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Replacement Management in Cattle: Health Management
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Introduction

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Introduction

Replacements are the future of the dairy industry. Focusing on improving health management of replacements will yield tremendous returns through decreased losses of animals with the greatest genetic potential on the dairy, decreased costs of medication, improved growth rates, improved feed efficiency and earlier entry into the milking herd.

Precalving and Calving Management

Health management of dairy replacements begins before the replacements are born. Several factors, such as nutrition of lactating and dry cows, vaccinations of lactating and dry cows, length of dry periods, cleanliness of the calving environment and disease status of the dams, will ultimately affect disease resistance and health of replacements. It is important to note, however, that cows that are overfed tend to have difficulty calving because of being excessively over conditioned. Cows that are underfed, which results in mineral or vitamin deficiencies or lack of body condition, may produce inferior and low-volume colostrum. They also may experience difficulty calving. Protein deficiency in cows during the dry period may lead to low birth weights, low metabolic rates and poor vigor of calves, resulting in poor survivability. Some research also indicates that inadequate protein and energy nutrition of the dam results in poor absorption of immunoglobulins from colostrum by the calf. Cows that lose condition during the dry period are also at greater risk of experiencing calving difficulty. Calves that experience difficulty births require more time before being able to stand, experience an increase in the time to voluntary suckling and have a decreased ability to absorb immunoglobulins. All these problems result in decreased transfer of passive immunity from the dam to the calf and increased risk of disease in calves. As the degree of calving difficulty increases, the risk of mortality for calves increases. Proper nutrition of dairy cows during lactation and the dry period will help decrease disease risks for replacements.

In recent times researcher are employing electronic cattle tags to remotely monitor cows’ general health conditions correlated with the movements of the head and other body parts. Some farming communities apply more direct video surveillance mechanism to monitor milking herd to prevent any possible disruption in milk production by taking care of early animal health symptoms and unexpected animal behaviours. Intelligent processing of video stream, combined with in-situ visual observations by a farmer could provide a better management culture in replacement management. Low cost thermal imaging cameras could also be deployed to monitor the cows and calves body temperature, environmental conditions, and any unusual spots in a herd that has significantly higher temperature than normally expected.

Early prevention of any bacterial and viral disease spread is extremely important for Precalving and Calving Management. This issue has become ever more important in today’s world, where market accessibility for a local producer of milk and dairy products, could be global. Bigger market access and business proposition comes with a significantly higher level of responsibility. Zero tolerance attitudes towards animal and food Biosecurity are key to greater market access and business sustainability. Greater awareness is needed to achieve a standard biosecurity management in cattle industries. Informed decision on planned vaccinations of the dams will also impact disease resistance of dairy replacements and a better preventive management. Proper vaccination of the dairy herd will increase the concentration of antibodies (immunoglobulins specific for diseases) in colostrum. Dams may be vaccinated during the dry period against pathogens that are common causes of diarrhea in calves, such as Escherichia coli, rotavirus and coronavirus. Vaccination of the dams during the dry period is more effective for prevention of disease in calves than vaccination of calves at an early age. The immune system of neonatal calves is unable to respond quickly to a vaccination or an infection because the immune system of the newborn is immature at birth. Both numbers and effectiveness of
antibody-producing cells are lower in calves at birth than in adult cattle. Therefore, it is important for calves to obtain antibodies against common diseases of calves by consumption of colostrum rather than from an attempt to vaccinate calves at an early age. Vaccination of the dams against pneumonia may also help to decrease the incidence or severity of this disease in replacements.

Another important factor that may affect the health of replacements is the length of the dry period of the dam. A dry period that is too short, i.e. less than 6 weeks, may not provide enough time for involution of the mammary gland and preparation for the next lactation. Cows with shortened dry periods produce small quantities of colostrum that may also have low concentrations of immunoglobulins. It is important for health of replacements, therefore, that cows have at least a 6-week dry period for production of high-quality colostrum.

Management of the calving environment has a tremendous impact on the health of replacements. It is important for calves to be born in a clean, dry environment. Wet, sloppy stalls provide a perfect environment for growth of bacteria. Calving on a grass lot may be the best alternative when the climate is dry and mild. If a maternity barn is used, it is important to clean stalls thoroughly between calvings to prevent transfer of disease. Maternity stalls should only be used for calving and never for housing sick cows. Maternity pens and sick pens should be kept in separate facilities in order to prevent transfer of disease to highly vulnerable neonates and periparturient dairy cows. It is also important for the cows to be as clean as possible at calving in order to prevent calves from contracting disease organisms when suckling or attempting to suckle their dams. Preferably, calves should be separated from dams prior to suckling in order to prevent the calf from ingesting pathogens present on the legs, belly, flanks or udder of the cow as the calf attempts to nurse. Separating the calf from the dam and feeding colostrum by bottle also ensures adequate intake of colostrum for transfer of passive immunity from the dam.

Finally, it is important to know the disease status of cows prior to calving. Diseases such as Johne’s disease, milk fever (Hypocalcaemia) close to calving, bovine viral diarrhea (BVD), and bovine leucosis virus (BLV) may be passed in utero or through colostrum. Calves should only be fed colostrum from cows known to be free of these diseases. It is important, therefore, to maintain a supply of frozen, high-quality colostrum from cows free of such diseases. Today’s cost could be tomorrow’s gain, so conservativeness towards deploying new technologies in replacement management could be addressed by community based farming, to try new practice, to tackle ever growing biosecurity related threats in dairy industries.

**Care of Young Calves**

The importance for baby calves of adequate consumption of immunoglobulins from colostrum has been reviewed elsewhere. Mortality resulting from lack of consumption of adequate amounts of immunoglobulins is commonly greater than 35% and has been reported to be as high as 60%. Others have indicated a 74-fold increased risk of mortality when calves do not consume colostrum. 80% of the Hypocalcaemia cases occur within 1 day of calving, because extremely high rate of drain calcium drainage (and other substances) from the blood during the milk and colostrum production, which cattle bodies are unable to replace quickly enough, bring severe health risk and subsequent economic loses.

Along with economic losses from high mortality rates as a result of lack of colostrum consumption, there are also increased costs associated with increased medication and poor feed efficiency. Transfer of passive immunity (absorption of immunoglobulins from colostrum) can be determined using commercial kits that measure immunoglobulins in the blood. For adequate protection of calves, blood immunoglobulin concentrations should be at least 10 mg ml$^{-1}$. Serum protein concentrations in calves are also highly correlated with the concentration of immunoglobulins in blood and can be used to determine adequate transfer of passive immunity. A hand-held refractometer can be used to measure serum protein; levels greater than 5.0 g 100 ml$^{-1}$ by 24 h of age indicate adequate consumption of colostrum. The similar technology could be used to measure ‘Specific Gravity of Urine’ and ‘Refractive Index of Serum’, as researchers are aiming to combine these factors for better diagnosis. The use of colostrum substitutes and replacers may help improve disease resistance in calves when high-quality colostrum is not available. It’s also important to have a better feeding management plan for the dry cows 2 weeks before the calving, as this effects the amount of calcium available to replace blood calcium, and how efficiently body can utilize the available calcium at a very critical period. The most prevalent health problem of calves on most farms in the United States is diarrhea. Organisms such as *Cryptosporidium parvum*, rotavirus and coronavirus that cause diarrhea will not respond to antibiotic treatment. For cryptosporidiosis, the only means of prevention is sanitation, which includes controlling flies. For rotavirus and coronavirus, the most effective prevention is vaccination of the dam to increase antibodies in the colostrum against these organisms. Other organisms, such as *E. coli* and *Salmonella* sp., may be resistant to many of the commonly used antibiotics. Producers often give antibiotics to calves during episodes of diarrhea in order to prevent secondary infections; however, this practice often does more damage than good, killing beneficial gut microflora and damaging the gut lining. The first step in caring for calves with diarrhea is to provide fluids for hydration and electrolytes for mineral loss, while continuing to provide milk for protein and energy. An electrolyte solution can be fed from 20 min to 2 h after each feeding of milk or milk replacer until feces return to normal. Secondly, the organism causing diarrhea should be identified to determine whether antibiotic treatment is needed.

Pneumonia is the second most prevalent health problem of replacements, especially for replacements raised indoors. Research has shown that calves raised in individual hutches (plastic, fiberglass or wooden structures providing individual housing) perform very well and have fewer health problems, especially pneumonia, than calves raised in closed buildings. Open-front housing for older heifers should also help prevent pneumonia. Adequate, draught-free ventilation is important for prevention of pneumonia. Hutches, pastures and open-front housing for replacements provide optimal ventilation. In addition, hutches can be moved from location to location, giving producers the opportunity easily to remove old bedding and to break disease cycles. No matter what type of housing is used for replacements, cleanliness, dry bedding and adequate ventilation are essential to decrease incidence of disease.
Another important factor for controlling disease in replacements is grouping of heifers. Most producers in the United States house young calves individually. In other areas, housing calves in groups and using mob-feeders is an efficient method of rearing calves during the liquid feeding phase. After weaning, calves should be housed in small groups of 10 or fewer until they have successfully made the transition from liquid feed to dry feed and the transition from individual housing to competing for food. The grouping could be done better by multi-sensory historical recording of individual cow behavioural patterns, body temperature, provenance of any previous disease records, long term eating patterns from the young age, and any obvious known symptoms at the time of the grouping. Additionally, by housing in small groups (rather than mixing large groups of animals at once), producers can limit the exposure of calves to disease organisms and match calves more closely by size. As calves age, they can be housed in increasingly larger groups; however, animals should be grouped so there is not more than 50 kg difference in size of animals up to 6 months and not more than 90 kg difference in size for older animals.

**Biosecurity**

Biosecurity is an outcome of a human system – so people are at its core. All dairy producers must actively institute biosecurity measures to prevent introduction of disease into the herd and to minimize spread of disease within the herd. For replacements, it is extremely important to prevent exposure of younger animals to older animals that may have Johne’s disease. Exposure is not limited merely to animal-to-animal contact, but also includes articles of transmission, such as manure on hands, clothing and boots of workers, manure from older animals on equipment for feeding and handling replacements, or water that has been contaminated by older animals. In addition, flies can transfer diseases from older to younger animals. Producers must determine whether to have a closed herd or to allow introduction of new animals to the farm. If new animals are brought to a farm, the producer should work closely with a veterinary surgeon to determine which vaccinations animals should receive prior to coming to the farm. Once new animals arrive on the farm, or animals return to the farm from contract-growers or exhibitions, they should be quarantined for at least 30 days. This will allow time to determine if the new animals are likely to become ill and to allow the new animals to be exposed more slowly to any disease organisms currently on the farm. Airborne disease spread in cattle farming is rare but when it happens, severity of damage is significantly higher. Prions, the proteins that cause mad cow disease and Creutzfeldt-Jakob disorder could be spread through the air, rather than just through contaminated food, as recent studies have reported. Foot-and-mouth disease (FMD) is a severe, highly contagious viral disease of cattle and swine, primarily get spread under favourable weather conditions. The disease may be spread considerable distances by over a route, within a short time period, directed by wind speed, air pressure and temperature. Given the fact that airborne spread is probably the one of the most serious issue in animal biosecurity management, a predictive meteorological service for national level biosecurity risk pathway analysis is essential, for prevention of large-scale livestock disease control. In recent time researchers have reported interesting results and applications of a data driven predictive model to track a probable route of an airborne disease, an alerting system to provide better biosecurity decision support for efficient management of cattle health.

Other potential sources of disease entry into replacements are visitors, vehicles removing dead animals, feed-delivery vehicles, wild and domestic animals, and birds. Within the herd of replacements, diseases can be transferred by using needles on more than one animal or using the same glove to palpate more than one animal. Producers must identify potential sources for transfer of disease-causing organisms within the herd and from outside the herd and institute a management plan to control them.

**Digestive Disorders**

Digestive disorders can occur in dairy replacements, resulting in problems such as acidosis and overeating diarrhea. Overeating diarrhea is found in replacements during the liquid feeding phase and may be prevalent in systems using accelerated feeding programs. This form of diarrhea can be treated by decreasing the amount of dry matter offered to calves in the liquid diet until the consistency of the feces returns to normal. Care should be taken to determine whether increased fluidity of the feces is caused by overeating or by disease organisms. If caused by disease organisms, treatment should include administration of an electrolyte solution and may require use of antibiotics.

Acidosis can occur in replacements if they consume large amounts of grains. Forages comprise the basis for diets for replacements after 3 months of age. Animals that gain access to fields of maize or bags of feed by accident will often suffer acidosis leading to laminitis (founder) or even death. Animals that are affected will generally have severe diarrhea. They can be treated by withholding grain until feces return to normal, followed by gradual reintroduction of grain into the diet.

**Internal Parasites**

Several types of internal parasites are found in dairy replacements. Perhaps the most common problem is coccidiosis. Coccidiosis causes diarrhea, which may be severe, resulting in weight loss, dehydration and anemia. Animals can be treated with a coccidiostat, such as amprolium, for severe coccidiosis. Coccidiostats such as decoquinate or lasalocid may be included in grain rations or even in milk replacers to help control coccidiosis.
Another common internal parasite of calves is *Cryptosporidium parvum*. This organism causes diarrhea in young calves at 7–10 days of age that lasts approximately a week. There are no cures for cryptosporidiosis and no means of prevention other than sanitation to decrease the pathogen load. Treatment involves electrolyte solutions along with continued milk feeding.

Replacement animals are very vulnerable to internal parasites (especially worms) during their first grazing season. Deworming of heifers yields economic returns in growth rates and feed efficiency. Producers should consult their veterinary surgeon to determine the most effective method of treating internal parasites both to decrease the parasite load in the animals and to prevent shedding of eggs onto pastures. Depending on geographical location, different deworming strategies are needed to control internal parasite populations. Producers should be aware that cold temperatures cause larvae to undergo arrest, even when ingested into the host. During this arrested stage, the larvae are resistant to most deworming agents.

**External Parasites**

Many external parasites, including various species of flies, affect health and growth of replacements. Several species of blood-sucking flies affect replacements. Horn-flies, Face-flies, Stable-flies, Ticks, Lice and Mite can be a major problem for cattle. They can cause substantial blood loss, transmit diseases including mastitis to replacements and decrease growth rates. Use of forced back rubs is probably the most effective method of decreasing populations of horn-flies. Additionally, removal of manure, which is the major breeding habitat for horn-flies, helps decrease populations. Another type of fly, the stable-fly, breeds in wet feed. Severe infestations of stable-flies can cause up to a 50% decrease in milk production. Counts of 25 flies per animal cause economically important losses in milk production and growth. Removal of waste feed from under feed troughs and other areas to decrease breeding areas is the most important mechanism for control. Horse-flies and deer-flies are also blood-sucking flies and may be responsible for spread of several diseases but are impractical to control.

Common house-flies are not blood-sucking insects but feed on muzzles, eyes and open wounds. They can be contaminated with more than 30 viruses and 175 bacteria, as well as other disease-causing organisms. The main form of control for common house-flies is sanitation and removal of breeding material because many house-flies are resistant to insecticide sprays. Cattle grubs are another parasite common in North America. The main damage to cattle is caused by the migration of the grubs through host tissues and production of cysts on the animals’ backs. Growth rates can be adversely affected with infestations of cattle grubs. Appropriate insecticide treatment will kill grubs; however, care must be taken not to administer insecticides when large numbers of grubs may have accumulated in the spinal canal. Killing of large numbers of grubs at once can lead to anaphylaxis in cattle. Other external parasites that may affect dairy cattle include fleas, lice, ticks and mites. Itchiness and formation of scabs should be examined by a veterinary surgeon who can prescribe appropriate forms of treatment.

**Vaccinations**

Many disease occurrences can be prevented or at least minimized by appropriate vaccination programs. The program that is appropriate, however, will vary from region to region, and even farm to farm. Establishment of a vaccination program requires knowledge of diseases prevalent in the area, history of diseases on the farm, history of diseases in the herd, vaccinations used previously in the area, species of diseases but are impractical to control.

Timing of vaccinations is important for replacement animals. If the colostrum consumed by the calf contained antibodies against the disease organism present in the vaccine, the vaccine will not generate a sufficient immune response in the replacement animal. Maternal antibodies obtained from colostrum may be present up to 6 months of age, preventing an adequate response to vaccinations. It may be beneficial to wait until 6 months of age or greater for many initial vaccinations in calves in order to avoid interference from maternal antibodies. Additionally, many vaccines are not effective in neonatal calves because their immune system is not sufficiently developed to generate a protective response.

Common mistakes made in vaccination programs are lack of booster vaccinations at the appropriate time and lack of frequent vaccinations. If the vaccination protocol calls for an initial vaccination followed by a booster vaccination within 2–3 weeks, maximum protection will not be achieved without the booster vaccination. Essentially, the money spent for the first injection is wasted. The second problem, lack of frequent vaccinations, is seen especially with leptospiral vaccines. Leptospiral vaccines should be administered every 6 months to achieve adequate protection. It is also important for heifers to start receiving leptospiral vaccinations at 6 months of age so that they have received two vaccinations by the time they are used for breeding.

**Conclusions**

Health management of replacements requires attention to many different areas, ranging from nutrition and management of late lactation and dry cows to vaccinations of replacements. A better-informed management plans for biosecurity risk and analysis is essential for the next generation replacement cattle management. Recent development of low cost sensory technology and
autonomous surveillance systems are essential to overcome error prone labour intensive human intervention system and complement the efficiency. Health management of replacements is an area that is often overlooked because producers do not see an immediate return on their efforts and prefer to spend their time improving management of the milking herd. For health management of replacements, however, the old saying that “an ounce of prevention is worth a pound of cure” really holds true.

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