Prevention of neonatal calf diarrhoea on beef suckler farms

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Neonatal calf diarrhoea is a common cause of morbidity on suckler beef farms. The disease occurs when one or more of the components of the typical epidemiological disease triad of agent, environment and host are compromised. Prevention of disease requires a plan that strengthens one or more of these entities.

The agents that cause neonatal diarrhoea in beef calves have been well described. Common pathogens include E coli, rotavirus, coronavirus and cryptosporidium. Less common agents are *Clostridium perfringens* type C, *Salmonella sp* and coccidia. Pathogenicity of the agents is determined by dose, environmental hardiness, infectivity and virulence and contagiousness. As we examine the prevention of neonatal diarrhoea, our ability to make an impact is limited to reducing the infective dose to a level below the typical threshold that causes disease.

COLOSTRUM QUALITY AND QUANTITY

Considerable research has focused on the value of calves ingesting an adequate quantity and quality of colostrum shortly after birth. A study by Homerosky in Canada, examined how suckle reflex within four hours after birth and dystocia score affected passive transfer level.[1] To no-one's surprise calves needing assistance (dystocia score 2=easy assist; score 3=difficult assistance) at birth had lower blood-total protein levels, indicating a lower level of colostrum consumption and lower level of passively transferred antibodies. What was surprising was that calves that were born unassisted but had a weak suckle had a failure of passive transfer rate of 78%. This number was higher than all calves that were scored a three for dystocia for needing mechanical assistance at birth.

Dystocia score	1	2	3
% calves in each dystocia score	29	53	18
Overall % FPT rate	14	39	64
FPT rate by suckle reflex			
Strong suckle reflex	8	26	49
Weak suckle reflex	78	94	98

Table 1: Dystocia scores.

**Failure of passive transfer (FTP)*

We can examine problems with colostrum as a quantity issue, which usually is associated with inadequate pre-calving nutrition of the dam. Bred cows and heifers need to have a ration that is balanced for energy, protein, vitamins and minerals. Water needs to be fresh, clean and easily accessible. At calving, heifers should have a body condition score (BCS) of 3-3.5 on a five-point scale. Cows should have a BCS of 2.75-3. Cows with BCS below this target will be at a higher risk of having inadequate nutrition to produce the quantity of colostrum needed by the newborn calf compared to females in adequate BCS.

Colostral quality can also be impacted by precalving nutrition of the dam. Quality can also be enhanced with proper vaccination of the dam before calving. Timing of vaccination is paramount as colostrogenesis begins many weeks precalving.[2] While all the vaccines stimulate good

immunity to the pathogen in the vaccine, some vaccines show more effectiveness in the field than others. Since the *E coli* strains that cause neonatal diarrhea are only able to cause disease in calves under five to six days of age, the ingestion of colostrum that has antibodies to *E coli* are perfectly designed to combat this disease due to its very short period of infectivity. While the rotavirus and coronavirus vaccines also stimulate an excellent immune response, the fact that both of these viruses can cause disease for weeks after the calf is born, makes this vaccine less clinically effective in the field. There is no vaccine for cryptosporidium and it does not appear that cows develop immunity to this disease.

CALF VIGOR AT BIRTH

Another area that is vitally important to the calf ingesting the maximum amount of colostrums, is the calf's suckle reflex and vigor at birth. Precalving nutrition is vitally important to these two factors. Cows with inadequate precalving nutrition give birth to calves that are slower to stand and suckle after birth. These calves are also less tolerant to cold weather if protein is lacking in the precalving ration.[3] Calf-birth weight is another risk factor in calf vigor, with calves extremely heavy or extremely light at birth having the poorest calf vigor score.

Genetics also play a role in calf vigor at birth, as there are known breed differences in calf vigor score. A calf from a heifer should be born within one hour after the appearance of the amniotic fluid, should stand in 30 minutes and nurse within 30 minutes of standing. Calves from cows should do the same as calves from heifers except that calves from cows should be born 30 minutes after appearance of the amniotic sac. If a herd is not meeting the goals of calving time progress, an examination of the genetics of the bulls, and to a lesser extent the cow, should be performed. Selecting a sire breed with less calving difficulty should improve this problem. If calves are not standing and nursing soon enough and females are in adequate BCS, selecting breeds with greater vigor score at birth and improving heterosis will improve this deficiency.

ENVIRONMENTAL IMPORTANCE

The final component of the disease triad is the environment. Recent studies in the west of the US, have led to a neonatal diarrhoea prevention strategy called the Sandhills Calving System (SCS).[4] Herd owners that have adopted this system for their farms and ranches have seen a very significant reduction or, in many cases, a complete elimination of morbidity due to neonatal diarrhoea. The system is based on two known scientific principles. Firstly, newborn calves born into a clean environment, will have less exposure to disease organisms. Secondly, older calves that are in the same environment as younger calves will shed disease organisms and become an incubator of disease for the younger calves. The younger calves have less resistance to these organisms compared to the older calves and the younger calves can then become ill.

The system starts with bred heifers and bred cows in separate prepartum, winter-feeding environments. These two groups then move to separate calving environments just before the first females are due to calve. We know that wintering heifers and cows together is also a risk factor for neonatal disease. Calving heifers and cows together in the same environment, even if it is an environment separate from the wintering one, increases risk of disease in all the calves. This is especially true with regard to the calves from the heifers as the heifers produce colostrum with less breadth of immunity as compared to their older herd mates. The bred cows, three years and over, are all placed in a single calving pasture or paddock. Cows that calve here are left in this pasture with their calves and calving continues for 10-14 days. After this time, cows yet to calve are moved to pasture #2. Now when cows in the second pasture begin to calve they are calving in a clean, uncontaminated environment and these calves are not exposed to the calves that are 10-14 days older as they are still in pasture #1. After seven to 10 days of calving in paddock 2, cows with calves are left here and all cows yet to calve are moved to pasture #3. This plan continues until all cows have calved. Figure 1 depicts the plan on week four of the calving season.

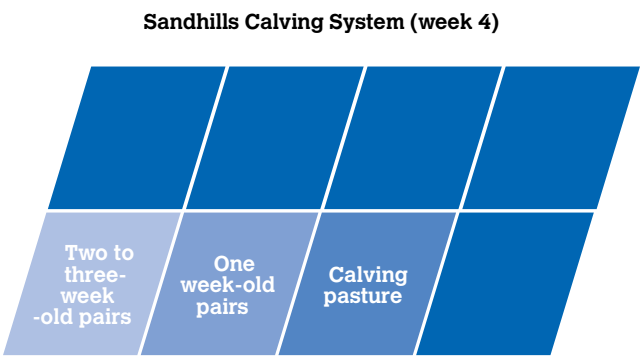

Figure 1: Sandhills Calving System, week four (courtesy David Smith, DVM, PhD).

In the original work in Nebraska, US, the researchers had the following impact on the two-test herd.

SCS		
Herd #1	**Five consecutive years before SCS**	**Three consecutive years after SCS**
Mortality rate average (range) due to scours	**6.5-14%**	**0%**
Cost of veterinary services and medication	**$3,114.18/year**	**$128.83/year**
Herd #2	**Two consecutive years before SCS**	**Two consecutive years after SCS**
Mortality rate average (range) due to all causes	**6.5-11.9%**	**1.5-2.3% (0% due to neonatal diarrhoea)**

Table 2: Before and after SCS.

The SCS study uses eight pastures for the adult cowherd and in some herds that number may be necessary. When I have worked with smaller herds (20-100 cows) in the midwest, we tend to use only four to five pastures for the cows. One area never to compromise, is to have the heifers calving separately from the cows. Since many herds only breed heifers for 42 days versus generally 65 days for cows, taking into account that heifer numbers will be significantly lower than for cows, we have utilised as few as three paddocks for heifers in some of our herds. One of our herd owners had battled neonatal calf diarrhoea for many years, where they tried nearly every preventative medicine and vaccine for the cows and newborn calves with no improvement in herd health. Calves with diarrhoea were generally observed about halfway through the calving season where all calves were born in a common calving lot and then pairs were moved to fresh pasture. Before our herd visit, the owner furnished us with pasture dimensions and locations. We performed a herd visit five years ago and laid out a plan of movement of bred cows and heifers. In years before the SCS, the owner experienced up to a 50% morbidity rate with up to a 6% mortality rate due to calf scours. In the five years after implementation of SCS, herd morbidity and mortality due to neonatal diarrhoea, has been zero each year. These results are typical of our experience on other herds.

The first comment I hear when I explain the SCS to clients, is that they do not have sandy soil. They have heavy soil where drainage is an issue. We have proven with our herds in Indiana that having sandy soil is not a prerequisite to having success with the SCS. My comment is always: "It's not the sand; it's the system." The system has two foundations of allowing calves to be born into a clean environment and having older calves in an environment separate from the newborn calves. We try to find the 'driest' spot on the farm to set up the system as we know that mud can become a significant issue when calving on wet, heavy, poorly drained soil.

When clients ask about calving in a barn, I cannot find a system that adheres to rule number one – that calves are born into a clean environment. We simply do not have adequate pen space to calve each cow in a clean, dry and disinfected environment. Even if that was not an issue, as soon as cow-calf pairs move outside to a lot, there are always calves with a more than two-week spread in age placed together in a common environment. Our herds that calved cows inside due to severe weather stress (generally January to mid-March), have in some instances moved to calving much later (generally, May to June) so that calves can be born outside in an environment conducive to their survival.

The highest risk scenario for neonatal calf diarrhoea is to allow cows and their nursing calves free access to a common shelter. This environment quickly becomes contaminated and neonatal disease becomes almost a certainty. If owners insist on calving during periods of severe weather stress, the use of calf huts that can house about five calves each can be used to provide a clean, dry place for the newborn calf to lie. As stated previously, calving outside when the weather is conducive is the best way to reduce the incidence of neonatal diarrhoea.

To prevent neonatal calf diarrhoea on suckler beef farms, the owner, manager and herd health veterinarian need to work together to formulate a plan that will produce the very achievable rate of zero calves with neonatal diarrhoea. Utilising the SCS is an important part of that solution.

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