supply 2.25 times the energy of an equal amount of starch. Researchers are trying to use fat in the equine diet to meet the energy demands with a smaller amount of grain required in the diet.

And what type of fat might be added to the diet? Davison said, "In cafeteria-style studies, horses have been demonstrated to prefer corn oil to blended fat, inedible tallow, or peanut oil, but they will consume soy oil equally as well as corn oil."

Corn oil, she said, appears to be the most digestible of the lot at 94%.

Protein

Davison then switched to a discussion of two words that have been used for years to convince horse owners to buy one product or another--percent protein.

"Evaluating rations for horses is commonly centered around percent protein, primarily in the concentrate portion of the diet," Davison said. "However, percent protein in the concentrate is a very small piece of information in the total picture. First of all, horses do not have a protein requirement, but rather an amino acid requirement. Second, there is a need for an amount of protein and a quality of dietary protein source in order to supply the amino acid requirement. To simplify the evaluation of a horse's diet into a statement such as, 'A mature horse needs 10% protein' can be very misleading and totally miss the mark with regards to the horse's needs. There is increasing discussion regarding the relationship between energy and protein and there is an effort to fine-tune feeding programs for horses on a nutrient:calorie ratio. These ratios are expressed as grams of nutrient per megacalorie of digestible energy."

She then used one of Purina's products as an example when she compared the protein intake of a horse eating oats at 11.5% protein to Omolene 200 at 14% protein. If the horse requires 10 pounds (4.5 kg) of oats to maintain his body condition, she said, he will need 7.54 pounds (3.4 kg) of Omolene 200 to stay in the same body condition due to the higher energy content of the Purina processed feed. The total protein intake would figure thusly--oats, 10 pounds (4.5 kg) times 11.5% equals 1.15 pounds (0.52 kg) of protein; Omolene 200, 7.54 pounds times 14% equals 1.06 pounds (0.48 kg) of protein.

"The horse actually eats less total protein on the higher-protein diet due to the nutrient:calorie ratio," Davison said. "He eats less protein, but a better quality protein that provides a better amino acid profile from the Omolene 200 than the oats."

Davison described some experiments designed to determine which feedstuffs had the greater protein

digestibility in the small intestine, then concluded her discourse with this statement: "Further work is obviously needed on a wider variety of feedstuffs to more clearly define protein digestion in the small intestine and its impact on meeting the amino acid requirements of the horse."

Hindgut Digestion

In Young's presentation on "Hindgut Digestion of the Horse," she said the hindgut comprises 62% of a horse's gastrointestinal system. The cecum, large colon, and small colon--which comprise the hindgut--of the average horse have a capacity of 30 gallons (114 liters), and "there are billions of 'bugs' (microbes) in there."

The "bugs" make up the microbial population that is responsible for the fermentation process that goes on in the hindgut. There are more than 50 species of bacteria in the hindgut, she said, and their good health is critical to a healthy equine digestive system.

"What affects the microbial populations in a horse's hindgut?" she asked. "Ration changes, forage quality, rate of passage of digesta, and substrate availability can all affect microbial populations."

The prime function of the microbial population, she said, is to break down fiber in the horse's diet. The fiber is normally provided in the form of hay or grass. It has been found, she said, that a change in hay can have a negative effect on the horse being fed. In one experiment, three management factors seem to have influenced the incidence of colic and are related to pH change in the cecum. Those factors were:

1. A change in diet or hay changes (can make a horse nine times more likely to colic);
2. A change in stabling conditions two weeks prior to incident; and,
3. A change in activity.

As an aid to hindgut health and proper fermentation, she recommended that no more than 0.5% of a horse's body weight (five pounds for a 1,000-pound horse or 2.3 kg for a 454-kg horse) in the form of grain should be fed at a single meal.

Despite the fact that the attendees had a long day, both speakers were plied with questions at the end of their talks.

Reproduction

The two speakers who addressed the reproduction topic--LeBlanc and Blanchard--are well-known and respected in their field. As presenters they are opposites: LeBlanc is bouncy and energetic, while Blanchard is a laid-back Texan with a dry sense of humor.

Horse owners say that infertility is the most common reproductive problem with their horses, according to LeBlanc. She divided client complaints into three categories:

1. Mare fails to cycle normally;
2. Mare cycles, conceives, and loses the pregnancy between 35 and 90 days; and,
3. Mare cycles and if she conceives, loses the pregnancy before 35 days.

In the first instance, she said, there is a problem with the hypothalamus-pituitary gland gonadal axis that governs follicular development and ovulation. Failures of this system, she explained, can be caused by seasonal effects, by developmental anomalies, by abnormal endocrine function, or by other causes.

In the other two categories, she said, the tubular genital system is often the center of the problem. Still another cause, she said, can be the systemic release of prostaglandin due to an unrelated illness such as colic.

She then went into detail about each of the problem areas and offered potential solutions. Some of

them are summarized as follows:

Seasonal Effects--It has become common practice in some areas to place mares under lights beginning Nov. 1 instead of Dec. 1 with the idea that mares will begin cycling within 60 days. A 200-watt bulb is adequate for a 12x12-foot stall. Work from the laboratory of O.J. Ginther, PhD, of the University of Wisconsin, has shown that mares placed under lights in November experience their first ovulation at essentially the same time of year as mares placed under lights in December--the end of February. Recent work in France indicated that addition of light for 35 days beginning Dec. 1 will produce cyclicity at the same time as if mares were subjected to 60 days of artificial lighting.

Spontaneous Prolongation of the Corpus Luteum-- A high percentage of mares experience this phenomenon. Administration of prostaglandin or its analogs are specific therapy.

Behavioral Anestrus (a perceived cyclic abnormality)--Mares might fail to exhibit estrous behavior when they are in physiologic estrus. Problem mares should be presented individually to the teaser. Most mares will exhibit subtle changes in behavior while they are in estrus, so keen observation skills are important.

Poor Estrus Detection--This is a problem in situations where clients do not have a stallion on the premises. Periodic examinations of the reproductive tract by rectal palpation, ultrasonography, and vaginal speculum will help one determine the stages of estrus. Measurement of serum progesterone levels is also helpful.

Tumors--The granulosa-theca cell tumor, the most common ovarian tumor, causes infertility by suppressing ovulation. Prognosis for future fertility (once the problem is resolved) is as good as it was before the tumor developed.

LeBlanc then concentrated on mares which cycle, conceive, and lose the pregnancy after 35 days. While she covered a variety of causative problems, the one that received much of her attention was endometritis.

Often, especially in older mares which have had numerous foals, endometritis gets its first toehold at breeding time. It is normal, LeBlanc said, for breeding (either artificial insemination or natural cover) to induce an inflammatory response within the uterus. How long that inflammatory response lasts determines whether it is a problem that might prevent pregnancy. The inflammatory response includes the formation of fluid within the uterus.

"The longer seminal by-products remain in the uterine lumen (cavity), the greater the inflammatory response and the greater the endometrial damage," she said. "Therefore, treatment of the susceptive mare is directed at rapid removal of fluids. This can be accomplished by uterine lavage and administration of oxytocin (10-20 IU either intravenously or intramuscularly) performed four to eight hours after breeding. Treatment is delayed after breeding to ensure that viable sperm are not prematurely washed from the uterus. Treatment is conducted prior to eight hours because the uterine inflammatory response in reproductively normal mares is greatest between eight and 12 hours after breeding."

The inflammatory response, she said, is primarily a reaction to the presence of sperm. The response is greater when frozen semen is used because the seminal fluid has been removed. The seminal fluid, she said, appears to negate the inflammatory response to some degree.

LeBlanc also discussed hormonal therapy to ensure that mares ovulate at a predictable time. Much of the discussion revolved around Ovuplant, which for a time was receiving mixed reviews, but which now seems to have overcome all hurdles. The problem in the beginning, she said, did not involve predictable time of ovulation—which occurs 41 to 48 hours after administration with a mean of 42 hours--but rather with what occurred when the mare didn't become pregnant. When that was the case, she said, there was often a delay in the return to estrus.

It was then discovered, she said, that if the Ovuplant pellet was removed two days after being administered, that problem no longer existed. The latest procedure involves inserting the pellet just

under the skin of the vulva.

AI With Shipped, Cooled Semen

As the use of shipped, cooled semen has grown, Blanchard said, so have the expectations of the clients receiving it. They now expect the same pregnancy rates as with fresh semen. This *can* be accomplished, he asserted, but much depends on the stallion and the way in which the semen is handled at both the sending and receiving ends.

"The ability of sperm to handle cooling is critical," he said. The ability of a stallion's sperm to withstand cooling should be tested at both 24 and 48 hours. Generally, the sperm will remain at their peak for 24 hours, then begin to deteriorate, although there are exceptions.

Blanchard explained it this way: "Fertility trials using cooled transported equine semen have yielded pregnancy rates varying from 0% to 70% per cycle, emphasizing that there is great variability among stallions in sperm ability to maintain fertilizing capacity following cooled storage.

"Pregnancy rate per cycle achieved by breeding with semen cooled for 24 hours at 4-6° C (39.2°-42.8° F) can reach 60-80%, so one should expect near normal pregnancy rates when semen is used for breeding after short-term (under 24 hours) storage, provided the semen quality is good following this cooling period.

"Breeding with equine semen cooled for 48 hours at 4-6°C (39.2°-42.8°F) usually reduces pregnancy rates to approximately half that achieved with fresh semen," added Blanchard. "However, breeding with semen cooled for 48-plus hours from certain stallions will still result in normal pregnancy rates."

A wide variety of factors influence pregnancy rates when mares are bred with cooled semen, he said. Among them are number of sperm inseminated, frequency of insemination, concentration of sperm in extender, amount of seminal plasma in final extender sample, type of extender utilized (including choice of antibiotic), cooling rate of extended sperm, storage time and storage temperature prior to breeding, stallion variability with regard to response of sperm to cooling, and inherent fertility of stallion and mare.

"If quality of fresh stallion semen is poor or fertility achieved by breeding with fresh semen is poor," Blanchard said, "it is highly unlikely that desirable results can be obtained by breeding with cooled transported semen. In order to maximize success with preserved semen, one should screen against ejaculates of poor quality."

The number of cooled sperm inseminated can vary depending on the stallion, Blanchard said, but a generally accepted number is 500 million. However, in order to get 500 million motile sperm in a shipment of cooled semen, it often is necessary to ship one billion.

A growing concern involving shipped semen, he said, involves heightened security at airports. Much more powerful X ray machines to examine luggage and containers are making their way into airports, he said, and it is possible that these more powerful machines can have a negative effect on sperm. Some companies are already putting lead shields around semen containers.

Blanchard went into detail on collection of semen, preparation for shipping, and actual shipping, then switched to an in-depth discussion of what happens on the other end--handling of semen when it arrives and the actual breeding of the mare.

Nutritional Management of Mares

Purina's Davison discussed the nutritional management of pregnant and lactating mares. Throughout the year, she said, broodmares should be in one of three different phases--early and mid-gestation, late gestation, or lactation--each with a different nutrient demand.

"Body condition," she said, "may be the single largest factor affecting the reproductive performance of

mares. Mares maintained in moderate to fleshy condition cycle earlier in the year, require fewer cycles per conception, have a higher pregnancy rate, and are more likely to maintain pregnancies than thin mares."

Few negatives have been found for fat mares, she said, other than the possibility that they will have less milk.

Davison uses a standard body scoring approach that ranges from 1 to 9--

1. Poor;
2. Very thin;
3. Thin;
4. Moderately thin;
5. Moderate;
6. Moderately fleshy;
7. Feshy;
8. Fat;
9. Extremely fat.

"A condition score of less than 5 in lactating mares," Davison said, "indicates that they may not have enough stored body fat to support efficient reproductive performance. Those mares require more cycles per conception and are more likely to skip a breeding season than are mares with a condition score of 6 or more. This is especially prevalent in mares that are 15 years of age or greater. Scores of 5.5 to 7 represent the optimum."

Davison then broke down nutrient needs for the three aforementioned states of condition--early and mid-gestation, late pregnancy, and lactation. Her comments are summarized:

Early and mid-gestation--A non-lactating, and pregnant mare in the first eight months of gestation has nutrient requirements very similar to those of any mature, idle horse. The developing foal gains only about 0.2 pounds (0.1 kg) per day. Grazing and/or good-quality hay will usually maintain mares which are in marginal condition. Mares in early gestation, eating moderate- to poor-quality hay, will need additional nutritional supplementation. A quality concentrate fed at 0.5% to 0.75% of body weight will help keep mares in good shape and support nutritional requirements during this period.

Late Pregnancy--As a mare enters the last three to four months of pregnancy, the unborn foal is growing more rapidly, averaging one pound (0.45 kg) of weight gain per day. During this time the intake of protein, energy, vitamins, and minerals should be increased. While forage might be able to provide sufficient calories to maintain the body condition of the mare, other nutrients--particularly protein and minerals--will be inadequate. Research has shown that foal birth weight can be adversely affected when mares do not receive adequate protein during late gestation, even when the mares maintain a condition score of 5.5 to 7.5. Therefore, simply keeping mares in good condition during late gestation does not guarantee proper foal development. A supplemental feeding program that provides an adequate protein, vitamin, and mineral balance is necessary during late gestation.

Lactation--At foaling, a mare's daily nutrient requirements increase significantly. Mares have been documented to produce an average of 24 pounds (three gallons, 11.4 liters) of milk daily during a five-month lactation. This represents 450 gallons (1,703 liters) of milk over 150 days. The average production in the first 22 days of lactation was 26.5 pounds per day. Free-choice spring grazing will meet some of the mare's nutrient requirements, but considerable supplemental concentrate will be needed.

Feeding the Growing Horse

Purina's Raub said, "Feeding the growing horse starts with conception." At birth, a foal is 10% of his mature weight and 60% of his mature height. By six months of age, he is 50% of his mature weight and 80% of his mature height. The parts of the horse's anatomy from the knees and hocks down, he said, are pretty much finished growing at 120 days of age.

These facts, he said, emphasize the need for proper nutrition of the young, growing horse. Creep feeding can help provide the proper nutrients, but it should not be a "group activity." Each young horse should be fed on an individual basis, he maintained.

The approach taken with a young, growing horse is dependent on the owner's expectations. If there is a need to produce a big, strapping yearling, then creep feeding might be essential. If there is no such need, creep feeding might not be necessary and the foal will ultimately reach the same mature height and weight, only at a later date.
Raub also discussed developmental orthopedic disease (DOD) in some depth. Excess protein, he said, doesn't seem to be the cause of DOD, but diets high in carbohydrates can affect the growth hormones and thus have an impact on DOD.

Foal Nutrition

Vaala's first lecture dealt with nutrition for the sick and orphan foal. "Feeding the orphan foal is relatively straightforward, since nutrient requirements and feeding regimes can be based on the nutrient intake and nursing behavior of healthy foals," she said.

Healthy newborn foals have a suckle reflex within 20 minutes of delivery and normally are able to stand and nurse from the dam within two hours of birth. During the first week of life, she said, newborn foals nurse on average four to six times an hour, consume 20-30% of their body weight in mare's milk, and gain one to three pounds (0.45-1.4 kg) per day.

If an orphan foal is being fed from a bucket with mare's milk, goat's milk, or milk replacer, she said, this should be started at the rate of 10% of his body weight and increased to 25% of his body weight over a 24- to 36-hour period, with food being offered every two hours.

Vaala also presented an in-depth lecture on a wide variety of foal diseases and, in each case, offered suggestions on treatment protocols based on the latest research. The time slots of speakers was so tightly budgeted that when continued questions forced a number of sessions beyond their time allotments, it eventually resulted in one of the speakers not even taking the podium. Geor, who heads the company's research involving exercise physiology, was at all of the sessions and often was called on to answer some of the many questions.

The Tour

A tour of the 1,200-acre research farm, established in 1926, took place on Friday afternoon, the middle day of the conference. The group toured the exercise physiology lab with Geor in charge; palatability research with Kent Lanter; mare and foal nutritional research with Raub; the Purina veterinary laboratory with Leo Eldridge, DVM; and the large animal metabolism unit.

The obvious goal was to impress on the visitors that millions of dollars of highly scientific research has gone into the development of the company's products. King closed out the session with a quick overview of Purina products.