Treating Subclinical Mastitis Based on Milk Culture Results

Very little of the attention paid to the culture and treatment of clinical mastitis cases has dealt with treating subclinical infections. This article demonstrates the usefulness of culturing subclinical mastitis to develop treatment protocols. Many of the common questions asked about culture results and treatment and management protocols are answered. Previous studies have shown that treatment based on SCC alone is not economical or even successful. However, identifying subclinical infections based on culture results will help target cows for treatment and improve treatment success.

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A number of articles have been written on the culture and treatment of clinical mastitis cases, but little has been written about treating subclinical infections. Perhaps this is because there’s little economic evidence to support treatment of subclinical mastitis except for the control and eradication of *Streptococcus agalactiae*. Years ago, when electronic somatic cell count (SCC) testing was first adopted to monitor dairy herds for subclinical mastitis, research was conducted that included SCC in treatment decisions. However, like clinical mastitis, many infections that caused subclinical mastitis are eliminated by the time that high SCC is detected in monthly...
testing. When these studies were evaluated, the reduction in SCC following treatment was not much better than the untreated controls. Therefore, when milk loss and treatment cost were factored into these studies, treatment based on high SCC did not show an economic benefit. However, we should take another look at subclinical treatment to understand some of the factors that affect their results.

Treatment Difficulties

Some of these factors are similar to those affecting clinical mastitis since subclinical mastitis is caused by the same organisms. Treating all cases of subclinical mastitis the same is no different than treating all cases of clinical mastitis the same. In a clinical mastitis study (1), milk cultures were used to help identify the bacteria causing clinical mastitis and antibiotic treatment was selected that was effective and appropriate. We should consider the same rationale when making treatment decisions for subclinical mastitis. As with clinical mastitis, by the time the elevated SCC is detected, the cow’s immune/defense system may have eliminated the pathogen. This is true for many bacterial infections, most commonly when Gram-negative coliform bacteria are responsible. Not all coliform bacteria cause clinical mastitis and bacteria are often eliminated before serious damage to the gland occurs. Yet, the presence of the organism and its toxins can elicit a high SCC that can remain high for days or even months before the gland recovers. An infection can cause enough damage to increase the SCC identified on the monthly DHIA-SCC records, but that SCC will drop to normal levels by the next DHIA sampling. This is common with environmental infections and we often use this observation as a way of monitoring records to see if environmental bacteria are responsible for the increase in herd SCC. If we use SCC to select cases for treatment, antibiotic treatment would be of little value because the bacteria have already been eliminated. Antibiotic treatment is only effective against bacteria and has little effect in improving tissue healing.

Selecting Drugs for Treatment

As with clinical mastitis, treating subclinical cases with antibiotics when the cultures are negative for bacteria will accomplish very little except add treatment cost and increase milk loss as more milk will be discarded. Therefore, antibiotic treatment should be reserved for subclinical infections that are culture positive for bacteria that are susceptible to antibiotics. Milk culturing can help select the most appropriate antibiotic that will eliminate the bacteria. This requires culturing high SCC cows before initiating treatment. As noted in a previous article (2) the use of the correct drug, in the correct dosage, for an effective treatment period may very well determine if a treatment is going to be successful or fail. Drugs differ in their efficacy towards various bacteria, the time they stay in the gland and how well they get to the infections. For example, Streptococcus agalactiae is very susceptible to many antibiotics and can be eliminated from the gland by treatment during lactation or the dry period. Other streptococci are less sensitive to some drugs and less likely to be eliminated. In a recent study looking at new subclinical infections at calving, we identified streptococci-like bacteria (enterococci) like those found in our lactation mastitis tubes would be of little use against these infections. Similarly, Staphylococcal organisms (especially Staphylococcus aureus) are not as accessible and it is difficult to get the drugs to the bacteria at a high enough concentration to eliminate the infection. Drug sensitivity testing and treatment protocols should be discussed with a professional who understands the pharmacology of both the drug and bacteria identified from subclinical mastitis cases.

Profitable Treatment

We can profitably culture subclinical mastitis and use the results to develop treatment protocols. As we look at culture results and discuss treatment and management protocols, the questions below are commonly asked.

1. When should we culture? Selecting cows for culture based on subclinical mastitis is a moving target and differs for each farm. A herd with a large number of high SCC cows may need to limit the number of cows for culture by identifying problem cows to bring the herd back into an acceptable range, while other herds with low SCC can lower the threshold to select all infected cows when trying to meet milk quality goals. In general, we can identify problem cows from DHIA reports if the Linear Score is greater than 4.5 (200,000 – 300,000 cells/ml) or select cows with high CMT scores (commonly used after calving).

2. When should a farm consider culturing subclinical mastitis? Most dairy farms can benefit by culturing high SCC (or high CMT) cows to identify pathogens (or lack of) that are responsible for elevated cell counts. Small dairies may find that on-farm culture programs are not practical, but they can select a veterinary clinic or laboratory that meets their needs.

3. What are we looking for when culturing subclinical mastitis? Identifying the pathogens that cause an elevated SCC in a herd is the first step in identifying practices that influence the spread of new infections and help identify management practices that can help prevent this spread.
Contagious pathogens have a different control strategy than environmentally acquired infections. Some pathogens can be eliminated from the lactating cow by antibiotic treatment while others are less responsive to therapy. If cultures are negative, subclinical mastitis is probably caused by environmental pathogens. Many of these bacteria damage gland tissue and it is a matter of time before the mammary gland heals and the SCC returns to normal. This may occur before the next test date or it may take the entire lactation and dry period to heal. In these cases, antibiotic treatment is of very little value.

4 Who should be cultured? High SCC (or high CMT) cows are good candidates and cows in early lactation with high CMT scores are often the best candidates. The ability to collect samples at appropriate periods and develop management protocols will determine the cows selected on any farm. A culturing program without a plan of action is of very little use and only adds a significant investment of time and resources. Therefore, a dairy herd manager needs to make a commitment and be willing to invest time and resources before tackling a subclinical mastitis problem. Target specific areas. Screening cows by culturing at calving (3-6 milkings post-calving) with the CMT is an excellent way to monitor calving areas, heifers, and dry cow management. Monitoring monthly DHIA records for cows with high SCC is useful in monitoring lactating cow management that includes housing and milking practices.

5 What infections can be identified by milk cultures? When we are culturing milk samples we are first trying to identify no growth (eliminated infections). Secondly, we try to identify Gram-positive pathogens that can be managed with the help of antibiotic therapy. Gram-negative bacteria are not as responsive to antibiotic therapy and are often self-limiting. An easy on-farm culture protocol can readily identify the bacterial pathogens.

6 What happens if mastitis cultures are negative? Culture-negative mastitis samples indicate the cow is not shedding bacteria in very high numbers or the infection has been eliminated. This is true of most environmental infections caused by coliform bacteria. Affected cows aren’t a big risk to infect other cows and should be managed as an individual cow problem. Often times the damage has happened already and little can be done to speed up the healing process. Preventing new environmental infections becomes the challenge. In the herd with a contagious problem (Staphylococcus aureus and Mycoplasma), a single culture may not identify the infected cow and additional cultures are required if the cow’s milk or the SCC does not return to normal.

7 Treatment Protocols? Clinical mastitis treatment protocols have been published in previous articles (1, 3) and articles with treatment protocols are available on MDR.
and CVM dairy websites. Gram-positive pathogens are more responsive to antibiotic therapy, while Gram-negative pathogens are not. However in severe clinical mastitis, supportive fluid therapy may be necessary whereas this would not be the case for subclinical infections. Deciding on a treatment strategy for subclinical infections is different than clinical infections because the health of the animal is not in jeopardy, and economics and milk quality are the primary goals. Having good culture results makes targeted treatment more effective while using the most appropriate antibiotics when antibiotic therapy is selected. Incorporating antibiotic therapy to reduce Gram-positive pathogens has been successful in herds while limiting milk loss. These protocols should be designed with the help of the herd veterinarian and monitored (culture and SCC) for treatment success.

8 What are the costs? If a farm has an employee or manager who has adequate training or is willing to go through the training process, on-farm culturing is very affordable and can be easily implemented within a treatment protocol. However, many veterinary clinic laboratories have rapid response times and are affordable. Either decision will require an investment of time and resources to initiate culturing protocols on the dairy farm. It has been very beneficial for many farms. If on-farm culture is selected, the farm personnel should work closely with the herd veterinarian to monitor culture accuracy and quality. Having the herd veterinarian monitor the culture quality also helps in identifying the appropriate treatment and management protocols for mastitis on the farm.

9 Can we culture for Mycoplasma mastitis? Most farm culturing protocols are not useful in identifying and monitoring mycoplasma mastitis. Mycoplasma requires special media and a specialized environment to grow this organism. When mycoplasma is identified on a farm, the farm should select an appropriate laboratory for culturing this pathogen. Starting by culturing bulk tanks for the presence of mycoplasma pathogens is a good monitoring tool. Mycoplasma bovis is a contagious pathogen. When found in the bulk tank, it indicates the presence of mycoplasma infections in the herd. Management practices can be developed to eliminate mycoplasma similar to eliminating other contagious pathogens (4).

10 What are the benefits of on-farm culture? There are two major benefits. Firstly, culture results are obtained in a timely manner that can help in making treatment decisions. Secondly, if the person responsible for culturing is also responsible for treatment, they become more aware of the pathogens causing infections. This awareness of the type of bacteria and its sources can improve prevention and make mastitis treatment more effective. All farms have mastitis cases, but until someone on the farm takes the responsibility for managing mastitis, few farms achieve a significant reduction in mastitis. In this respect, I do not separate clinical from subclinical mastitis because the cause and management is often the same.

11 Motivation. The person responsible for culturing milk samples should be the same person working with the veterinarian to routinely review the cultures and culture results at regular herd visits. The employee should be involved in the mastitis treatment and management decisions. This routine feedback will engage the employee and/or owner/manager in the herd’s mastitis control. Seeing a reduction in antibiotic use and a positive response to proper antibiotic treatment can be a very motivating factor. However, someone of authority must monitor the progress. This may be someone on the farm (owner, manager or supervisor) or the veterinarian working with the farm.

12 Where can I find these culturing procedures? There are a number of websites that promote on-farm culture. The Bi-plate culture method can be found on the MSU College of Veterinary Medicine Dairy website at <http://user.cvm.msu.edu/~sears/>. The CVM Dairy Website also includes a training presentation under “Dairy Health Solution – Slide lecture presentation” or under the Training link – “Clinical Mastitis Treatment Decisions”.

13 Where do I get the supplies to start on-farm culturing? Talk with your veterinarian or check our website under laboratory and laboratory supplies. There are other laboratory resources suppliers that can help you equip an on-farm culture lab.

Conclusion

Culturing subclinical mastitis can be an important aspect of monitoring subclinical problems on herds. If contagious pathogens are the major cause of clinical mastitis, then contagious mastitis also will be identified in subclinical mastitis. Treatment and management should focus on reducing the presence of these pathogens. However, if environmental pathogens are a major cause of clinical mastitis, culturing both clinical and high SCC cows is needed before ruling out contagious pathogens as a significant cause. In most herds the isolation of pathogens in a herd will be similar for both clinical and subclinical mastitis. It is almost always the same pathogens causing both forms of mastitis, but the severity of
the symptoms are usually the result of the amount of tissue damage caused by the pathogen.

Summary

In the past, most of our emphasis has been on culturing and treating clinical mastitis. Until now we have not addressed the use of these same tools to treat subclinical mastitis. Although SCC data are an excellent tool to evaluate herds, monitor progress and select cows for culture, it is not a good tool to select cows for treatment. Previous studies have shown that treatment based on SCC alone is not economical or even successful. However, selecting subclinical infections based on culture results will help target cows for treatment and improve treatment success. On-farm culturing is an opportunity for many Michigan herds.

References


Environmental Management

Vegetative Treatment of Compost Site Runoff

Changes made last year to the Rules for Bodies of Dead Animals (BODA) have brought alternative methods for composting into the spotlight. This article focuses on the potential use of vegetative treatment or filter strips around the composting site.

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Since the filing of the latest Rules for the Bodies of Dead Animals (BODA) Act in September 2007, much has been said about new alternative methods of composting. This spring and summer many producers will be putting new mortality composting practices into place in their farms. Though much could be said about these rules, this article focuses on the potential use of vegetative treatment or filter strips around the composting site.

Specific rules were included to protect surface and groundwater. During rainfall and storm events, nutrients and contaminants wash through uncovered compost. This is very similar to what happens with manure, silage storage, feed preparation areas, and waste water from animal holding areas. Runoff or effluent may be directed over a vegetative area to reduce amounts of nutrients, organic compounds, and pathogens that leave the compost site and potentially pollute the waters of the state.

Farms producing over 20,000 pounds of mortality (bodies of dead animals) annually and all animal processing operations (e.g. butcher plants, livestock collection points) are required to compost in a concrete lined storage structure designed in accordance with the liner criteria in the NRCS Waste Storage Facility standard (CPS-313). In addition, BODA Rules require that effluent leaving uncovered compost on these farms must be reintroduced immediately back into compost, collected and stored for crop production, or diverted to a wastewater treatment strip designed and constructed according to the NRCS Wastewater Treatment Strip standard (CPS-635). CAFOs under General Permit cannot use a wastewater treatment strip, unless they have applied for an Individual Permit.

One essential component of a wastewater treatment system is a collection structure or a settling basin. The collection structure is designed to settle and collect solids and collect any dry weather leachate. The structure must have the capacity to collect the runoff water from a 25-year, 24-hour storm event (3.56 to 4.48 inches of precipitation, depending on location in Michigan) falling on the composting area and the area of the structure itself. Wastewater leaving this structure and going to the rest of the system must flow at a rate less than that caused by a 2-year, 24-hour rainfall event (2.09 to 2.42 inches depending on location in Michigan). The first 100 feet of the grass
Potential of Two Aerobic Units to Treat Milking Facility Wash Water

Milking facilities generate 3.5 to 11 gallons of wash water per cow daily. This large volume of wash water requires proper treatment and disposal practices to prevent potential negative environmental impacts. Current practices including manure storage lagoons, land application, and use in alternative farming facilities are effective but not perfect. This article describes the use of aerobic treatment units as an alternative.

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Dairy milking facilities produce wash water, a high strength waste, as a byproduct of cleaning the milking facility after each milking event to maintain sanitary operations. Wash water composition includes high concentrations of cleaning products, fresh water, milk waste and animal waste. Wright and Graves report a wash water production range of 3.5 to 11 gallons/cow per day (1). Variation in production rates is largely due to management practices, number of milking events per day and herd size. The National Agricultural Statistics Service reports 344,000 head of cattle in Michigan alone, and over 9 million cattle in the United States (2). Consequently, the volume of milking facility wash water can be calculated at 400 million to 1.3 billion gallons annually in Michigan with a range of 11 billion to over 36 billion gallons annually in the US. More details concerning the characteristics of this wash water can be found in a prior MDR article by Safferman (3). This large volume of wash water requires proper treatment and disposal practices to prevent potential negative environmental impacts.

Current practices for management of the milking parlor wash water include storing it in manure storage lagoons, land application and use in alternative farming facilities, such as composting. Manure storage lagoons provide little to no treatment. Land application at acceptable nutrient agronomic rates is the major disposal option but requires extensive land management planning and is restricted by land availability and climate. The use of wash water in alternate farming facilities, such as composting, rarely requires the volume of water produced by the milking facility. Further, many farms do not operate these alternative facilities. Wash water can account for 20-50% of manure pit storage volume (4). This increase in liquid content results in larger volumes of waste, increasing the risk of leaks, overflows, runoff and migration of undesirable solids and nutrients into groundwater. Further, this wash water has minimum nutrient content, yet there is a high cost for moving this excess water to the cropland.

Objectives

This research examined an alternative treatment and disposal technique for dairy wash water. Specifically, two aerobic treatment units with different solid/liquid separation techniques were evaluated for their capability of treating

<table>
<thead>
<tr>
<th>Source/Research</th>
<th>Reuse Category</th>
<th>Water Parameter</th>
<th>Suggested Reuse Quality</th>
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<td>Dong et. al, 2003 (5)</td>
<td>Dairy Milking Parlor Floor Flushing</td>
<td>Total Chemical Oxygen Demand</td>
<td>650-700 mg/L</td>
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<td></td>
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<td>Nitrogen</td>
<td>70-80 mg/L</td>
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<td></td>
<td></td>
<td>Phosphorus</td>
<td>6-10 mg/L</td>
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<tr>
<td>USEPA, 2004 (6)</td>
<td>Agricultural Reuse - Non-food Crops</td>
<td>Suspended Solids pH</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Total Suspended Solids</td>
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<tr>
<td>Sarkar et. al, 2006 (7)</td>
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<td></td>
<td></td>
<td>Total Dissolved Solids</td>
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<td></td>
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<td>Fat, Oil, and Grease</td>
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<tr>
<td></td>
<td></td>
<td>Chemical Oxygen Demand</td>
<td>24.7 mg/L</td>
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high strength wastes to a suitable effluent quality for reuse as non-contact first flush water. Reuse quality for a first flush scenario is ultimately determined by the farmer as there are no regulatory standards which define this value. Table 1 provides some recommended standards.

Design/Method and Materials

Experimentation was conducted at the Michigan State University Dairy Teaching and Research Farm. This facility actively milks between 140 and 160 dairy cows twice a day. Two treatment systems modeled after those used for onsite wastewater were tested. Each included shared primary settling tanks, individual dosing tanks to control flow, the aerobic treatment unit (ATU), a recirculation system for dilution of the ATU influent, and a ultra violet (UV) disinfection unit. Wash water was pumped from the milking facility collection pits beneath the milking facility to the treatment system settling tanks. After the settling tanks, separation of flow was achieved using a distribution box to maintain two treatment lines, one for each of the aerobic treatment solid/liquid separation designs. The ATUs were the Nayadic™ and the Multi-Flo™. Both treatment units (explained in more detail below) are off-the-shelf designs for onsite generated domestic household waste and are manufactured and provided by Consolidated Treatment Systems Inc. Following the ATUs, recirculation tanks diverted a portion of treated wash water back to the dosing tanks to dilute the primary effluent to reduce the ATU influent organic concentration. Specifically, for every part discharged from the system, 3 parts (by volume) were recirculated.

The ATUs were designed for a household flow of 750 gallons per day. An equivalent hydraulic loading for the milking facility was calculated as 68 gallons per day due to higher Biochemical Oxygen Demand (BOD) concentrations within the wash water as compared to household effluent. However, households typically produce slug loadings from the nature of domestic use (e.g. flushing a toilet) and do not typically recirculate as does the treatment system designed for the milking facility. For convenience, testing and data acquisition initiated with a dairy wash water flow of 50 gallons per day with the intent of treating higher flows, if warranted. Treatment units were initially filled with wash water and run until failure. Approximately three weeks before testing was discontinued, a second aerator was installed in the Multi-Flo™ to increase the Dissolved Oxygen (DO) because of the low measurements indicating the system was oxygen limiting. The increased aeration resulted in a greater DO value which allowed for an increase in flow to 100 gallons per day. A variety of inline filters were tested for a short period in an attempt to reduce solids, but proved to be ineffective due to clogging.

Results

Over the 6-month operational period, water quality was determined on a regular basis by measuring several parameters, those reported are in Table 2. Observations, trends, average values and reduction percentages were evaluated. A summary is provided in Table 2 for average values of the baseline influent (untreated wash water), Nayadic™ effluent and Multi-Flo™ effluent with the corresponding confidence intervals.

Baseline BOD and Chemical Oxygen Demand (COD) values were much greater than reported by literature. A tremendous reduction of the effluent BOD was realized, especially in the Multi-Flo™ system. Chemical Oxygen Demand was substantially higher than BOD, indicating a significant amount of non-biodegradable carbon. Non-biodegradable carbon is a result of organic material which is not easily aerobically biodegradable, which would explain the higher COD values.

<table>
<thead>
<tr>
<th>Treatment Parameter</th>
<th>Baseline Influent</th>
<th>Nayadic™ Effluent</th>
<th>Multi-Flo™ Effluent</th>
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<tr>
<td>pH</td>
<td>6.42</td>
<td>7.97</td>
<td>7.81</td>
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<tr>
<td>Alkalinity (mg/L)</td>
<td>3,165</td>
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<tr>
<td>Ammonia (mg/L as N)</td>
<td>257</td>
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<td>23</td>
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<tr>
<td>Biochemical Oxygen Demand (mg/L)</td>
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<td>36,528</td>
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<tr>
<td>Total Phosphorus (mg/L as P)</td>
<td>149</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Total Solids (mg/L)</td>
<td>16,750</td>
<td>4,173</td>
<td>1,165</td>
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<td>Total Suspended Solids (mg/L)</td>
<td>8,725</td>
<td>1,253</td>
<td>238</td>
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<tr>
<td>Nitrate (mg/L as N)</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Kjeldahl Nitrogen (mg/L as N)</td>
<td>107</td>
<td>85</td>
<td>14</td>
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</tbody>
</table>
The source of these materials is most likely cellulose materials such as fiber. Variation in the baseline values for BOD and COD were most likely due to the inconsistent daily volumes of milk waste added to the underground tanks. Manure was also a source of varying COD and BOD concentrations due to the random cleaning of an adjacent floor which was also connected to the underground tanks.

Levels of total and suspended solids were also tremendously high and variable. Only the Multi-Flo™ was able to reduce the suspended solids substantially, however, a low level could not be sustained for long time periods. These results indicated a physical solid/liquid separation as provided by the socks in the Multi-Flo™ was required for adequate treatment. The gravity solid/liquid separation mechanism in the Nayadic™ was ineffective. The very high dissolved solids level undoubtedly contributed to the extreme baseline COD. Not only were high solids levels a problem in reaching treatment goals, they also caused major operational problems within all treatment segments.

Nitrogen (N) was monitored by measuring Total Kjeldahl Nitrogen (TKN), nitrate and ammonia. In this case, TKN was a measure of the organically bound nitrogen only, however it is typically known to include Ammonia. TKN (organically bound N only) represented about one-third of the total N in the wash water, while ammonia was the main remaining source. The effluent TKN was low, as it was most likely converted to ammonia by ammonification. Ammonification is dependent upon oxidizing conditions which were more typical in the Multi-Flo™. Effluent ammonia concentrations were also low, especially in the Multi-Flo™, most likely resulting from denitrification. Nitrate was not present in significant concentrations in any of the influent or effluent samples. This was not surprising as the high organic carbon levels and low Oxidation Reduction Potential (ORP) results in an environment conducive for denitrification of nitrate to N gas. Alkalinity and pH results substantiated these findings.

Phosphorus levels were unexpectedly high, most likely due to the large volumes of manure and possibly cleaning products that was mixed with the wash water. Any phosphorus removal can only be attributed to the particulate fraction being removed with solids.

Researchers perform maintenance on the Multi-Flo (left) and Nayadic aerobic treatment units employed for this study. The units were complemented by multiple settling, dose, and recirculation (foreground) tanks. An on-farm application would require fewer components than this study.
Overall, as determined by DO and ORP levels in the aeration tanks, the system was typically oxygen limiting. However, a substantial improvement in water quality was realized throughout the testing. Treatment to a water quality level adequate for reuse could be realized in the Multi–Flo™ system. However, these levels could not be maintained for greater than a month. Further, the flow rate of 50 gallons per day was substantially less than that produced at the dairy farm. The MSU Dairy produces an average of 1,800 gallons per day, or approximately 12 gallons per cow per day, above the reported values (1).

**Conclusions**

The following conclusions were reached from the testing research.

- Aerobic treatment units proved able to treat high strength dairy waste wash water.
- The Multi-Flo™ consistently out-performed the Nayadic™ for all water quality parameters.
- The Multi-Flo™ reached effluent water quality standards for reuse at a flow rate of 50 gallons per day for a first flush cleaning of the dairy milking facility for 1 month.
- System maintenance was determined vital for proper treatment performance.
- Treatment is reliant on the characteristics of the wash water produced by the farm. Large amounts of solids were determined to be the main detriment to system operation and treatment performance.
- The volume of wash water treated, 50 gallons per day, does not meet production of the wash water requiring disposal. Feasibility of the treatment units will depend on improved efficiency.

The primary limitation of the system was the high solids levels in the influent wash water. A reduction in solids would lead to multiple positive improvements. The potential to treat high strength wash water was shown. However, the use of an ATU-based system is still not proven because the high level of solids in the wash water at the MSU Dairy prevented sustainable operation. However, the results show that a similarly sized Multi-Flo™ system may have potential for a smaller farm which practices solids reduction methods. Wash water characteristics closer to reported values and an increase to two aerators within the treatment unit would give the Multi-Flo™ more potential as a viable treatment option.

The costs for these treatment units is reasonable to be considered for wash water treatment specifically at a smaller dairy. Because these units were not suitable for the testing location further tests aimed at answering questions concerning specific treatment volumes and their associated costs will be emphasized to determine practical implementation.

**References**

Cover Crops: Manure’s Best Friend

Because cover crop roots and top growth act like a sponge to capture, contain, and reuse manure nutrients, they can be an effective way to retain soil nutrients and reduce fertilizer costs. Even if only 40 pounds per acre of nitrogen are retained, spring fertilizer costs can be reduced by $25 per acre by planting cover crops such as oats, oilseed radish or cereal rye. This article offers a rundown on how to get the most from cover crops.

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Forget the notion that cover crops are old-fashioned; they have never had so much to offer, especially for ground that will receive manure.

Roots and top growth act like a sponge to capture, contain and recycle manure nutrients. Consider the difference between soil surfaces after silage harvest compared to a field with a growing crop. After silage is harvested there is little crop residue and, regardless of the soil type, machinery and rain can pack the soil, making the surface hard and impermeable. Surface-applied manure may soak into the soil. But if it doesn’t, the next rain may carry the manure along the natural drainage patterns of the field. If the field drains toward a tile drain surface inlet, stream or ditch the mixture of rain water and manure could create a direct discharge that pollutes surface water. Injecting or incorporating manure will decrease that risk.

Consider a silage field with an established cover crop. The roots of the cover crop make the soil surface more permeable so water and manure nutrients are less likely to move over the surface. The top growth reduces runoff, overland flow and erosion. Manure nutrients that infiltrate will be taken up by the cover crop and held over the winter. These nutrients will be released the following spring in time for the subsequent crop to take advantage. Even if only 40 pounds per acre of nitrogen (N) are retained, spring fertilizer costs can be reduced by $25 per acre. And the savings increase when phosphorus (P) and potassium (K) values are included. Research shows that cover crops improve soil quality, add organic matter and reduce compaction. And, a green cover crop in late winter and early spring always makes a favorable impression on neighbors.

Planning Ahead Helps Overcome Challenges

The time and labor involved in establishing a successful cover crop can be challenging. The busy fall harvest leaves little time to plant a cover crop. Plan ahead. Know how many acres are needed to utilize all manure nutrients in the coming months. Order seed and be ready to plant when the time is right.

Surface-applied manure is vulnerable to runoff, especially during frequent winter and spring snow melts. Don’t apply manure on heavy snow packs. Right-to-farm guidelines specify that liquid manure should not be winter applied on slopes greater than 3 percent, and solid manures should not be applied on slopes greater than 6 percent. Select fields for spreading that do not slope to surface waters. If cover crops are not used or not well established, manure must be injected or incorporated.

Select the Right Cover Crop

Oats are sometimes used as a cover crop in the fall and need to be planted soon after silage harvest. Drilling oats improves germination and growth before frost. When oats are allowed to grow for 8 to 10 weeks before a killing frost, they can retain up to 75 pounds of N per acre (1). Because oats winter-kill they are not a problem in the spring for no till or minimum tillage systems.

Another cover crop that is excellent at recycling N is oilseed radish (Raphanus sativus). Oilseed radish planted before September 1 can recycle 60 to 75 pounds of N per acre (2,3). Oilseed radish is a fast growing, non-legume broadleaf that will reduce winter annual weeds. It winter-kills in Michigan and is easy to manage in the spring.

Cereal rye is the best cool-season grass for capturing excess N. Because rye over-winters it can hold 25 to 50 pounds of nitrogen in the spring (4). It germinates at temperatures as

Photo courtesy Natalie Rector

A rye cover crop seeded into corn stalks in the fall. The goal is not yield per acre, but rather nutrient recovery and environmental protection.
The goal is not yield per acre but nutrient recovery and environmental protection per acre. For more information on cover crops and slurry seeding, visit <http://www.animalagteam.msu.edu or www.covercrops.msu.edu>.

References


Even if only 40 pounds per acre of nitrogen are retained by cover crops, spring fertilizer costs can be reduced by $25 per acre.

Natalie Rector is a frequent contributor to The Scoop on Animal Agriculture and the Environment, a semi-monthly electronic newsletter aimed at helping livestock and crop farmers use manure nutrients to their fullest. To subscribe to The Scoop, send an email to stuever@msu.edu.
Progressive Planning for the MAEAP Livestock System: Livestock*A*Syst

MAEAP’s special initiative to work with small- and medium-sized livestock operations, Progressive Planning, has introduced Livestock*A*Syst to help dairy producers and others more consistently and precisely evaluate environmental risks in their farms, develop a plan to address them, and move along the path toward environmental assurance. Many participating producers have voluntarily made changes in their operations and have reported their implemented practices.

Jan Wilford
Michigan Dept. of Agriculture

The Michigan Agriculture Environmental Assurance Program (MAEAP) provides an excellent opportunity for Michigan farmers to proactively and voluntarily manage their farms for the protection and enhancement of soil and water resources. For livestock producers, the ultimate accomplishment in MAEAP is Livestock System Verification. Verification is awarded after an independent farm inspection following the producer’s implementation of a Comprehensive Nutrient Management Plan (CNMP) which incorporates MAEAP approved components. Some MAEAP producers may elect to immediately pursue completion of a CNMP and verification; however, many producers find that smaller, more progressive steps in environmental improvement are more economical and practical for their circumstances.

A Progressive Approach

The MAEAP Livestock*A*Syst (Progressive Planning) approach to environmental assurance is designed to meet the needs of those producers who are not yet ready, able, or interested in implementing a CNMP and receiving MAEAP Livestock System Verification.

The Livestock*A*Syst is a series of risk questions and answers about livestock management practices reflecting components of a CNMP and including all the elements of the Right to Farm (RTF) Manure Generally Accepted Agricultural and Management Practices (GAAMPs) Manure Management System Plan. Producers can work one-on-one with a non-regulatory MAEAP partner to identify potential environmental risks and to develop a confidential Livestock Action Plan to reduce those risks. The action plan is the producer’s plan and can be completed at his or her own pace. There is no deadline.

As progress is made, MAEAP provides recognition of the producer’s efforts to be an environmental steward through program promotion and local contacts. Complete implementation of the Livestock Action Plan prepares the producer for the development of a CNMP and for MAEAP Livestock System Verification, if those are the producer’s goals. Progressive Planning allows participating owners of small- and medium-sized farms to enjoy the piece of mind of knowing that their practices are in conformance with the RTF Siting and Manure GAAMPs and that they are working to comply with environmental laws.

How does Livestock*A*Syst Work?

The environmental risk questions in Livestock*A*Syst are grouped into seven different sections. Producers select all sections relevant to their farm. Not all risk questions will apply to all livestock farms. These risk areas are in both the original Progressive Planning Program and the revised Progressive Planning Program. In the revised version, the narrative guidance is transformed into concise risk questions with low, medium and high risk practices identified. The risk areas are:

1. Whole Farm Nutrient Balance
2. Farm Site Review
3. Manure Spreading Plan
4. Conservation Practices on fields used for manure application
5. Emergency Plan and Employee Training
6. Mortality Management and Veterinary Waste Disposal
7. Odor Management

Producers answer each risk question by selecting the statement that best describes conditions on their farm for that area. Risk levels are ranked as High, Medium, and Low Risk. Some questions are coded to indicate conformance with a RTF GAAMP practice or violation of state law. Figure 1 is a sample question that shows: 1) a violation of state law, 2) a GAAMP level of operations, and, 3) a MAEAP level of operations, as identified in the program.

This sample question has only a low and high risk option from which the producer is to select. The italics in the low risk answer reflect a RTF GAAMP. The Livestock*A*Syst includes footnotes when a high risk is also a violation of state law. For each area, the producer enters the number representing their risk in the column titled “Your Risk”. The far right column indicates particular records or evidence required for MAEAP Progressive Planning Verification.

After completing each section, producers list, in the Livestock Action Plan, the practices that present a high risk of contaminating water resources. The plan is printed inside the front cover of the bulletin. Medium risks that do not meet MAEAP Progressive Planning verification requirements are also included.

Finally, in the Livestock Action Plan, producers list alternative practices, structures or equipment that are planned and
which will reduce risks. A target date (selected by the producers) for accomplishing the planned changes is included.

Confidential Assistance

Participating farmers are offered confidential, one-on-one guidance through the Progressive Planning process via “Local Coordinators” who are members of MAEAP’s non-regulatory partner organizations including Michigan Farm Bureau, Local Conservation Districts, Michigan State University Extension, and Michigan Milk Producers Association (MMPA). Producers may select the organization with which he or she would prefer to work.

Local Coordinators are available to assist producers in a variety of ways including:

- Providing guidance through the Livestock*A*Syst.
- Understanding MAEAP and other environmental expectations.
- Identifying farm specific areas of concern and opportunity related to environmental stewardship.
- Setting farm-specific goals, timelines, and plans for improving and sustaining good environmental stewardship.
- Identifying the appropriate resource persons for assisting in the completion of specific steps in the Progressive Planning process.

Producers can work one-on-one with a non-regulatory MAEAP partner to identify potential environmental risks and to develop a confidential Livestock Action Plan to reduce those risks.

Figure 1. Sample question taken from the “Direct Discharge to Surface Water or Groundwater” Section of the Livestock*A*Syst.

<table>
<thead>
<tr>
<th>Risk Question</th>
<th>Low Risk - 3 (recommended)</th>
<th>Medium Risk - 2 (potential hazard)</th>
<th>High Risk - 1 (significant hazard)</th>
<th>Your Risk</th>
<th>Records or evidence for MAEAP verification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.12) Is wastewater directly discharged to a lake, drainage ditch, or stream.</td>
<td>No. Milking parlor and milkhouse wastewater is managed in a manner to prevent discharge into surface water.</td>
<td></td>
<td>Yes.</td>
<td></td>
<td>No discharge present.</td>
</tr>
</tbody>
</table>

After developing and implementing a plan to address the risks indicated by the Livestock*A*Syst, producers can contact MDA to request a farm visit by calling 517-373-9797. An MDA inspector will schedule a visit at the farmer’s convenience. When the Progressive Planning risk reduction objectives are verified as having been met, the producer will receive a letter and certificate from MDA and MAEAP. Owners of small- and medium-sized livestock farms may choose to continue with CNMP development and verification in the MAEAP Livestock System.

Sign Up

Producers can sign up for MAEAP Progressive Planning at any time by submitting a sign up form to the MDA. Forms are available from MAEAP partnering organizations or the MAEAP web site <http://www.maeap.org>. The Livestock*A*Syst booklet is available electronically at <http://www.maeap.org>, from conservation district offices, MMPA field staff, and as a MSU Extension bulletin. The booklet was produced with assistance from MAEAP partners including MMPA, the Corn Marketing Program and the Michigan Groundwater Stewardship Program.

No Obligation

Signing up does not obligate the farmer to specific changes. Farmers can progress as far as they feel comfortable or to meet individual farm goals. However, some circumstances

4 Natural Resources and Environmental Protection Act 451 of 1994, Part 31: Water Resources Protection.
such as CAFO designations, some EQIP requirements, and Michigan Department of Environmental Quality enforcement actions require farms to implement a CNMP and/or other farm practice changes in a more prompt manner than Progressive Planning was intended to facilitate.

Results

The results achieved to date via the Progressive Planning approach are summarized in the list below. The reporting reveals an impressive number of farmers, acres involved and discharge risks eliminated. Still, while many are involved, the number of participating farms remains small relative to possible participants. For example, over 2400 dairy farms in Michigan are eligible for Progressive Planning. Many would benefit from involvement. MAEAP’s objective is to increase livestock producer participation and to reduce negative environmental risks and impacts of Michigan livestock production.

The Environmental Practice Changes within MAEAP Progressive Planning system for 2007 are summarized below.

- 288 small- and medium-sized farms submitted surveys which examined their progress in MAEAP Progressive Planning.
- Almost 150,000 acres were involved in MAEAP Progressive Planning.
- Dairy farms represented the largest participation with 242 farms, 84% of the total.
- 25% of the small- and medium-sized farms involved eliminated a direct discharge. A total of 97 direct discharges were eliminated on 66 farms.
- A total of 82 high risks of a discharge were eliminated.
- Almost 270 changes were made to achieve nutrient sustainability, including adding additional acres, reducing animal numbers, moving to higher yield crops, changing crop rotations and reducing phosphorus in the feed rations.
- 65% of involved farms adopted or modified their soil testing regimen.
- Almost two-thirds of involved farms reduced commercial fertilizer applications and developed record keeping systems. Over 50% adopted the Right to Farm phosphorus guidance.
- Almost 500 conservation practices were implemented including site specific field evaluations, mapping sensitive areas, planting cover crops, changing tillage practices, installing buffers and evaluating fields for the appropriateness of winter manure application.
- Almost 70% of all participants modified their mortality management practices to include timely disposal.
- Almost 60% developed a plan to enhance relations with neighbors related to manure application and odor management.
- At least one-fourth of the farms have implemented an Emergency Action Plan.

For More Information

Specific information related to the Livestock*A*Syst and the MAEAP Livestock System can be found at <http://www.maeap.org> or by calling the MAEAP office at 517-373-9797.

Field evaluations are an important part of the MAEAP verification process. Here, MMPA Member Representative Supervisor Dale Ledebuhr and MMPA Member Representative Gary Best work on a field evaluation.

Photo courtesy Jan Wilford
Herd Health

BVD-PI Eradication: Unintended Consequences

Bovine Virus Diarrhea (BVD) is a costly viral disease that can inhibit conception and the immune system and cause abortions, birth defects, and pneumonia. A ground-breaking effort to eradicate BVD from Michigan’s Upper Peninsula is currently underway. While the 3-year study is far from over, some lessons already have been learned, and progress is reported here.

Ben Bartlett
Extension Dairy Educator
Upper Peninsula

Dan Grooms
Dept. of Large Animal Clinical Sciences

Bovine Virus Diarrhea (BVD) is the most costly viral disease in US cattle herds, costing an estimated 2 billion dollars per year. The disease can inhibit conception, cause abortions and birth defects, cause pneumonia, and inhibit the immune system making cattle more susceptible to other diseases. Because BVD can infect the unborn fetus before it has developed an immune system, calves are sometimes born persistently infected (PI) with the BVD virus. While not all PI calves survive, some calves are born looking completely normal and are shedding large amounts of BVD virus in all their secretions for their entire lives. These PI animals serve as a BVD disease reservoir, a “typhoid Mary”, and make controlling the disease very difficult.

The dairy and beef cattle producers of Michigan’s Upper Peninsula are cooperating with MSU (College of Veterinary Medicine, Diagnostic Center for Population and Animal Health, and UP Extension) and Pfizer Animal Health for the next 3 years in a program to identify and eliminate all animals persistently infected with Bovine Virus Diarrhea (BVD-PI). This project will be the first time in the US that an entire geographical region will have tried to eliminate all BVD-PI cattle. The Upper Peninsula is ideal for this project because it is an isolated geographic region, has a variety of large and small herds, and most cattle movement is out of the UP.

Here is a short overview of the eradication program. After informational meetings in December 2007, a number of meetings were held across the UP for producers to come in and sign up for the BVD-PI eradication program. We talked one-on-one with each producer to get general background information and to create a testing program that would cover all cattle on each farm, but be as easy as possible for each farm to implement. Each producer will collect an ear notch and deliver those samples to a local MSU Extension offices which will then ship samples to the MSU diagnostic laboratory.

The expected outcomes of this BVD-PI eradication project will be an increase in general herd health in the hopefully few herds that have PI cattle and the assurance that a herd is BVD-PI-free in herds that test negative. We also hope that over time, the tested negative status of UP herds will add value to the animals when sold as feeders or replacements.

While the program is just beginning, as with any program there are always “unintended consequences,” or things that have occurred that were not expected. Here are some anecdotal events worth noting.

In one region, a producer asked for a meeting be held in an area with few producers. All but one cattle producer was in attendance to sign up for the program and the producer sent someone to look for the person who was missing. This producer understood the value of having the entire neighborhood involved and went the extra mile to make it happen.

One producer couldn’t wait for us to start testing after hearing the symptoms of BVD-PI infected herds. His fears were correct when he identified an infected dam and daughter in his medium-sized operation. When we discussed the eradication program, it was obvious that, while the current testing program had found two positive cattle, it was not adequate to screen his entire herd. The lesson learned was that a testing program needs to be carefully planned to screen the entire herd in a timely manner.

The phone call that really told us we had made an impact was when a fellow in a very remote part of the UP called and said he needed to get his two cows tested so he could take them to his neighbor’s for breeding. People are concerned about biosecurity.

The BVD-PI eradication effort will be analyzed to assess its impact as the program progresses. Currently, 152 herds have signed up for the program, representing about 11,008 cattle with 94 farms submitting 3,709 samples for testing so far. It is evident through the “unintended consequences” that this BVD-PI eradication program already has made significant impact on many cattle operations across Michigan’s Upper Peninsula, even before a positive BVD-PI sample has been identified.

The expected outcomes of this BVD-PI eradication project will be an increase in general herd health in the hopefully few herds that have PI cattle and the assurance that a herd is BVD-PI free in herds that test negative.
New Horizons in Johne’s Disease Control: Summary of Talks Presented at the Conference

In April, top scientists from around the country gathered at Michigan State University for a 3-day research conference on Johne’s Disease (JD). They shared results from their studies and talked about future research and educational needs and courses of action. In conjunction with this conference, a single-day educational conference, “New Horizons in Johne’s Disease Control: Integrating Cutting Edge Research into On-Farm Practice” was held simultaneously to draw upon some of the presenting scientists to speak on topics of a more applied nature. Over 90 veterinarians, dairy industry personnel, and dairy producers attended. Here are summaries of some of those presentations. The full proceedings are available on the web at <http://www.jdip.org>.

Phil Durst
Extension Dairy Educator
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Dan Grooms
Dept. of Large Animal Clinical Sciences

Best Management Practices for Control of Johne’s Disease (JD).
Scott Wells and C. Ferrouillet, University of Minnesota.

The authors assessed the results when commercial dairy producers implemented recommended practices for Johne’s control in their farms. They asked the questions; “How effective are these practices for the control of JD?” and “What are the best control strategies for use in dairy herds?”

They stated that while testing and culling of positive cattle and, in some states, vaccination have their place and are beneficial, management to protect vulnerable calves from exposure to the bacteria that cause the disease is the most important tool to control JD.

As in Michigan, Minnesota has been involved with a herd demonstration project for 5 years. Six Minnesota herds were involved. These herds had a risk assessment done at the start of the project, with a risk score calculated. The farm owners could decide what control practices they would implement. Annual testing using both serum ELISA and fecal culture provided a means to measure progress. Over the 5 years of the study, the prevalence of JD within the herds decreased as indicated by both serum ELISA (from 8% down to 3.1% of cows) and by fecal culture (from 10% down to 5.6% of cows).

In addition, producers throughout Minnesota have enrolled in the Minnesota Voluntary JD Control Program. Surveys showed that these producers effectively reduce their risk score by changing their practices during their first 2 years in the program and then level off in their risk control. Over that same period, the prevalence of cattle testing positive by serum ELISA test decreased for the first 4 years, but increased in year 5. This further indicates the necessity of continued effort in the control of JD.

They concluded that implementing risk control practices (see box on page 17 for a list of some recommended practices to control Johne’s Disease on the farm) does indeed reduce the rate of JD within herds by reducing the number of new infections. However, even over a 5-year period, the disease was not eradicated in any of these herds. It will take more time and a continued commitment to maintain tight JD control practices and ceasing purchase of cattle from herds of unknown Johne’s status, to eliminate the disease.

Consensus Recommendations on Diagnostic Testing for Johne’s Disease (paratuberculosis) in the U.S.
Michael Collins, University of Wisconsin.

A review was undertaken by a team of experienced veterinarians in the field of Johne’s Disease to define the best course of action regarding testing for JD in dairy and beef herds based on business type, infection status and prevalence. However, even in doing so, they first acknowledged that producers should focus on management as the primary means of JD control with testing used as a secondary tool to further manage the disease.

They looked at available testing options and based their work on the accepted sensitivity and specificity of each of those tests. They also recognized that there are various purposes for testing. These include classifying a herd as infected, controlling the disease, surveillance, eradication and confirming the disease in herds with no prior confirmed JD cases and in herds that are known to be infected. Because each test has strengths and weaknesses, test selection should be based on the objectives of the testing.

The principles guiding them were facts or assumptions about herd management which included:

- Only low-cost tests are sellable to producers.
- Speed of test results is over-rated – more important is having the results at the time when the producer needs to make a decision about culling or classifying as “do not breed”.
- Look at every test result quantitatively, considering that indications of the state of disease progression may be determined by response to test.
The authors prepared a table with recommendations for commercial dairy herds, seedstock dairy herds, cow-calf beef herds, and for seedstock beef herds. For instance, the recommended test to classify a commercial dairy herd as infected is a pooled environmental culture, whereas the recommended test to control disease in the same herd is the ELISA. To confirm a clinical diagnosis of JD in a herd with no prior confirmed cases they recommend a necropsy of animals that die or can be sacrificed, or fecal culture or polymerase chain reaction testing of others.

The full table and explanation is included in the proceedings on the Internet at <http://www.jdip.org>.

**MAP Super-shedders: A New Paradigm Shift in Johne’s Disease.**

*Robert Whitlock, University of Pennsylvania.*

Having previously defined JD-infected cows that are super-shedders of the bacteria, and knowing that the risk of exposure to bacteria by herdmates on the farm is high, a team working with Dr. Whitlock tested the hypothesis that some cows may ingest the bacteria *Mycobacterium avium paratuberculosis* (MAP) and subsequently excrete it without becoming infected. By excreting the bacteria as pass-through bacteria, they risk being identified as infected animals when they, according to the hypothesis, are only passive shedders of the organism.

To test their hypothesis, they tested almost 2300 fecal cultures from 556 cows in three herds in three states. Seventy-eight of those cows were culture positive for an apparent prevalence rate of 3.5%. Bacteria in cultures from manure samples are measured as colony forming units (cfu) of MAP per gram (gm) of fecal material. Low shedders may have 5 cfu/gm of manure, moderate shedders may have 50 cfu/gm while heavy shedders may have 500 cfu/gm. Supper-shedders are defined as shedding 10,000 to 10 million MAP bacteria per gram of manure.

In these three herds with a fairly low apparent prevalence of JD, 15 cows (some from each herd) of the 78 culture positive cows (19%) were defined as super-shedders. A single super-shedder cow puts out bacteria approximately equivalent to 7 clinical cases or 160 heavy shedders, or over 2000 moderate shedders or almost 24,000 low shedders. These cows account for tremendous numbers of bacteria in the barn environment.

It is evident that super-shedders do exist and play an important role in the epidemiology and control of JD. These few animals put many other animals on the farm at risk of infection. Therefore, identifying and eliminating super-shedders is important in controlling the transmission of JD.

**Diagnostics and Strain Differentiation of Mycobacterium avium paratuberculosis: Current Tools and Challenges.**

*Srinand Sreevatsan, University of Minnesota.*

The current tests for Johne’s Disease are valuable but limited. They are limited in their sensitivity, ability to detect subclinically infected animals, determine the stage of the disease and to specifically identify differences in the strain of the bacteria causing the disease.

However, scientific advances including the recent characterization of the complete genome sequence of a cattle isolate of *Mycobacterium avium paratuberculosis* (MAP) allow researchers to continue to seek ways to overcome those limitations with new tests and new means of identification.

The immune reaction within an animal in response to an infection has a progression that is well-defined. Research is being conducted to identify bio-markers that could help to pinpoint the state of the disease. Bio-markers also may serve as tools in the development of therapeutics, determining response to therapy and predicting prognosis. The technologies used in bio-marker discovery include traditional in vitro analysis of DNA variation (disease susceptibility), circulating DNA or RNA (disease progression and prognosis), RNA expression (disease induced alterations), protein expression (disease progression), and metabolite quantification.

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**Some recommended practices to control Johne’s Disease on the farm.**

- Calve cows in clean, dry pens with as little exposure to the manure of cows as possible.
- Remove calves from dam before they begin sucking.
- Feed colostrum from a Johne’s test-negative dam.
- Isolate calves from manure of cows in regard to where they are housed, cleanliness of caretakers, and movement of manure with equipment.
- Don’t pool waste milk for calves as any cow shedding the bacteria that causes Johne’s can then infect the whole group of calves.
- Keep feed for heifers less than 1 year of age isolated from cow manure through clean equipment handling, controlling runoff, and not feeding cow feed refusals to young animals.
- Remove cows with clinical Johne’s Disease from the herd as soon as possible.
Similarly, researchers are working at distinguishing between strains of the MAP organism. Measuring the genetic diversity within a population is of particular importance for bacterial pathogens as it can result in differences in virulence, antibiotic susceptibility and other phenotypes important for the treatment and control of infectious diseases. Work on the MAP bacteria will have application to other bacterial diseases. Sreevatsan’s study is also looking at Crohn’s disease to see if there is a particular group of MAP strains that may be involved in this disease. Strain-specific differences may hold the key to understanding and, therefore, improved management of disease.

Vaccines against Johne’s Disease and Mycobacterium avium subspecies paratuberculosis (MAP): An Introduction and Update.
Paul Coussens, Michigan State University.
There is one vaccine for Johne’s Disease (JD) currently on the market in the US. It is not approved for use in Michigan due to the cross-reactivity with testing for bovine tuberculosis. In addition, it apparently does not protect against cattle becoming infected, rather it seems that it does work in reducing clinical signs of the disease and reducing the shed of bacteria.

The purpose of vaccination is to “educate” the immune system and prepare it for a rapid and strong response to live pathogens. Given the cost and widespread nature of JD, there is a desire to develop a vaccine that would overcome many of the current challenges associated with vaccinating against this disease.

The immune system is amazing, complex and effective in many ways. However, the MAP bacteria, in effect, highjack the immune system and use it to hide and disrupt the response to its invasion. New vaccine types that have the promise of overcoming the challenges this bacteria present are being studied. The process of developing those potential vaccines takes time and money. Vaccine candidates are selected from in vitro studies. Then certain ones are evaluated in mice. The field is narrowed and tried in baby goats before the best 2-3 mutants are evaluated in calves.

JDIP, the Johne’s Disease Integrated Program, funds promising research in this and other areas reported on at the conference.

The Future of Johne’s Disease Control in the US.
Ken Olson, JDIP Outreach Coordinator.
In 2004, a 5-year strategic plan was developed and approved to target funds available for JD research and outreach. Since then, there has been much success in creating awareness by producers and getting many to start control practices. However, participation nationally in JD control or certification programs has been low. In addition, federal funding has decreased significantly.

The US Animal Health Association Johne’s Disease Committee established a new Strategic Planning Committee and charged them to develop a new plan. They have done so and now have a draft Strategic Plan available for comment. Their intention is to consider comments made now and to present a recommended plan at the 2008 USAHA Annual Meeting in October.

The proposed Strategic Plan is different in several ways from the previous with these main points:

- Move from a primarily federal/state program to a more public/private partnership.
- Simplify the herd classification system while continuing to provide recognition to low-risk herds.
- Focus education efforts on those who can help producers manage, control and prevent JD (e.g., veterinarians).
- Focus research on control and prevention of JD with the highest priorities given to work on diagnostics, effective control strategies and vaccines.

Input is being sought relative to the goals, measures and strategies of the proposed plan and will be used to design a program that will work for producers under current conditions.

Conclusion
Johne’s Disease is a critical concern impacting the future profitability and potentially market access for the dairy and beef industries. Management of the disease requires knowledgeable industry professionals and producers and a dedicated effort on all farms to reduce risk and to control the spread of this disease. Researchers and Extension at MSU and in other states are working to help meet those goals.

For more information see:
<http://www.jdip.org>
<http://www.johnes.org>
<http://old.cvm.msu.edu/extension/johnes/>
Get Some Culture: Eat Yogurt

Zeynep Ustunol
Dept. of Food Science and Human Nutrition

With annual retail sales in the neighborhood of $4.8 billion, cultured dairy products, and yogurt in particular, are currently driving the growth of dairy foods consumption in the U.S. (1). Origins of yogurt are uncertain. It is often reported that when goats were first domesticated in Mesopotamia about 5000 B.C. nomadic tribes stored milk in goat skin bags for transportation later to find the milk converted to a custard like product by natural wild bacteria (2). Yogurt was introduced to the U.S. market by Dannon Company in the 1940s and initially was sold as diet food. To enhance consumer acceptance strawberries and other fruit purees and preserves were added to decrease tartness. Yogurt later was accepted as dessert. The image of yogurt has changed dramatically in North America over the years. In the 1970s yogurt in its many forms became a snack and a convenience food. Today, there are more than 50 different products that are found in the dairy case at the grocery store in a variety of packages and flavors ranging from blueberry-cheese cake to lemon-meringue and mocha, yogurt with blended fruit, fruit on the bottom, go-gurt, whipped yogurt, yogurt drinks, yogurts with topping and add-ins. These hardly look like an ancient food of the nomadic tribes.

Yogurt is a fermented product resulting from fermentation of milk and/or mixture of milk and cream with the lactic acid bacteria, Lactobacillus bulgaricus and Streptococcus thermophilus. These microorganisms convert lactose to lactic acid, which provides for the unique flavor of yogurt. Due to the decrease in pH the protein structure also is altered to form a delicate gel. Other types of cultures such as Lactobacillus acidophilus and bifidobacteria are also added to most yogurts due to the data accumulating on the health benefits of ingesting probiotics. The term probiotic although not legally defined in many countries refers to ‘microbial preparations that when ingested exert a positive influence on host health and physiology’ (3). Today, Lactobacilli and bifidobacteria are the primary probiotics used in fermented dairy foods such as yogurt and dietary supplements. Yogurt contains no less than 3.25 percent milkfat and 8.25 percent solids not fat. However, it is also available in a variety of fat levels, including nonfat and lowfat; ‘light’ or reduced calorie forms sweetened with aspartame and various beverage forms. There are no standards of identity for frozen yogurt products.

Yogurt has enjoyed a centuries-old reputation as a health food. A one-cup (8 oz) serving contains 30 – 40% of your daily calcium needs, plus about 9 grams of high quality protein (approximately 20 % of the daily recommended value) and is an excellent source of potassium, phosphorus, magnesium, zinc and vitamins B2 (riboflavin), B3 (niacin), B6 and B12. Beyond these important nutrition basics the live and active cultures found in yogurt are thought to provide additional health benefits.

It may have all started with Eli Metchnikoff (1845-1916) who first published his observations on lactic acid bacteria, digestive tract and the aging process. In his book ‘Prolongation of Life- Optimistic Studies’ published in 1907 Eli Metchnikoff wrote that consumption of fermented dairy products produced by lactic acid bacteria provided for improved health and longer life (4). Today, an increasing number of health foods, functional foods, and pharmaceutical preparations are promoted with health claims based on the probiotic characteristic of some of these bacteria. Gastrointestinal (GI) microflora play a widely accepted and important role in the health of the host and possess immunomodulating capacity. Probiotic ingestion is thought to alter the GI microflora by providing bacterial cells to the gut ecosystem and has been suggested as potential candidates for immune modulation (5). Dairy products such as yogurt are considered excellent carriers of probiotic organisms. Various studies have been conducted on the effect of probiotic bacteria on immune function. Improvement of the immune system due to probiotics have been attributed to strengthening of non-specific defenses against infection, increased phagocytic activity of white blood cells, increase in IgA production, proliferation of intra-epithelial lymphocytes, adjuvant effect in antigen-specific immune responses, and regulation of Th1/Th2 balance (6). However, clear mechanistic data are still lacking. With fermented dairy products, the metabolites produced by the fermentation process also may exert immunomodulatory activity.

Upon ingestion of a product such as yogurt, probiotics remain in transit in the GI system for a variable length of time, and it is commonly believed that the probiotic effects are more likely to occur if the bacteria remain alive for as long as possible and are present in a sufficiently large quantity in the GI tract. Thus, the National Yogurt Association has established criteria for live and active culture yogurt in conjunction with its ‘Live and Active Cultures’ seal program. For manufacturers to carry the ‘Live and Active Cultures’ seal, refrigerated

see Yogurt on page 23
MSU Takes Top Honors at National Dairy Challenge

Miriam Weber Nielsen
Dept. of Animal Science

Michigan State University undergraduates with an interest in dairy competed in three Dairy Challenge contests during the winter and spring, culminating in a win for MSU at the 7th annual North American Intercollegiate Dairy Challenge (NAIDC) in Madison, Wisconsin on April 4-5, 2008. The students at freshman through senior levels combined their skills, knowledge and passion for dairy to work together on teams to evaluate dairy farm management.

In addition to MSU, the University of Minnesota, the University of Illinois and Purdue University each won platinum awards at this year’s national contest as Big 10 universities took home first-place finishes in each farm division. Members of the first place teams each received a $200 scholarship.

Members of the team representing MSU were animal science juniors Christine Hadley, of Niles; Ashley Messing, Bad Axe; and Laura Zeldenrust, Fremont; and animal science senior Andrew Reinker, Horton. The team was coached by MSU animal science professors Herb Bucholtz and Miriam Weber Nielsen, animal science doctoral student Marcus Hollmann and agricultural economics doctoral student Nicole Olynk. Hosted by the University of Wisconsin–Madison, this year’s competition attracted a record 32 teams representing dairy-related programs at universities across the United States and Canada.

All undergraduates with an interest in dairy are invited and encouraged to participate in the MSU Dairy Challenge in the fall. Participants in the MSU Dairy Challenge are invited to attend the Midwest Regional Dairy Challenge. The 4-person team to compete in the NAIDC is selected by the judges of the MSU Dairy Challenge.

The innovative competition tests students’ skills and knowledge of all aspects of a dairy business in an interactive, educational and challenging event. It encourages students to apply theory and learning to a real-world dairy farm, while working as part of a team.

Day 1 of the Dairy Challenge begins with each team receiving selected farm records and then walking through the farm operation. After the farm visit, each team has the opportunity to interview the farm manager. Then, each team completes a farm analysis and develops a presentation with recommendations for herd management. Day 2 is presentation day, when teams present their recommendations to a panel of judges. Students field questions from the judges, and then receive oral feedback from the judges on their presentation. Presentations are evaluated by the judges, and the day concludes with placing of the teams and presentation of awards.

Twenty-five undergraduates participated in the MSU Dairy Challenge last fall, which featured an advanced division for students who have taken courses in dairy nutrition or advanced dairy management, and a new novice division. The contest farm was owned by Harry, Gene and Gary Sanborn in Hubbardston. The winning undergraduate team in the advanced division received $200 each and consisted of Ashley Messing, Matt Freechack (animal science senior, Eden Prairie, Minnesota), and Kimberly Sabo (animal science senior, Eastpointe). The second-place team received $100 each and was comprised of Laura Zeldenrust, Christine Hadley, and Kimberly Aebig (animal science senior, Montague).The team placing third and receiving $50 each was Kayla Kreh (animal science junior, Kinde), Andrew Reinker and Amanda Vlietstra (animal science senior, Kalamazoo). The winning teams in the novice division received gift cards: 1st place, $100 each—Gail Carpenter (animal science junior, Dansville), Jenna Kramer (dairy management freshman, Harbor Beach), Nick Leipprandt (dairy management freshman, Caseville), and Benjamin Wenner (animal science and agribusiness management sophomore, Ohio); 2nd place, $50 each—Nicole Beeching (animal science junior, Lawrence), Lindsey First (animal science junior, Ionia), Autumn Sieffert (agribusiness management junior, Grawn), and Jenna Taylor (dairy management freshman, Stockbridge); 3rd place, $25 each—Eric Carson (dairy management freshman, Hesperia), Charles Hood (dairy management freshman, Paw Paw), Bill Huisjen (dairy management freshman, Fremont), and Adam Lewis (dairy management freshman, Jonesville); 4th place—Krista Beeker (animal science sophomore, Constantine), Baylee Drown (animal science junior, Cedar Springs), Courtney Huff (animal science senior, North Branch), and Kayla Stomack (animal science junior, Minden City).

Fourteen students represented MSU at the Midwest Regional Dairy Challenge January 31 – February 2, 2008 in Merrillville, Indiana. The regional Dairy Challenge events mix students from different schools on 5-person teams to focus on development of skills in teamwork in addition to dairy management. Participants from MSU included Nicole Beeching, Andre Bruinsma (dairy management sophomore, Morenci), Brad Curtis (agribusiness management senior, Williamston), Johan deGroot (dairy management sophomore, Indiana), Lindsey First, Christine Hadley, Rebecca Hale (dairy management sophomore, Fowler), Kayla Kreh, Joe Pasch (animal science sophomore, Weidman), Kayla Stomack, Katelyn Thompson.
Bucholtz Retires after 36 Years

This summer, after 36 years of working with Michigan’s dairy producers and scholars, Herb Bucholtz retired from Michigan State University. Herb came to Michigan as a graduate student in 1968. Four years later, he assumed his first professorship at Michigan State University, the institution at which he would remain until his retirement. Over the last three and one-half decades Herb has proven himself to be a committed proponent of dairy, consistently making the connections and sharing the knowledge that strengthen our industry.

“Herb’s belief in education extends past the dairy farmer of today to include the dairy farmer of tomorrow,” said Karen Plaut, chair of the MSU Department of Animal Science. “He has never been worried about what credit he will get or from whom he will receive recognition for his work. His goals are simply to develop our Michigan dairy farmers and he has truly made a difference in students’ lives and to many careers in the dairy industry.”

There are several standout accomplishments from Herb’s productive career that typify his impact on dairy Extension education of professional dairy nutritionists and farmers in the U.S. and Michigan. Firstly, he has been a key leader, pusher, facilitator, and contributor of the Spartan Dairy Ration Evaluator software series. He has been instrumental in each version of Spartan, from Spartan 1 in the mid-1980s to Spartan 3.0, now in development. Herb has been the main interface and facilitator in the field with users of the program worldwide and his contributions have made Spartan 3.0 a user-friendly tool for dairy producers and professional nutritionists. Secondly, Bucholtz is one of the founding fathers (along with M. Eastridge and T. Johnson) of the Tri-State Dairy Nutrition Conference, perhaps the preeminent conference of its kind in the U.S. today. This Conference attracts professional nutritionists and the most progressive and innovative dairy producers from across the U.S. and several foreign countries each spring. Finally, in the most recent years Herb has been a key leader, facilitator of and presenter in the MSU Dairy Nutrition Roundtables. This program, held in December each year at several sites in Michigan, aims to bring the latest in research and “hot topics” to about 50 professional nutritionists working in Michigan. Typically these meetings are dairy nutritionists responsible for providing feed supplements, ration formulations, and feeding management programs for about 2/3rds of the dairy cows in Michigan. These three signal accomplishments signify the importance and impact that Herbert F. Bucholtz has had on dairy Extension programming during his career. It is truly outstanding.

On the lighter side, Herb is fondly known as the consummate Extension Specialist who can take a single overhead and present an action-packed, day-long Dairy Nutrition Short Course to a room full of attentive dairy farmers, looking to enhance nutrition and feeding programs of their herds. With self-deprecating humor, he can dispel any notion that his ideas are those of an out-of-touch ivory-tower professor. Herb has a knack for putting things in practical down-to-earth terms. Perhaps one reason he is so good at this is because he has a great deal of practical experience as a former dairy farmer and dairy farmers can sense that he knows what it is like to be in their boots. On the serious side, Professor Bucholtz’s numerous impacts on the dairy industry in the U.S. and especially in the Tri-State region (Michigan, Indiana, and Ohio) and in Michigan during his 36-year career have been immense.

Herb Bucholtz has made significant contributions to Michigan’s dairy industry as a Professor of Animal Science and Extension Specialist. He recently retired after 36 years.

Photos courtesy Lindsey DeVries and Bill Robb
The Dairy Title of the 2008 Farm Bill

Christopher Wolf
Dept. of Agricultural, Food, and Resource Economics

The 2008 Farm Bill was more of the same in many respects. However, several changes may have direct effects for dairy farmers. Firstly, the Milk Price Support Program was continued but renamed the Dairy Product Price Support Program. Secondly, dairy imports are to pay check-offs for generic advertising. Thirdly, the US Department of Agriculture (USDA) is required to expedite the process of amending Federal Milk Marketing Orders. And finally, the Milk Income Loss Contract (MILC) program remains with the eligible milk per farm increased and a feed cost trigger now included.

Changing the name of the Price Support Program from “milk” to “dairy product” reflects what the program actually does as it is an open offer to purchase cheese, butter and nonfat dry milk. The intention has been that keeping these products above a certain level will translate back to a floor on the farm milk price (set at $9.90/cwt for the last several years). When the last World Trade Organization agreement was set in 1994, the Milk Price Support Program was rated at an enormous $5 billion of support. That value turned out to be much larger than the actual support as the US milk price determined by market forces has been above support for most of the period since. This name change may actually affect trade agreements in a positive way by lowering the calculated effective support level in future agreements although the exact result is unknown at this time. The program also has trigger net removal levels for cheese, butter and nonfat dry milk that result in product price support reductions. However, the current price climate is such that the support prices are below cost of production and therefore likely irrelevant.

Having imported dairy products pay a 7.5 cent/cwt assessment means that they will pay half of the 15 cent/cwt assessment that domestic production pays. This change was in response to the allegation that imports were free-riding on domestic dairy promotion efforts. The result will be to make imports marginally more expensive and is likely to be of concern in future trade agreements.

One of the criticisms of USDA in recent years has been the long period between proposed changes and implementing those changes sometimes taking multiple years—although if the changes were adverse to farmers then the delay may have been welcome. California, operating their own state milk marketing order, is much more efficient at ruling and implementing changes. However, to be fair, California regulators have a more uniform situation in the state than the Federal regulators do. The 2008 Farm Bill revises Order amendment procedures. Within 30 days of a request for a hearing the USDA must schedule a hearing for sometime in the next 120 days or request further information or deny the request. All post-hearing briefs must be filed within 60 days of the hearing date. The USDA must issue a recommendation within 90 days of the brief filing deadline and a final decision within 60 days of a comment deadline. The entire process could still take a year or more.

The Most Important Change

The most important change is likely to be inserting the feed cost adjuster into the Milk Income Loss Contract (MILC) program. Previously, MILC payments were triggered when the Boston Class I price was below $16.94 (equivalent to a Class I mover of $13.69). The new program uses that milk price as well as US average farm price received for corn, soybeans and hay. These prices are currently used by USDA to calculate the milk-to-feed price ratio with a representative 16 percent crude-protein dairy ration. With the feed price adjuster, payments occur when the cost of 100 pounds of feed (51 pounds of corn, 41 pounds of hay, and 8 pounds of soybeans) exceeds $7.35. Therefore, if the USDA dairy feed cost is less than or equal to $7.35, then the MILC Class I mover target price is $13.69/cwt. If the feed cost is higher than $7.35, then the percentage difference between that feed cost and $7.35 will be multiplied by 45 percent. The resulting percentage will be used to increase the target price for the month in question. For example, the May 2008 feed prices received by farmers (reported by USDA in Agricultural Prices and available online) were: corn $5.12/bu, hay $166/ton, and soybeans $12.30/bu. Using these values, the feed cost is:

\[
(5.12\,\text{bu corn})/(56\,\text{lbs/bu}) \times 51\,\text{lbs} + (166/\text{ton hay})/(2000\,\text{lbs/ton}) \times 41\,\text{lbs} + (12.30/\text{bu soybeans})/(60\,\text{lbs/bu}) \times 8 = 9.71
\]

$9.71 is 32 percent ($2.36/$7.35) above $7.35. The percentage increase in the MILC target price is 45 percent of 32 percent, or 14.4 percent. Therefore, the trigger for the Boston Class I price is increased by 14.4 percent becoming $19.38. To determine the trigger price on a Class I mover basis, the Boston Class I differential of $3.25 is subtracted from the Boston Class I price (i.e. $19.38 - $3.25 = $16.13, the Class I mover trigger). The May Class I mover was $16.62 so no payment will be triggered for that month. Feed prices for each month since December 2007 have been enough to trigger adjustments in the MILC pay price. However, the Class I movers have been high enough so that no payments would have been triggered. The outlook is for continued high feed prices so that should milk prices drop, the MILC program could be an important safety net.

Another change to the MILC program is that annual payment limits were raised from 2.4 million (about 120 cows) to 2.985 million pounds (about 150 cows) per farm. As before, payment months run consecutively once a start date for that fiscal year (beginning October 1) is picked.
Yogurt from page 19

Yogurt products must contain at least 100 million organisms per gram of product at the time of manufacture. Frozen yogurt products must contain 10 million organisms per gram at the time of manufacture. These levels are based on research involving clinical studies. To achieve and maintain an effect, the probiotic must be repeatedly administered to ensure a sufficient population level over time. In case of heat-treated yogurt, these organisms are killed due to post-fermentation heating.

Other reported health benefits of eating yogurt include aiding with lactose intolerance, helping to reduce osteoporosis, helping to combat yeast infections and providing protection against colon cancer.

So, yogurt gets the “thumbs-up” by most health professionals, parents, and kids. Given all the health benefits of yogurt you may even want to go straight for the big tubs. Okay, at least it is easier to handle and store than the goatskin bags!

References


Calendar of Events
July - October

Michigan Dairy Expo & 4-H Dairy Days
July 21-25
MSU Pavillion
East Lansing
Contact: Joe Domecq at 517-353-7855
or domecqjo@msu.edu

Lake City Experiment Station Forage & Livestock Field Day
August 23
5401 Jennings Rd
Lake City
Contact: 517-355-8401
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