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Disease Considerations In An Expanding Dairy

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In today’s dairy environment, the producer is often forced to consider expansion in order to stay in business. In the rush of expansion details concerning facilities, financing, and animal purchases, the farmer may overlook some of the basic fundamentals of biosecurity and disease control. In this aspect, the dairy farmer may be behind the learning curve that has already been experienced by the swine industry. The swine industry is well aware of selecting stock that have a negative sero-prevalence for specific diseases. Swine producers are also aware of new population isolation and vaccination protocols for incoming replacement stock prior to entry into the main operation. Too often such techniques are overlooked in the dairy industry during expansion resulting in disastrous health and financial outcomes to the producer.

A few of the diseases of special importance to the dairy farmer are Bovine Viral Diarrhea, *Mycobacterium paratuberculosis* (Johne’s disease), and *Mycoplasma* mastitis species. Other important factors are the general herd condition and mammary gland health. Mammary health evaluation includes whole herd quarter cultures and historical examination of the selling dairy records.

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Bovine Viral Diarrhea

Bovine viral diarrhea (BVD) is a virus that manifests as diarrhea, respiratory disease, unthriftyness, reproductive depression, abortion, and death. Abortions compound losses by the loss in production due to repeat breeding and longer calving intervals. In the beef cattle industry, financial losses of 4-7% due to abortion and loss of unthrifty calves are estimated.¹ One could extrapolate that these losses will be greater in dairy cattle due to the addition of milk production losses. In expansion scenarios, BVD has a devastating record as one of the major causes of acute death loss.

When compared to beef operations, dairy expansion is a higher biosecurity risk. Prevalence rate estimates suggest that there is a 70-90% exposure rate within the dairy population.² What techniques are available to the practitioner and the producer to help minimize the risk to an expanding dairy? Titers may be determined through serological testing, but these only indicate exposure at one point in time to some form of antigen that could be either vaccine or field virus. The exception would be the dairy herds that have active shedding occurring due to the presence of persistently infected individuals within the population.³ These herds tend to manifest above average titer ranges when compared to vaccine induced titers.

Since titer results can be inconclusive if
a titer rise is not demonstrated, testing should then focus on the presence of the virus in the animals. Virus detection is best determined by using virus isolation and capture ELISA. Virus isolation can be done and involves inoculation of a cell culture and allowing the virus to proliferate to cause visible cell damage. The virus can then be isolated from the cell line. Capture ELISA is a relatively new procedure that should be considered a "screening" technique. Plated antibody is exposed to virus with the result that the virus is "captured". Once "captured", the virus is unavailable for further diagnostic work (unlike virus isolation). The advantage in the "capture" technology is the speed and the cost. ELISA capture tends to run about half the cost of virus isolation and the results are available in a matter of days. Each of these tests can help determine if the animal in question is infected with BVD. Utilization of this techniques can minimize the chance of acquiring an animal with an active infection and the attendant risk to the receiving herd.

Herds that utilize bulls tend to be herds that may be less concerned with herd biosecurity due to the rapid turnover of these individuals. But if the dairy farmer chooses to have bulls on the farm for breeding purposes, these individuals should undergo as rigorous a testing procedure as females that are added to the herd. Acquisition from a purebred, respected breeder does not confer virus negative status. Bulls are a particular biosecurity risks due to seminal shed of BVD virus. Shedding bulls may not appear to be clinically infected.

**Johne's Disease**

Johne's disease is caused by the acid fast organism *Mycobacterium paratuberculosis*. This insidious organism is a major biosecurity risk since it is extremely slow growing and it takes at least 18 months for a cow to show clinical signs of infection. The main route of infection is through the newborn ingesting fecal material from a contaminated source. There are other routes of infection such as in-utero and embryo transfer. Other species of animals that can be infected and can transmit the disease to cattle include sheep, goats and deer. It would be prudent to keep sheep and goats isolated from the dairy cows on a farm. On farms that pasture cattle instead of keeping the herd housed in free stall barns, there is a slight risk of contracting the disease from the deer in the area. Johne's disease primarily infects the GI tract of the animal including the regional lymph nodes. Recent work has also suggested that this may be a septicemic organism as well. The organism has been isolated from the ovaries of infected cattle and ground muscular tissue. The onset of the disease is slow and is manifested as a progressive, fatal, chronic wasting disease.

There are several reasons that this disease needs to be kept out of the dairy herd. The primary reason is financial. Cows that are clinically normal yet still test positive can demonstrate a loss of $1,200 per cow per lactation. This figure does not include the loss of market value of the animals showing clinical signs and death loss of infected
individuals. Since this disease is a chronic wasting disease, there will also be other financial concerns due to longer calving intervals from low energy levels resulting in poor ovarian performance and decreased success of reproduction. An additional loss is the wastage of feed value from the malabsorption-maldigestion diarrhea. *M. paratuberculosis* is shed primarily through the feces. An infected, shedding individual will shed billions of the organism into the environment on a daily basis, effectively putting all young cattle on the farm at risk.

An additional concern to the expansion operation is the "Johne's Iceberg". Current epidemiological work suggests that for every home raised case of Johne's, there are probably another 10-15 undiscovered cases lying underneath. Purchase of existing dairy operations with a few Johne's cases may in fact have quite a few additional cases lying under the surface. Current estimates indicate that an expansion unit has a 1 in 10 chance of buying Johne's into their operation. Another area of concern to the dairy industry is the possibility of a link to Crohn's disease in man. Crohn's disease in humans has close similarities to Johne's in bovines. At this point, it has been very difficult to obtain *M. paratuberculosis* from human tissues. If the link is solidly made in the future, this finding will become an issue for the dairy industry from the scope of a possible zoonotic disease and public health concerns.

Johne's is best treated by preventing introduction of the disease on to the farm. The purchaser should request the Johne's disease status from any herd under consideration. As time advances, this practice may be more common for the seller to have performed some of this testing in advance. If test records are not available or current, the seller and purchaser should discuss and determine who will fund the tests and what will be done with the positive individuals that are detected. The purchaser should bear in mind that testing is probably only 40-50% selective, at best, and that the testing procedures will not remove all the positive animals from the herd. The purchaser must also be aware that cattle are creatures of habit and acclimation. Movement to new facilities will impose stress from transportation, new feeds, social changes, and milking procedures. The addition of stress may be enough to cause some infected animals to become clinically positive. The end result is that it will be impossible in the current environment for an expansion herd to purchase totally clean livestock. In addition to sampling incoming herd additions, it is valid for an expansion herd to perform some statistical sampling to determine their own prevalence rate. Thus when buying cattle, the expanding producer should only buy cattle from farms with a prevalence rate that is either equal to or lower than their own.

The tests that are available to help diagnose Johne's disease are fecal culture, serum ELISA, milk ELISA, DNA probe, complement fixation (CF), and SN titters. The drawback to all these tests is that they lack sensitivity. When choosing a test for sensitivity, the fecal culture, serum ELISA and milk ELISA are approaching 40-50%. This number can change when faced with the animal being clinical or subclinical affected. The DNA probe is too expensive to be employed on a herd-wide basis. The CF and SN tests lack the sensitivity of the other tests and should only be used when examining an overtly clinically positive cow. The issue of specificity becomes the next issue of test selection. Specificity means how certain a positive test is truly positive. The specificity of the fecal culture and serum ELISA tests are very high (approaching 99%). There is no question that a positive is truly positive. The milk ELISA lacks specificity (83-87%), resulting in a higher
number of false positives. The use of the milk ELISA mandates that the positive individuals be retested with one of the more specific tests to determine with better accuracy if they are truly positive.

**Mycoplasmal Mastitis**

The third disease agent that the dairy farmer needs to guard against is *Mycoplasma* species. These agents cause a variety of diseases such as pneumonia, arthritis, and mastitis. These organisms are highly contagious pathogens that if brought into a naïve herd could lead to a rapid increase in culling due to an increase in untreatable mastitis and decreased milk production. Cows infected with mycoplasmal mastitis can have two outcomes. The first is that infected individuals will be culled due to incurable mastitis and low milk production. The other outcome is for affected cows to spontaneously recover from the infection and return to production. These cows should also be culled, as the cow is a source of infection to the rest of the herd. Epidemiological studies suggest that larger dairy herds have a greater chance for virulent mycoplasmal agents to be present. Since this agent does cause a variety of severe disease manifestations, it is worth the effort to test for these pathogens. Testing for *Mycoplasma* species can be incorporated into a routine pre-purchase mastitis screening of the herd in question. Serial bulk tank cultures are sensitive enough to detect the presence of an infected individual within the herd. Subsequently, efforts must be directed at individual cow culturing to determine if the cow is infected.

**Other Biosecurity Concerns**

In the acquisition of an existing herd, the purchaser should make every effort to obtain the somatic cell count (SCC) records of the herd in question. If these are not available, each cow should be individually SCC tested to determine those cows that may have infected quarters. Sellers that are able to provide SCC records over the previous year and documented low counts are in a position to ask for a premium price for their animals. A purchaser would be also well advised to consider quarter culturing of the herd to determine the type of infection that is present within the herd, as well as the number of cases. Culture results should be divided into two categories: infectious/contagious and environmental. Infectious pathogens that are of concern include: *Mycoplasma* species, *Staphylococcus aureus*, and *Streptococcus agalactiae*. All of these species are contagious and can readily be spread throughout a naïve herd. Agents, other than the above mentioned, should be considered environmental pathogens. Some can also be a problem to treat. The antibiotic susceptibilities should be examined closely. The use of SCC and culturing will allow an expansion operation extra assurances that they are acquiring cattle with good udder health.

**Replacements**

Two choices are available to the producer when purchasing replacements: purchasing first calf heifers or purchasing mature cows that are already in production. Each option has points of strengths and weaknesses to consider.

**Strengths of the mature cow**

1) A proven track record of production.
2) A proven track record of somatic cell count.
3) Mature cows should have been exposed to a routine vaccination program and natural exposure, thus providing a solid immune system to work with. Also from the disease standpoint, the cow’s titer for BVD is likely higher from both previous vaccination and from natural exposure to the virus. With higher titers to this virus, the cow should have better protection.
4) More easily adapted to new surroundings due to previous lactation experience.

**Strengths of the heifer**

1) Little exposure to contagious mastitis pathogens and the resultant glandular infections. This is especially true for the contagious mastitis organisms. The exception to this rule is *Staphylococcus aureus* which is the most frequently isolated mastitis of fresh heifers due to contamination from calfhood suckling. With respect to *Mycoplasma*, first calf heifers are at less risk since they have not been exposed to a milking
Heifers are at risk if fed unpasteurized milk from an infected cow due to the risk of glandular seeding of this organism.\(^\text{10}\)

2) No previous lactational history to have adversely affected her energy status for the next lactation.

3) May have been reared in a segregated area that could lessen the chances for BVD exposure.

Weaknesses of the mature cow

1) Exposure to a wide variety of contagious pathogens, both systemic and local mastitis pathogens.

2) Johne's status is unknown. Older cows may be more prone to becoming clinical cases due to age of onset for this disease even though prevalence rate is dependent on exposure during the first year of life.

Weaknesses of the heifer

1) Less lifetime immune system exposure to vaccination protocols resulting in an immune system that is less capable of coping with a systemic challenge.

2) Heifer has to undergo the challenges of adapting to social, ration, and lactational change with the onset of lactation (less adaptable). Heifers tend to be pushed around by the older members of the herd.

3) First calf heifers have a higher chance of being persistently infected with BVD and hence, can be source of viral shedding for the rest of the herd.\(^\text{4}\)

4) Testing for Johne's in heifers will be difficult due to the lack of antibody present.

Critical Control Points

Up to this point, this article has been discussing the Hazard Analysis for expansion dairies. The hazards include: infection and losses due to BVD virus, the presence of Johne's disease, Mycoplasma infections and mastitis, as well as mastitis from both contagious and environmental bacterial species. After identifying the hazards, there needs to be implementation of Critical Control Points (CCP) to circumvent these potential problems. The following are some suggested procedures prior to accepting new herd additions.

1) Request that the farm of origin allow access to the treatment records of the herd in regards to treatment of clinical mastitis. This will allow evaluation of the numbers of cases treated, products used, and hopefully, the outcome of those cases. The purchaser should also request that there be a minimum of a bulk tank culture be performed so that the types of mastitis organisms are known. Current somatic cell records are also critical to allow determination of the infected cows.\(^\text{11}\)

2) The farmer should also request that the new additions be tested for BVD titers and that a virus isolation test for BVD be performed to prevent the addition of an actively infected animal.\(^\text{1}\) Since titers can be so variable and the titer origins unknown, it might be better to ask the producer to spend his money for virus isolation or capture ELISA techniques. Capture ELISA compares quite favorably with titer testing in regards to cost of the tests. This method would be the most effective solution in first calf heifers that are entering the facility. When a titer is obtained, it is just a single snapshot in time of that animal's immune status. Thus, without evidence of a rising titer, this information may be of little value.

3) Once the prospective cattle are purchased, they should be kept separate from the base herd for an appropriate length of time so that any disease that the stress of moving could set off would be seen and not introduced into the rest of the herd.\(^\text{12}\) Not only should these cows be kept separate, but they should also be milked separately. These cows should be milked at the end of the milking order to prevent contagious mastitis from getting a foothold in the herd. At the end of the isolation period, these cows should be retested to ensure that they are indeed negative for the above mentioned diseases.

4) Any new lactating animals should be individually tested for antibiotic residues prior to placing their milk in the bulk tank. In the heat of cattle movement, there is a real potential that the previous owner may forget to inform the new owner of treated individuals. As always, any individuals that are freshening should also be tested for residues before entry into the bulk tank, as testing
the bulk milk would be too late to prevent drug residue contamination.

**Biosecurity**

As emphasized previously, biosecurity is usually the last thought in an expansion dairy situation. The concept of biosecurity also extends to the hospital facilities of the receiving dairy. One of the first biosecurity violations is sick pens doubling as maternity pens. Sick animals are viral and bacterium factories. The concept of a hospital or sick pen is to provide a place that allows the animal to be treated and recover, while limiting the spread of these pathogens to one area. When dealing with pathogens like BVD, Johne’s, *Salmonella* and *E. coli*, there is a common thread which is fecal/oral transmission. The maternity area is the last place that you want these pathogens lying in wait for new calves. For the health of the herd, the maternity pen must be in a separate area, cleaned, and freshly bedded for new arrivals. Isolation and cleanliness of freshening cows is the best and the only means to break the cycle. The maternity pens should not be located in high traffic areas. This pen should allow for ease of access by cleaning equipment so that the pen can be cleaned between calvings.

When locating the sick pen in a dairy operation, an area that will again allow easy access and cleaning should be chosen. It should not be located in the traffic lane of cows waiting to be milked. Run-off or nose to nose contact may allow for transmission of pathogens from the occupants of the hospital area to other uninfected cows. The sick area should also be designed to capture and restrain cows easily, while allowing a veterinarian full access to both sides of the animal to facilitate examinations.

Another aspect of biosecurity that is often ignored is other animal species control. Sheep and goats have been shown to be able to transmit BVD to cattle and are also a source of malignant catarrhal fever. Swine have transmitted pseudorabies virus to cattle with fatal results. The farmer needs to keep this route of transmission in mind if there are any other species of livestock on the farm and maintain separation of these species.

**Conclusion**

Consolidation of the dairy industry is the current trend. This article has attempted to perform some Hazard Analysis for the expansion unit. Once identified, these hazards must be circumvented by the implementation of the appropriate Critical Control Points by the producer and his/her herd veterinarian. These issues can be dealt with before, or after, the expansion event although dealing with these issues after the fact can have devastating financial consequences. As always, good ration analysis and cow comfort issues are a major factor in production along with good biosecurity measures.

**References**