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Managing Bovine Respiratory Disease

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Bovine respiratory disease is by far the most devastating disease affecting cattle in the United States. It is the leading cause of death in weaned calves, second only to scours as the leading cause of death in pre-weaned heifer calves. Economic losses from the disease include the cost of treatment, the cost of labor, decrease in milk production, decrease in weight gains and death. The disease is caused by a combination of factors including viral infection, bacterial infection, stress and individual animal immune response. Respiratory disease can be managed through vaccination, stress management and nutrition.

The bovine respiratory system includes the nasal passage, oral passage, sinuses, trachea and lungs. Defense mechanisms of the respiratory system include clearance through coughing and sneezing, secretions, immune cell response and biochemical response. Respiratory disease starts with impairment of the defense mechanisms by viruses. Stress also contributes to the disease by hampering the animal's immune cell response. Such stressors can include castration, weaning, inclement weather or a sudden change in diet. Once the respiratory defenses are compromised, bacteria that enter the airways have the ability to cause damage to respiratory tissue. Bacterial invasion in the lungs stimulates inflammation that can cause permanent damage, thus dramatically decreasing the performance of recovered cattle.

Viruses that contribute to respiratory disease are bovine infectious rhinotracheitis (IBR), bovine viral diarrhea (BVD), bovine parainfluenza-3 (PI3) and bovine respiratory syncytial virus (BRSV). All of these viruses are transmitted through nasal drainage, aerosolized droplets when coughing and direct contact. The first

three viruses first impair the upper airways (nasal and oral passages, sinuses and trachea) while BRSV directly impairs the lungs. Symptoms associated with viral infection include depression, decreased appetite, coughing, abnormal nasal discharge, raw and irritated nostrils, conjunctivitis and fever (>104°F). With BVD, animals can also develop painful ulcers in the mouth. There are no treatments available for viral infection.

The bacterium normally isolated from sick cattle is *Mannheimia haemolytica*. Other bacteria implicated in respiratory disease include *Pasteurella multocida*, *Histophilus somni* and *Mycoplasma bovis*. All of these bacteria are considered opportunistic. Animals are constantly exposed to these bacteria, and their healthy immune systems normally keep the bacteria in check. When viral infection and/or stress are added to the equation, these bacteria start to invade the respiratory system and cause damage and inflammation.

Treatment of respiratory disease is multifactorial. Once recognized, sick animals should be isolated and antibiotic therapy started immediately. The spread of disease can be minimized by always handling healthy animals first, wearing laundered clothing, boot covers and coveralls when treating sick animals and limiting people who have contact with sick animals. Consultation with a veterinarian is needed to determine which antibiotic is the best for treatment. It is very important for the animal's caretaker to follow instructions on the dose and duration of the antibiotic as well as the withdrawal period. Sick animals will also likely need supportive therapy with fluids and non-steroidal anti-inflammatories (NSAIDs). Recent studies have shown a significant reduction in lung pathology caused by secondary inflammation when an NSAID such as flunixine was administered early in the disease. By having a solid treatment plan designed by a veterinarian, cattle have a much better chance at recovery.

Prevention is by far the preferred method for managing respiratory disease in dairy cattle. New stock should always be tested for BVD and isolated for 30 days prior to introduction into the herd. Newborn calves should receive high-quality colostrum within 2 hours after birth. Once calves have received adequate immunity via colostrum, they should be removed from the dam as soon as possible to limit exposure to bacteria. Calves should then be placed in individual pens, avoiding nose-to-nose contact with other calves. Newly weaned calves should be placed in small pens in groups of 8 to 10 so they can adapt to pen mates and diet changes. Once adapted, calves can be placed in larger pens, provided the pens have dry bedding and are well ventilated. Optimum nutrition should be provided to animals before and during times of stress, as protein is required to maintain health. Sudden changes in diet can cause strain to an animal's immune system. For this reason, calves should be gradually transitioned from milk to hay or ration.

Vaccination protocols should be designed in collaboration with a veterinarian. Vaccines should be purchased through reputable vendors and handled with care. Breeding stock should be vaccinated with an IBR-BVD-PI3-BRSV vaccine 30 days prior to breeding. The killed vaccine can be given again to pregnant animals 30 days prior to calving to boost production of antibodies in the colostrum. Calves should be vaccinated with IBR-BVD-PI3-BRSV vaccine at 2 to 4 months of age. Follow the manufacturer's instructions as some vaccines require two doses 3 to 4 weeks apart. Giving vaccines to calves prior to 2 months of age is controversial due to circulating antibodies from colostrum that may interfere with the calf's ability to produce its own antibodies. Giving the vaccine early to a calf won't hurt, but it may not be the best use of resources. There are also vaccines for protection against bacteria. The bacterial vaccines are often included with the viral vaccines but can be given separately. It is best to follow the advice of the veterinarian.

Bovine respiratory disease will always be a threat to cattle due to the contagious nature of viruses and variability in individual animal immune response. The extent of disease can be minimized by testing and isolating new stock, vaccinating the herd properly, administering gradual diet changes, recognizing illness, treating early and employing biosecurity. Being prepared is the key to avoiding unnecessary loss.

Making the Most of Your Water Resources

Dirk Philipp, Associate Professor – Forages

Water resources are becoming scarcer as an increasing number of people and entities compete for them. This isn't by any means important only for the western U.S. but increasingly for the eastern U.S. as well, as drier summers may become the norm in the future. Although many dairies are located in semiarid areas today, grazing-based dairies of the eastern U.S. will face some challenges for sure. Optimizing water use efficiency is usually connected to irrigation agriculture, but there are ways to increase overall on-farm water use efficiency under rain-fed conditions as well.

In plant science, water use efficiency refers to the amount of biomass generated per unit of water. Different forages have different water use efficiencies, mainly based on photosynthetic pathway (either C3 or C4) and the area of adaptation. As an example, warm-season forages (C4) such as bermudagrass have higher water use efficiencies than tall fescue, a cool-season forage (C3). Legumes are also C3 forages. For instance, for every additional ton of alfalfa yield, about 7.5 inches of water have to be added, while only 2.3 inches have to be added for every additional ton of bermudagrass.

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This is the reason alfalfa is grown under irrigation in the western U.S. but, in turn, does well in the eastern U.S. under rain-fed conditions. It should be noted that although warm-season forages use less water than cool-season forages for a particular amount of biomass generated, they do not necessarily yield well under droughty conditions. But they can be more drought resistant and recover quicker after a drought.

From this perspective, it makes sense to keep the many details of farm operation in mind while optimizing water use for the entire operation. There are some fixed items, such as cattle drinking requirements or general water use in milking parlors for all kinds of uses including cleaning. In pastures, there are several management choices that can be made to optimize water use in the long term.

One of the obvious choices is to select the right forage and try to close gaps in forage supplies. In a tall fescue system, the obvious choices are summer annual forages grown on a separate field, provided rainfalls are sufficient. The forage of choice in many grazing dairies throughout the Southeast is bermudagrass, however, which is often irrigated. In those cases, the sprinkler systems are also being used for cooling the animals, which results in an overall increase of on-farm water use efficiency related to milk yield.

Much can be achieved with proper pasture and soil management. Think of the soil as a storage reservoir for water, which ideally will be slowly released for plant water uptake. Of course, soil texture has the highest influence on the amount of soil water stored, but keeping amounts of soil organic matter (SOM) stable or even increasing it will simultaneously increase soil water storage capacities. This can be achieved with proper grazing techniques, in particular avoiding overgrazing to maintain root mass and enhancing water infiltration rates. Adequate stocking rates are mandatory to avoid soil compaction. To increase soil organic matter, forages need to receive adequate fertilizer rates at the right times of the year to have sufficient organic matter material generated that, in turn, can be incorporated and converted to SOM by soil microbes.

Although watering need for animals is a relatively small item in the overall farm water budget, attention should be paid to the amount of water needed once temperatures reach the 90s or higher. Especially for dairy cattle, water requirements may double compared with cooler days and can be as much as 40 to 50 gallons per day under hot conditions. The watering devices used on the farm should reflect these needs and work in such a way that those amounts can be delivered consistently. The cooler months of the year are perfect for checking watering devices and making upgrades if needed.

Why Is Reproduction Jeopardized in the High-Producing Cow?

Michael Looper, Professor and Head

Genetic selection of more productive dairy cows during the last 60 years has not come without associated disadvantages – most specifically, reduced reproductive performance. University research indicates milk production per cow has increased 218 percent while conception rates have declined from 66 to 40 percent since 1951. However, the aggressive selection of increased milk production is not solely responsible for the demise of reproductive performance in the “modern” dairy cow. Conception rates of virgin heifers have remained at 70 to 80 percent during the last four decades. So, the question must be asked and answered, “Is the decrease in reproductive performance of dairy cattle due to increased milk production?” There are several managerial strategies currently implemented on dairy operations that have an impact on reproduction.

The stress of negative energy during early lactation may cause abnormal development of follicles. Most dairy operations use a 60-day waiting period prior to breeding. University research suggests that follicular development during early lactation when cows are exposed to adverse conditions, such as negative energy balance, may compromise reproduction. In one University research study, 42 percent of postpartum cows (40 days in milk or less) had normal ovulations, while 40 percent had multiple nonovulatory follicles and 18 percent formed cysts. The 42 percent of cows that had normal ovulations is similar to current conception rates on dairy farms. It has been estimated that it generally takes 60 to 80 days for ovarian follicles to reach ovulatory size. If these estimates are correct, a majority of postpartum follicles would be developed during a period of severe negative energy balance (first 60 days after calving).

Concentrations of progesterone, the hormone required for maintenance of pregnancy, may be reduced in the “modern” dairy cow due indirectly to increased milk production. Cows with increased milk yield obviously must increase their dry matter intake. Notable increases in blood flow to the liver are due to increased feed intake. Consequently, progesterone will be cleared from the body more rapidly. Research indicates that cows consuming large amounts of feed had less progesterone than cows consuming moderate amounts of feed. Without sufficient concentrations of progesterone, pregnancy will be jeopardized.

Change in the pattern of estrus or heat expression. Researchers in the 1940s found the duration of heat averaged almost 18 hours in dairy cows observed three times daily. More recently, researchers in Virginia reported the duration of heat averaged 7 hours in dairy cows. Some dairies use timed breeding programs to overcome poor heat detection rates; however, conception rates often remain low. Reproductive performance will not improve with these programs if heat detection and insemination skills are inadequate.

Utilization of more first lactation cows in expansion herds. According to DHIA records, first lactation cows account for between 30 and 38 percent of all milking cows. Negative energy balance associated with high-producing cows during early lactation is more detrimental to first lactation cows as compared to older cows. Negative energy balance increases the days to first ovulation and first heat in cattle.

Inbreeding. Since 1970 inbreeding in Holsteins has increased from less than 1 percent to almost 5 percent. It is estimated that inbreeding will reach 10 percent by 2020.

There are several approaches to improving reproductive performance of high-producing cows. Because management schemes commonly implemented on dairies may negatively impact reproductive performance, a first step to improving reproductive performance is to continually examine the following components of the breeding program as well as reevaluate all matters which support general cow health.

1) Appropriate training and continued education of those involved in observing and breeding cows.

2) Ensure proper semen handling and insemination techniques.

3) Consider the economics of observing heat more frequently in the herd and breeding 6 to 8 hours after observing heat. Breeding cows earlier than 60 days after calving should be

considered if cows are in good body condition.

4) Use of reproductive drugs (for example, PGF2a and GnRH) in synchronization protocols with more frequent heat detection efforts should be considered. However, the use of these programs in the place of good management schemes will not have a positive return on investment.

5) Increasing cow comfort by decreasing the time in the milking parlor and holding pen and increasing time spent eating or resting can have a positive impact on reproductive performance. Likewise, cow health must be optimized in order to obtain acceptable performance. Metabolic and reproductive disorders during early lactation will not only decrease milk production but compromise fertility. Implementing preventative transition programs to care for cows prior to and after calving, especially first lactation cows, will help boost reproductive parameters.

Increased milk yield is not solely responsible for the decline in reproductive performance in high-producing dairy cows during the last 60 years. Management schemes commonly implemented on dairies must also be evaluated and possibly revised to improve performance. Similarly, stressors such as negative energy balance and transition cow problems must be minimized in order to increase pregnancy rates on dairy farms.

Transitioning Heifers From Milk to Solid Feed

Shane Gadberry, Associate Professor

A research review entitled "Transitioning from milk to solid feed in dairy heifers" was recently published in the *Journal of Dairy Science*. While the review doesn't conclude with a definitive protocol for early life nutritional management of the dairy heifer, it highlights research responses and areas of research that need further investigation, which in time could result in a paradigm shift for how dairy heifers are raised.

The dairy heifer is unique among ruminants. The duration wild and domestic ruminants nurse their offspring is adequate for their young to develop a functional rumen populated with rumen microbes that readily digest forages, and social interaction with their mother helps the young learn foraging behavior. In commercial dairy production, offspring are weaned from their dams within a few days and are often raised in isolation for 30 to 60 days on restricted quantities of milk while being transitioned from milk to solid feed. Solid feed may emphasize grain consumption early followed by access to conserved forage or pasture. The following bullet points highlight some food for thought from this research review.

- Pair-housed calves were reported to adapt to solid feeds more quickly than individually housed calves.
- Concentrate feeding over forage feeding produces greater butyrate, which is beneficial to rumen papillae development; however, concentrate feeding without adequate buffering can result in lower rumen pH and reduced rumen health. Concentrate feeding also supports a rumen population less conducive to fiber digestion.
- Forage feeding in early life increases buffering capacity of the rumen, increases rumen weight and volume, stimulates rumination and supports a greater rumen pH. Forages represent a more slowly digestible form of the diet, which can affect total digestible energy intake.

Feeding concentrate in early life can stimulate rumen development; however, care must be taken to avoid acidosis, and early forage introduction may be beneficial to rumen health and capacity.

- Commercial calf starters are recommended to contain 18 percent crude protein (dry matter basis), and replacement of soybean meal with other protein sources usually results in a reduction in feed intake and weight gain.
- Corn is a more readily accepted starch source, and whole oats may be an acceptable substitute for corn, whereas other grains substituted in place of corn have decreased feed intake and performance.
- Physical form of the diet (pelleted versus textured) has shown mixed results for feed intake and growth.
- A mixed diet of concentrate plus forages prior to weaning from milk resulted in greater post-weaning forage intake compared to calves that were not exposed to forage but fed concentrate only pre-weaning.
- Individually fed calves can be reluctant to consume forages, whereas calves reared in groups may be less apprehensive toward unfamiliar foods.
- Transition to pasture can be hastened when introduced into a group that is already adapted to grazing.
- High-volume milk feeding (20 percent body weight) may elicit lifelong benefits, but the effect may be more associated with total nutrient supply in early life than quantity of milk offered.

In general, the paper highlights the opportunity to better adapt dairy heifers to a pastoral environment by early life socialization and introducing forages pre-weaning. Feeding concentrate in early life can stimulate rumen development; however, care must be taken to avoid acidosis, and early forage introduction may be beneficial to rumen health and capacity.