The Michigan
Johne's Disease Control Demonstration Project

• Research Findings • Lessons Learned • Producers' Perspectives •

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The Michigan Johne's Disease Control Demonstration Project is a research effort spearheaded by the Michigan State University College of Veterinary Medicine and its partner organizations. Additional information can be found at http://cvm.msu.edu/johnes.

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Johne's Disease Control Demonstration Project

The Michigan Johne's Disease Control Demonstration Project is a cooperative program between the Michigan State University (MSU) College of Veterinary Medicine (CVM), Michigan State University Extension (MSUE), Michigan Department of Agriculture (MDA), and the United States Department of Agriculture (USDA). This project was part of the larger National Johne's Disease Control Demonstration Project. The objective of the project was to demonstrate and investigate management factors that are effective in controlling Johne's Disease (JD). The project goals were as follows:

- To evaluate the effectiveness of JD control strategies.
- Develop new knowledge on JD control through field research.
- Promote the Michigan Voluntary Johne's Disease Control Program.
- Develop JD education resources.

Eight Michigan dairy farms and one beef operation were enrolled in the project . The enrolled herds represented a variety of management systems. Initially, a herd risk assessment was conducted to identify areas on the operation where JD might be transmitted. Subsequently, a JD control program was developed for each individual herd. This plan was developed in cooperation with the herd owner/management, their herd veterinarian, and other appropriate personnel such as MSU Extension Livestock Educators, nutritionists, USDA veterinarians, and veterinarians from MSU. The prevalence of JD in the respective herds was tracked annually through repeated testing. Each herd's control program was reviewed annually and updated as necessary. Farms participated in the program for 4 to 7 years. Information gathered from this long term interaction was then incorporated into research and educational efforts.

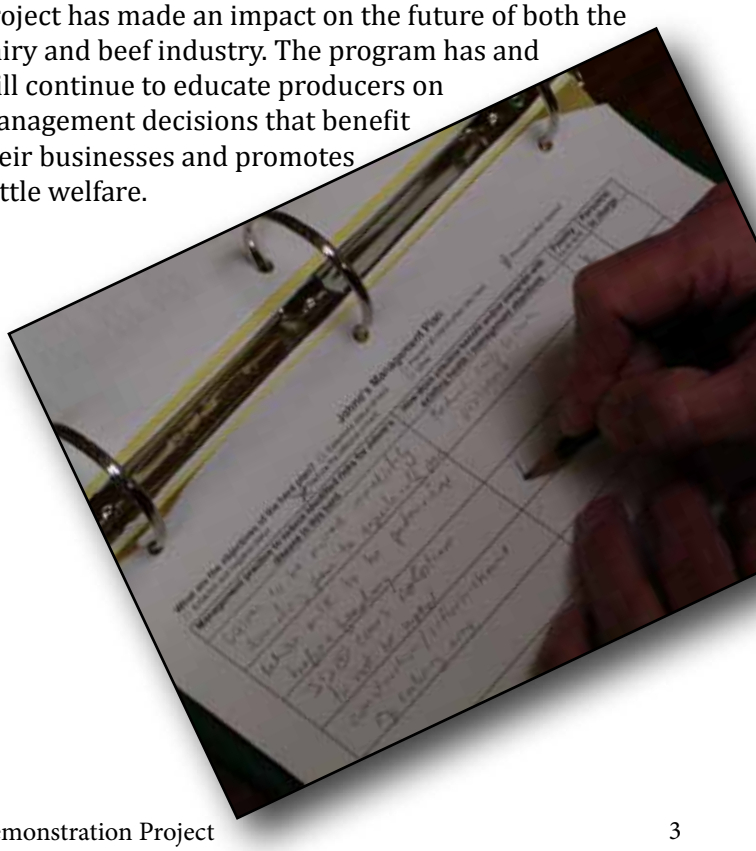
Several field based research projects were conducted to develop new knowledge on the control of JD. Results of these projects have been reported at national and international meetings and published in peer reviewed publications.

General themes for these projects have included:

- Risk and importance of calves shedding *Mycobacterium paratuberculosis*
- Role of environmental contamination in Johne's disease control
- Economic cost and benefit of Johne's disease control
- Frequency of *Mycobacterium paratuberculosis* on the skin of cows in maternity/close-up facilities
- Development of new management tools to help control Johne's disease
- Evaluation of different testing strategies

Educational objectives have also been key to the success of this project. Information from this project has been incorporated into MSU Extension meetings and field days, MSU Extension publications, including the Michigan Dairy Review and the Cattle Call, and veterinary training programs. The project, along with the USDA sponsored Johne's Disease Integrated Project, led the organization and development of the first annual "New Horizons in Johne's Disease Control" workshop in April 2008. This industry focused outreach meeting attracted industry leaders from around the Great Lakes region.

The Michigan Johne's Control Demonstration Project has made an impact on the future of both the dairy and beef industry. The program has and will continue to educate producers on management decisions that benefit their businesses and promotes cattle welfare.



Buning Dairy Farm

High Cull Rates Signal Problem with Johne's Disease

The Bunings of Falmouth, Mich. pride themselves on the high quality milk they produce and the awards they receive from their milk marketing cooperative, but their unusually high cull rate indicated they had another problem to tackle on the farm.

"We strive for high quality milk and have made some good strides over the years in that area," says Norm Buning. "But we were having issues with having to cull good cows too early. We knew we had to get to the bottom of that problem."

In January 2002, an 18-month old home-raised heifer was diagnosed with clinical Johne's disease (JD). That was the indication to the Bunings that they had a problem with the disease and the underlying cause of their high cull rate.

Working with their veterinarian, Dr. Gary Koester, the Bunings signed on to the Johne's Disease Control Demonstration Project. After the first round of testing they were able to identify positive cows and put a management plan in place to decrease the incidence of JD on their farm.

"We wanted to see if we could manage our way out of the problem rather than culling heavily," Norm says.

In 2002, the farm had a cull rate of 32 percent. JD testing conducted in 2003 showed 2 to 5 percent prevalence with occasional clinical cases in raised heifers generally older than 4 years of age.

Working with the researchers from MSU, the Bunings began making management changes to eliminate the spread of the disease. The calving area was identified as the highest area of risk for JD transmission on the farm. Individual maternity pens were used on the farm, but were not cleaned between each calving. Also, JD clinical and suspect cows were calving in the same maternity pens as test-negative cow.

Additionally, pooled colostrum was fed to all calves which placed the replacements at risk of contracting JD from the dams that were not yet identified as test-positive or negative for JD. The calving area was in close proximity to the weaned calf pen in the old basement-style barn. Other risks for disease transmission included fence line contact and a shared water source between bred heifers and dry cows on pasture during the summer months.

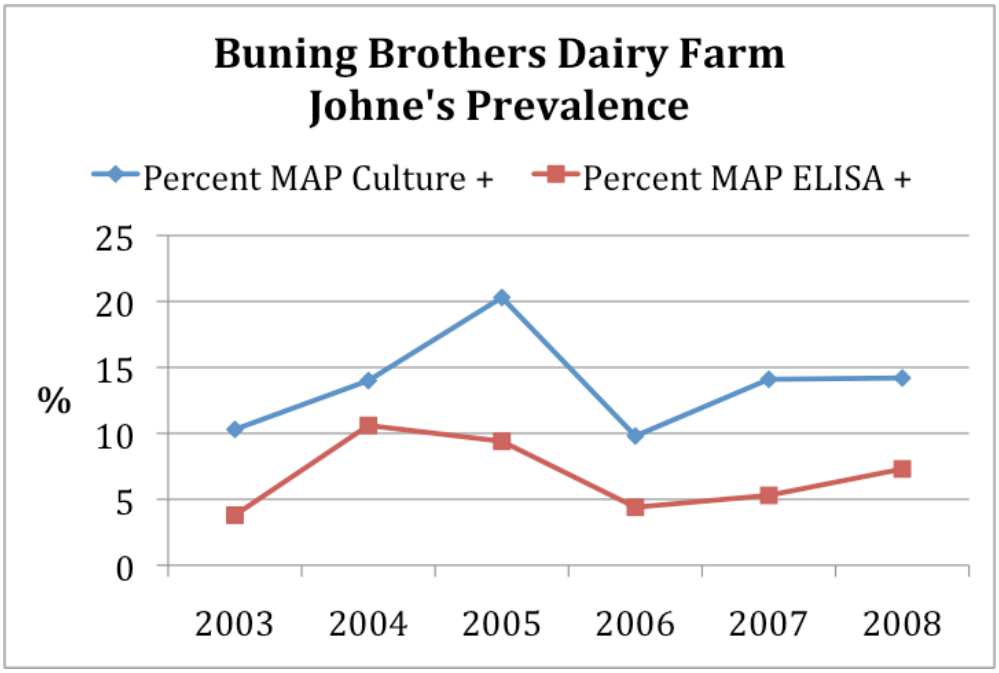
"When we started this program back in 2003 we didn't know as much about the risk factors as we do now," Norm says. "We have made a lot of changes over the past several years."

"We came to realize that Johne's is typically a management disease," Norm says. "That's hard for some people to swallow. It is more of a management problem than a cow problem. And there is a stigma attached to the disease. You don't want your neighbor to know. But we had to face it head on and make some changes."

Many of the changes the Bunings made focused on the calving area and feeding areas. By identifying JD positive cows they were able to separate the test-positive animals into a different calving area and not pool their colostrum. They also stopped feeding waste feed from the milking herd back to the heifers.

"Now that we know more about the disease we can see where it was a problem for several years," Norm says. "In the late 1990s we had a 42 percent cull rate. Looking back now we assume that our infection rate was probably as high as 20 percent at that time."

Over the span of the Johne's Disease Control Demonstration Project, the Bunings have been in an expansion mode using home grown replacements. The farm currently milks 300 cows with a rolling herd average of 28,800 pounds of milk. The prevalence of JD increased steadily over the first three years of the study before declining dramatically in 2006.



What we learned:

The introduction of JD into the Buning Dairy Farm likely began with the purchase of replacement animals in the early 1990's. Once introduced, several transmission risk factors allowed the disease to spread to young animals. These included the use of a single calving pen which was not cleaned regularly, the use of pooled colostrum and waste milk for replacement heifers, feeding of waste feed to heifers and housing of weaned calves in fence-line contact with adult cows.

One of the unique features about this farm is that newly weaned calves were housed in two group pens that were located adjacent to the calving area. *Mycobacterium paratuberculosis* (MAP) was isolated several times from both the maternity pen and the calf environment, highlighting the importance of maternity pen cleanliness and the potential for adult cows to contaminate calf environments.

Management changes have included increasing the cleanliness of the calving pens, stopping the use of pooled colostrum, and switching over to milk replacer for pre-weaned calves. Waste feed is now fed to steers that are raised on the farm for beef. Facility improvements have included a new dry-cow barn that has significantly improved cow cleanliness entering the maternity pen. Long term plans include the construction of new maternity and heifer facilities.

Lessons Learned:

✔ Purchasing animals increases risk of JD entering an operation.

✔ Cleanliness in the maternity pen is crucial for decreasing JD transmission.

✔ Housing susceptible calves near maternity pens or other adult cow housing can lead to MAP contamination of the heifer environment and transmission of JD.

✔ Feeding waste feed to non-replacement cattle is a cost effective use of this valuable resource.

Brock Dairy Farm

Small Changes Used to Tackle Large Problem

Implementing several small management changes over the past 5 years has brought the Johne's disease (JD) prevalence on the Brock Dairy farm down from nearly 14 percent in 2005 to less than 10 percent in 2009. For Steve Brock, the steady decline is just as important as totally eliminating the problem.

"Every year we see a one percent decrease in positive animals, that is encouraging because we know the management changes are working," Steve says. "Sure, you would like to see it go away overnight but that isn't going to happen unless we cull real heavy."

In 2005 when the Brocks joined the Johne's Disease Control Demonstration Project, they had a milking herd of 500 with a total of 900 head of cattle on the farm. At that time, a whole-herd test showed the prevalence of JD to be 13.5 percent. In 2006, the milking herd was reduced to 450 cows, having culled 165 head of cattle. Of those culled, 50 showed signs of clinical JD.

Through whole-herd testing and on-farm management evaluations, the MSU researchers determined the primary risk for JD transmission on this Menominee County farm was in the calving area. Through the spring, summer and fall, 70 percent of the cows calve in a five-acre pasture, which is ideal. However, a group maternity pen was used inside the barn during the winter.

Year	Number of Cows	Number of ELISA Positive	Percent ELISA Positive
2005	495	67	13.5
2006	457	52	11.4
2008	434	52	12.0
2009	486	26	9.5

Standing surface water that accumulated in the heifer and dry cow pastures was also an area of disease transmission. Culture testing of the surface waters revealed the organism that causes JD.

"We implemented a number of changes specific to the maternity area and our handling of colostrum, but really, it was nothing earth shattering," Steve says. "We are trying to eliminate as much as we can through management changes."

Management changes on this Upper Peninsula farm included using individual maternity pens in the barn during the winter and calving test-positive cows in a separate area. Colostrum is only fed from test-negative cows and a colostrum replacement is used when shortages of colostrum exist.

"Working to eliminate the presence of Johne's has impacted the overall health of the herd," Steve says. "We are seeing an overall improvement in the herd and milk

production is better. Before we started working on the Johne's problem, our cows were leaving faster than they should."

To prevent the spread of JD in the pasture, a fence was installed around the perimeter of the water and an additional water source was established in the dry-cow pasture. Cows and heifers were also moved farther away from the lactating cow barn to prevent contamination from barn run-off.

"Nobody wants to talk about Johne's disease, but we knew we had it," Steve says. "We weren't going to bury our heads in the sand and hope it would go away. We are trying to be proactive: find out what causes it, how to control it and how to fix the problem."

Although the research study is complete, the Brocks plan to continue testing and monitoring the management program they put in place.

"We can handle this problem," Steve says. "We are making changes that not only eliminate this disease but also make our herd healthier and our cattle more productive."

What we learned:

JD was introduced into the Brock Dairy Farm most likely during a herd expansion project when cows were purchased from multiple sources. Risk factors for subsequent *Mycobacterium paratuberculosis* (MAP) transmission include the use of a common calving area in the winter months and feeding of pooled colostrum. Another major issue that likely contributed to rapid MAP transmission was access of replacement heifers to surface water in the spring, summer and fall. This water was culture positive for MAP on multiple occasions. This finding highlights the importance of environmental contamination serving as a possible mode of MAP transmission.

Management changes have included the creation of multiple calving pens for use during winter months, use of colostrum replacer or colostrum from JD test negative cows and only feeding waste feed to the oldest heifers. Access to standing surface water is also being managed by fencing and drainage.

One of the spillover effects recognized with increased management of neonatal calves and their environment has been a decrease in calfhood disease, most significantly, calf scours. This highlights how management practices, such as clean maternity areas, can reduce the incidence of multiple infectious diseases.

Lessons Learned:

✔ Management of the calving area, colostrum and calf milk to control JD can also help reduce other neonatal calf diseases.

✔ Standing surface water can serve as a source of MAP transmission to young cattle.

MSU Dairy Cattle Teaching and Research Center

"Warming Boxes" Used to Separate Calves on MSU Dairy

Controlling and eventually eliminating Johne's disease (JD) is an important goal for any operation experiencing JD related illnesses, but for the MSU Dairy Cattle Teaching and Research Center the implications were greater because a cow with JD could cause erroneous data results for research projects.

"We were very interested in participating in the Johne's Disease Control Demonstration Project," says MSU Dairy Farm manager Bob Kreft. "We wanted to identify and quickly eliminate any Johne's in the herd because if our animals are Johne's positive it can confuse the other research going on in the barns."

The MSU dairy joined the study in 2002 and conducted a whole-herd JD test on their 250-head of lactating cows. Along with identifying possible test-positive cows, the researchers looked for areas that were hot spots for disease transmission. Calving areas and feeding pooled colostrum were the two areas of concern on the MSU dairy.

"It was really helpful to have Dr. Dan Grooms here to help identify some of our opportunities for improvement," Bob says. "We got good information that has been really helpful. We knew about the fecal-oral transmission but they were able to pinpoint more than that."

To control the spread of JD in the calving area, the dairy crew designed warming boxes outside of the maternity pen. Calves, as soon as they are born, are removed from the maternity pen and put into separate calf boxes. The boxes are built on an elevated grated floor equipped with small space heaters that can be used in cooler temperatures.

In the feeding area, procedures have been changed so that tractors and the feed mixer bringing in the feed no longer travel through areas in the barn that may have manure. The tractors now drive into the freestall feed lane and back out instead of driving over cow traffic lanes.

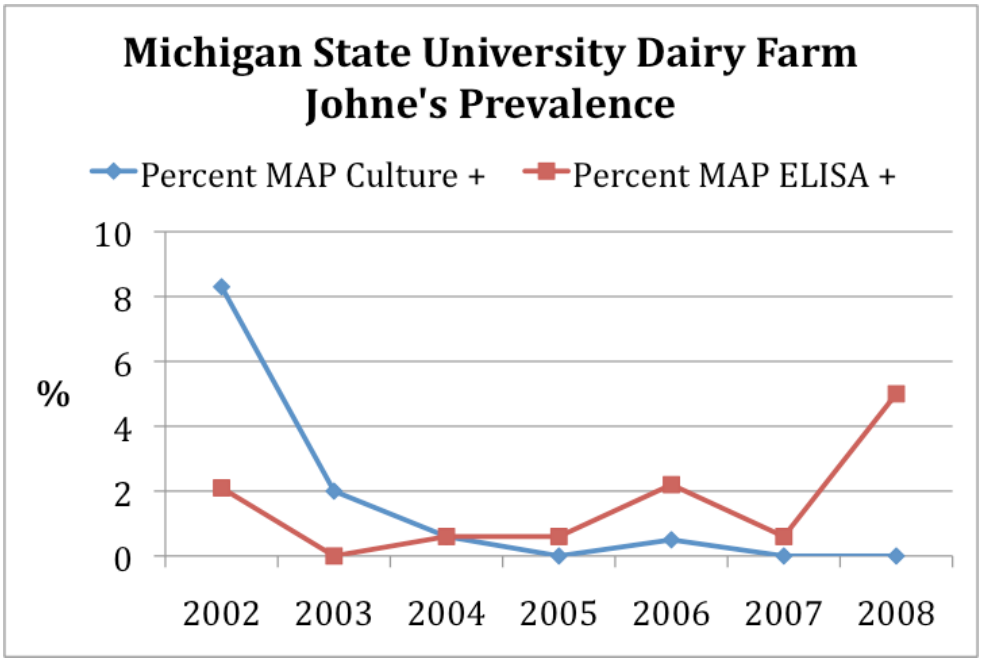
Bob and the dairy crew also rearranged the animal pens so that the breeding age heifers do not come in contact with milking cows. Previously, the two groups were only separated by a gate, which still allowed contact between the younger and older animals.

"On this farm, a heifer doesn't meet a cow until she is 22 months of age," Bob says.

In addition to the management changes, the MSU dairy instituted an aggressive culling program, the most aggressive of any of the demonstration herds. Cows identified as culture positive were culled and extra

testing was performed to identify high-risk animals and limit the transmission of the disease.

"We have a lot of visitors to the farm every year and with all the research going on, we needed to control this as quickly as we could," Bob says. "We plan to continue to monitor our progress and conduct herd tests at mid-gestation and at calving. We will then have the information we need to make any culling decisions."



What we learned:

The prevalence of JD in the MSU dairy farm was never very high. However, many factors have motivated management to eliminate JD from the operation. A very aggressive JD control program was initiated that initially relied heavily on testing and culling. In addition, management changes have been made to better manage the calving area and colostrum feeding.

Despite this aggressive strategy, JD test-positive cattle will occasionally be found. This highlights the difficulty of completely eliminating JD from a farm and the need for long term persistence and evaluation of the JD control plan.

Lessons Learned:

✔ Complete disease elimination is difficult despite aggressive control programs.

✔ Relying on a test and cull strategy can certainly help reduce JD prevalence, but is unlikely to lead to its elimination.

✔ Continuous evaluation and refinement of the JD control plan is necessary.

Peterson Farm

Controlling Johne's in a Beef Operation

Participating in the Johne's Disease Control Demonstration Project helped dispel some myths held regarding Johne's disease (JD) for Cass County beef producer Gail Peterson. As one of the owners of the family's 250-head Angus operation, Gail was looking for more information and support to tackle the problem emerging on his farm.

Gail and his wife, Mary Lou, farm with his mother Dorothy, and two of their sons, Alan and his wife, Sarah, and Jeffrey and his wife, Katie.

Gail first suspected they had a problem with JD in 2004 when fresh heifers were developing severe diarrhea and losing weight right after calving. In 2005, they joined the Johne's Disease Control Demonstration Project and conducted a whole-herd test to identify test-positive animals.

"I thought you only had to test the younger animals, not the whole herd," Gail says. "Working with the MSU team we were able to put new management practices in place to slow the transmission of the disease."

Because the Petersons raise their calves until they are ready for market, the weight reduction associated with JD has a direct impact on the profitability of the farm.

Having identified the positive animals, Gail was able to segregate the herd into different groups to isolate the test-positive animals. By knowing which animals were positive he is also able to monitor them more closely for weight loss and ship them before they lose too much weight.

"The biggest thing we have done is to remove young calves from the larger group of cows getting ready to calve. We have also divided the calving area so we have more, smaller lots so they are not as concentrated," Gail says.

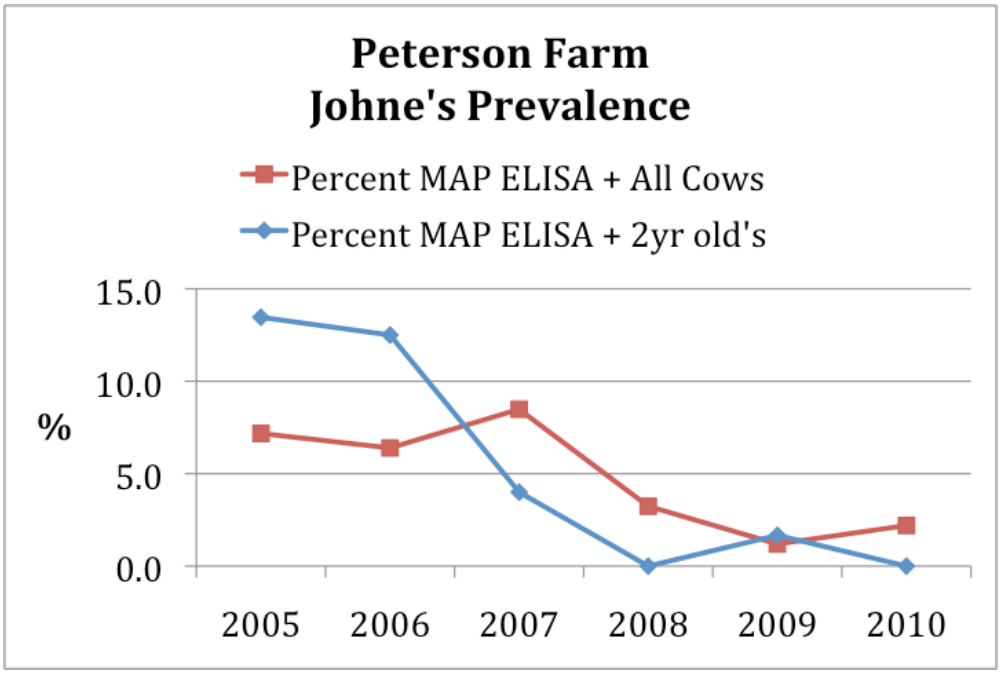
Because the Petersons rely on selling healthy seed stock, they are culling heavily to reduce the number of test-positive animals in their herd. Since 2005 the number of test positive animals has declined from 7.2 percent to 2.2 percent.

In addition to reducing the incidence of JD, the Petersons have also seen a reduction in the number of scour problems and overall improved health of the calves.

"We will keep test-positive cows until they are ready to go to market, but we don't breed them back," Gail says. "We separate the cull group from the rest of the

herd to minimize transmission of the disease to younger cattle."

"We have seen a lot of positive things just by making a number of small changes. We hope to get to a point where we can become a test-negative herd and sell quality Johne's-negative seed stock. I believe that will give us an advantage when we go to sell cattle," Gale adds.



What we learned:

Controlling JD in beef operations presents different challenges because of how calves are managed. The Peterson's first noticed clinical disease in their younger cows.

Upon investigation, it was determined that almost all of the JD test positive cows were in the younger generations, suggesting the disease was introduced recently. High stocking density in the calving area and housing of weaned heifers with cull cows in the fall and early winter, likely led to rapid transmission of the disease.

To control JD, the most significant change made was how the calving area was managed. The stocking density of the calving area was reduced significantly and new cow-calf pairs were moved to transition pastures as soon as possible.

In addition, the practice of housing weaned heifers with cull cows was stopped. To reduce the disease level in the herd quickly, all test positive cows are not re-bred and eventually culled. These simple management changes have led to a significant reduction in disease prevalence in a relatively short period of time.

Lessons Learned:

- ✔ In beef operations, the calving area is the most critical area for managing JD transmission.
- ✔ Making simple management changes in how the calving area is managed can significantly reduce JD transmission and prevalence.
- ✔ Housing weaned replacements with cull cows is a risk factor.
- ✔ Culling JD test positive cattle early is advantageous in that risk of transmission is reduced and cull prices are higher if sold before clinical disease occurs.

Ingraham Dairy Farm

Education Key to Combatting Johne's Disease

Beth Ingraham and her husband, Tim, didn't know much about Johne's disease (JD) when it was first detected in their herd, but they did know it was something they did not want in their herd of registered Jerseys. Within a year of participating in the Johne's Disease Control Demonstration Project, the Ingrahams reduced the Johne's disease prevalence in half. By the end of the study, they had virtually eliminated JD from the herd.

"We culled real heavily at first. Anything testing positive was culled" Beth says. "We wanted to get rid of it as fast as possible. It is a terrible disease."

The Ingrahams operate a certified organic dairy in Ionia County. Keeping their herd of 100 Registered Jerseys healthy and productive, without compromising their organic status, is very important to the owners.

The Ingraham's first encounter with JD was in 2002 when they were having some overall herd health issues and their veterinarian Dr. Tony Ellis suspected JD. When the test came back positive the Ingrahams set in motion a series of management changes to eliminate any further spread of the disease.

"We really didn't know much about Johne's," Beth says. "We have learned so much being involved in this project. Who knew that a small speck of manure could have such an effect on herd health."

In 2003 the Ingraham herd prevalence was greater than 10 percent. At that time, there were multiple areas on the farm at high risk for JD transmission. The maternity pen was overcrowded and also housed sick animals. Because the Ingraham herd was kept on pasture for the majority of the year, the calves were often left to nurse the dam for up to a week. Calves were fed unpasteurized whole milk and housed in a pen adjacent to the maternity pen with direct fence line contact with adult cows.

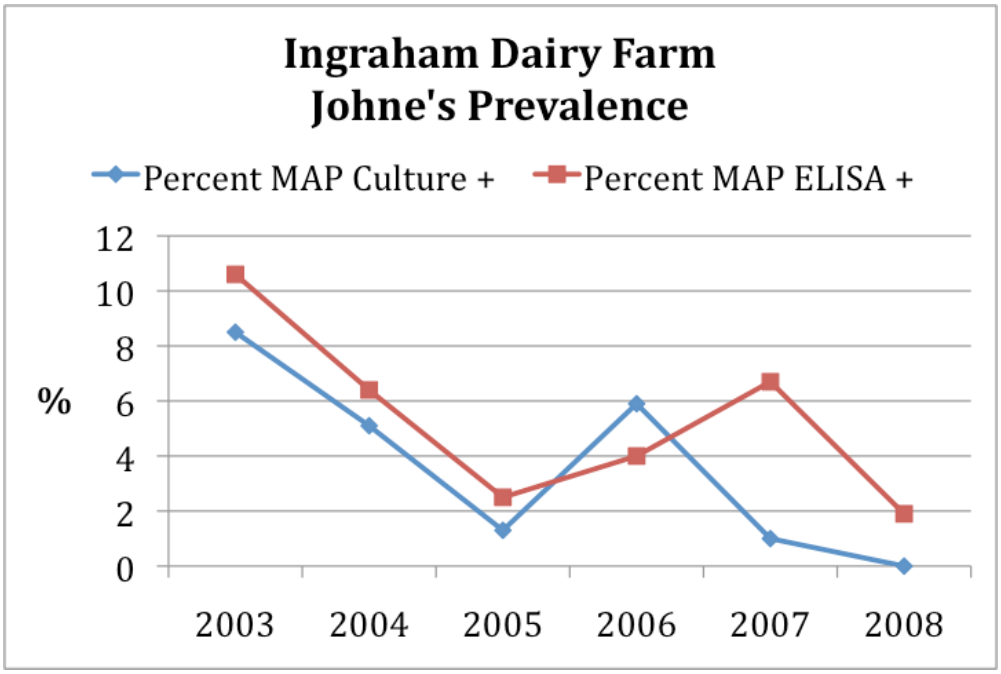
Adding to the management risk factors was the fact the herd had been assembled from multiple sources in 1995.

The Ingrahams have made a number of changes since their first encounter with JD. The first step was testing all animals to determine the prevalence of the disease. Then they focused on the calves, separating them from the dams within 6 to 10 hours. They also put in place management practices that keep the manure

cleaned up and out of the traffic flow of cows and machinery.

"We have become very diligent about manure," Beth says.

The management changes and heavy culling are paying off for the Ingrahams. They hope to reach a point where they can list their cattle as JD free, and in turn command a higher price for the replacement animals they routinely sell.



What we learned:
The Ingraham Dairy Farm is a small organic Jersey farm that began experiencing problems with Johne's disease soon after being assembled from multiple sources.

Management practices that increased the risk of disease transmission included a common calving area where sick cows were often housed too. Calves were left with their mother in this calving area for multiple days; and once removed, they were fed unpasteurized whole milk. Both of these practices significantly increased the risk of JD transmission.

Additionally, weaned calves were housed in pens that had fence line contact with adult cows. Because control of JD at this dairy was a high priority, significant management changes were made. Management of the maternity pen was changed. It is used for calving cows only, and time spent in the pen is minimized.

Calves are removed from the cow immediately, and following colostrum, all calves are fed milk from JD test-negative dams. Also, all test positive cows are put on a "do not breed" list and eventually culled. Because of facility limitations, housing of weaned calves in contact with adult cows has not been addressed. However, by changing management practices focusing on pre-weaned calves, the prevalence of JD has dropped significantly over time allowing the owners to move toward their goal of being JD free.

Lessons Learned:

✔ JD can be controlled through strict management changes in herds that are assembled from multiple sources.

✔ Not all risk factors need to be addressed to make progress in JD control.

Fisk Dairy

Healthy Calves Lead to Healthy Herd

Better calf management on the Fisk Dairy Farm led to a drastic decrease in the incidence of Johne's disease (JD)for this third generation dairy farm in Kent County. When the owners, Jack and Katie Fisk, entered the Johne's Disease Control Demonstration Project they were undergoing a herd expansion using internal replacements. However, JD transmission in the calving area was hampering their growth.

"We weren't real familiar with Johne's when we started the project," Jack says. " We knew it was starting to be a problem so when our veterinarian, Dr. Mike Bolton, suggested we join the study we thought it was a good idea. It has been really beneficial and has helped our herd a lot."

The areas at greatest risk for JD transmission was the maternity pen and pre-weaned calf areas. The farm had one maternity pen bedded with straw. It was cleaned infrequently with fresh bedding occasionally added between calvings. JD suspect and test-positive cows also calved in the same pen with all other cows.

When multiple cows were calving, colostrum was pooled and fed to the calves. Calves also received unpasteurized whole milk. Weaned calves were fed hay in an alley adjacent to the lactating cow area, where feed could be contaminated with feces from the adult cattle. Bred heifers and dry cows were also housed together in the same pen.

"We became more aware of all the ways Johne's could be picked up on the farm and how to correct the situation," Jack says. "We made a lot of changes with the calves and now pay more attention to the overall health of the herd."

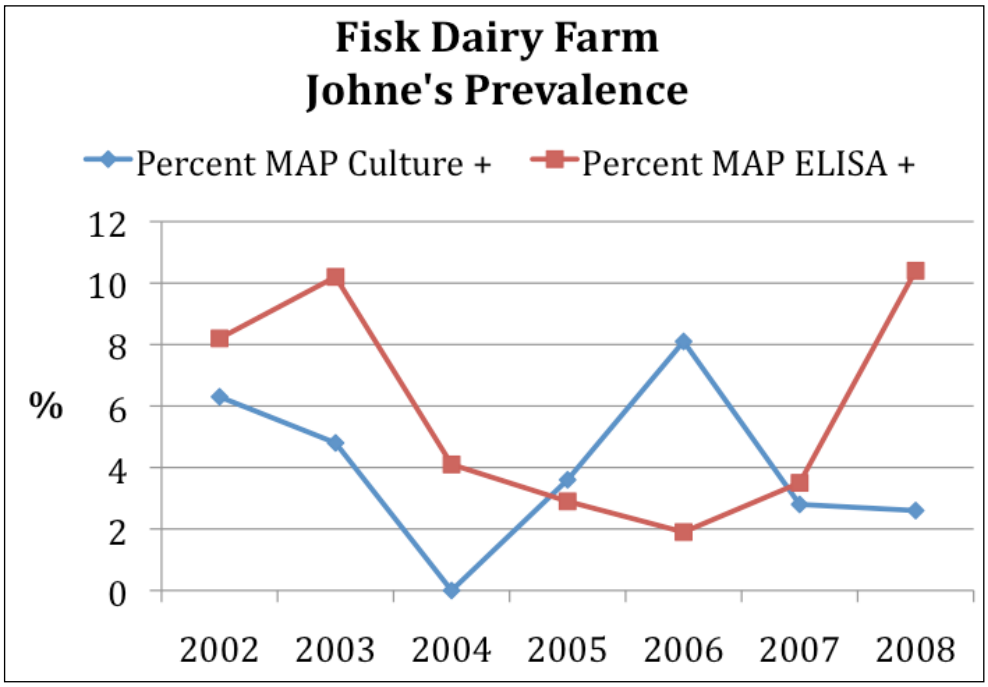
To help monitor herd health, Jack body condition scores (BCS) his herd on a regular basis. He uses the BCS to help track clinical signs of JD. They also work closer with their veterinarian to help identify health problems early on.

"We want happy and healthy cows," Jack says. "We monitor everything closely and if anything looks a little funny we work with the vet to get on it right away."

Over the course of the JD study, the JD prevalence decreased substantially. At the start of the program in 2002, 46 cows (out of a herd of 208) were culled, of those culled, 5 percent were JD suspects. In 2004, the dairy went into new management, and at the time all test-positive cows were culled regardless of production and reproduction status. Following the "Johne's cleansing" of the herd in 2004, the number of cows culled due to clinical JD dropped to less than 1 percent in 2005.

The number of cows culled due to JD crept up again in 2006. The researchers predict that while cows that were JD test positive were culled, the younger, infected animals in the herd began testing positive as they matured.

"Participating in this study really helped us a lot," Jack says. "We would have been in a lot of trouble (with Johne's) eventually if we had not been a part of this research. We plan to continue monitoring and testing on our own now that the research study is complete."



What we learned:

Early culling of cows with clinical JD was the major driving force for the ownership of the Fisk Dairy Farm to control JD. The primary risk factors for JD transmission on this operation were a small maternity area that often had multiple cows in it and was infrequently cleaned, feeding of unpasteurized whole milk to calves, and housing of weaned calves adjacent to adult cows.

Initially, the prevalence of JD was significantly reduced when management restructuring forced downsizing of the operation and the culling of all JD test positive cows. Changes made to further reduce MAP transmission included more intensive management of the maternity pen and changing from whole milk to milk replacer.

Despite significant culling, JD continued to be found in new cows over time, primarily due to inconsistent application of JD management strategies. This highlights the need for maintaining a consistent and long term JD control strategy.

Lessons Learned:

✔ The long term and consistent implementation of a JD control program is necessary to make continued progress.

✔ Culling of test positive animals is a useful management tool, but needs to be combined with other changes to reduce the risk of MAP transmission.

Schalk Dairy Farm

Johne's Infection in a "Closed" Herd

Galen Schalk of Hillman, Mich. had read the reports about Johne's disease (JD) in dairy herds, but he thought, 'that's not me.' Having a closed herd since 1974, Schalk thought his herd was immune to the problem surfacing in so many other herds. But when he tested his herd as part of the Johne's Disease Control Demonstration Project, he was surprised to learn that he not only had JD positive animals, but over 20 percent of his herd tested positive in the first round of testing and jumped to 42 percent the second year.

"I had heard about Johne's disease but thought, "That's not me." Galen says. "We have had a closed herd since 1974, so because I was not bringing new animals into the herd, I didn't feel we were at risk."

Once the presence of JD was identified in the herd, Galen was eager to eliminate the problem as quickly as possible. At the time he was milking 165 cows with a rolling herd average of 26,000 pounds of milk.

The area of highest risk on the farm was the use of a manure pack in the calving area. This pack created the perfect environment for organisms to survive and spread to new calves. The Schalks had already drawn plans for a new transition barn on the farm, but they switched it to be a new maternity area and housing for close-up cows.

"It was good that we were already looking to put up a new building, because we really needed a better place to calve in the animals," Galen says.

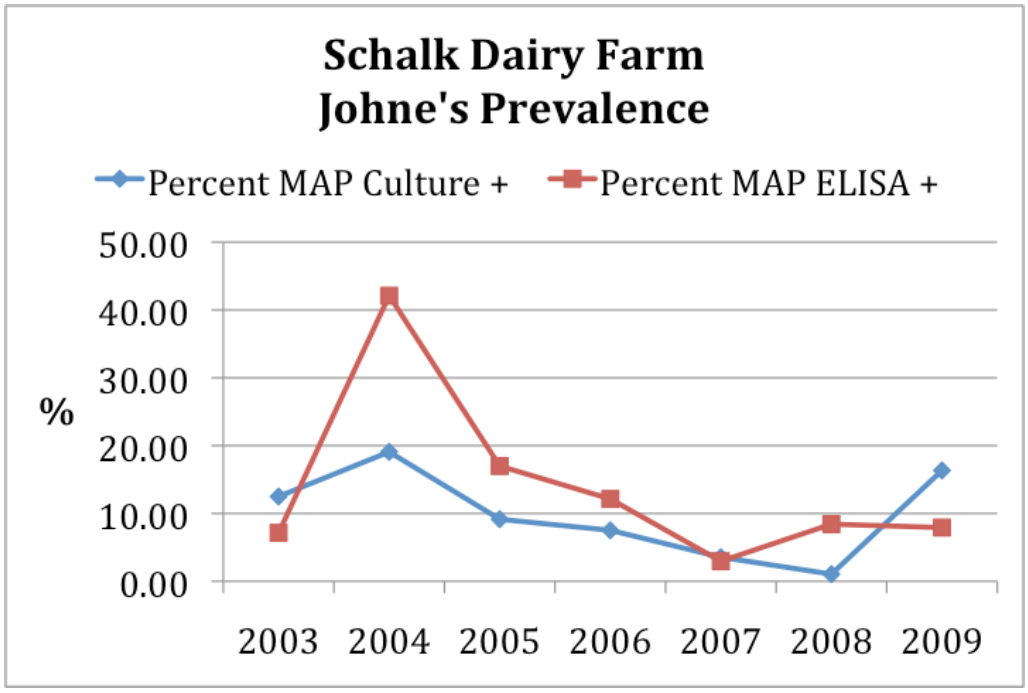
The new maternity area also allowed Schalk to use a separate stall for each cow and to clean and disinfect the area between calvings. The Schalks also implemented a program to separate the colostrum of JD positive cows so that it was not fed to new calves.

"We culled a number of animals in the first two years of the project," Schalk says. "But we still need to manage for the disease because we know some of the older animals are Johne's disease carriers."

Schalk now tags all animals that test positive for JD with a special red neck chain. Any heifers born to a positive dam are also tagged with the red neck chain until they test negative. By visually identifying the JD carriers, Schalk can better manage the disease and work to keep the disease from spreading.

With the demonstration project complete, Galen is looking ahead at how he will continue the management

practices on his farm. Now that he has the prevalence rate down to less than 5 percent he will continue to test the herd to monitor for any new infections.



What we learned:

The Schalk Dairy Farm is an example of how a low level of disease can erupt into a major problem if not managed

By all accounts, this farm was a closed operation since the 1970's. It is likely the disease was introduced when the herd was assembled and was being maintained and transmitted at a low level for 30 years.

When the disease was finally recognized, the number of infected cows, and cows showing clinical signs of JD was rapidly increasing. By the beginning of the MJDCDP, it was estimated that 40 percent of the adult cow herd was JD infected.

Significant risk factors for JD transmission were identified and included: a common calving area that was infrequently cleaned, calves remaining with their dam for extended periods of time, feeding of whole milk, and housing of weaned calves near adult cows. All of these factors were addressed, thus significantly reducing the risk of JD transmission on the farm.

In addition, testing allowed for the identification of JD test positive cattle that were then monitored and prioritized for culling. These changes have led to a dramatic decrease in JD prevalence on the farm and a significant improvement in overall herd health and productivity.

Lessons Learned:

✔ Although Johne's disease is most commonly seen in herds that are purchasing cattle, it can become a problem in closed herds, especially when routes of potential transmission are not managed.

West End Dairy Farm

Concentrating on the Basics

Tackling a Johne's disease (JD) problem taught Jake Fisk that concentrating on the basics of good calf care can help eliminate the spread of many diseases, not just Johne's. When his herd experienced an outbreak of JD in 1999, Jake culled aggressively to try and eliminate the problem, but he learned that reducing JD requires more than culling cows. So when his veterinarian, Dr. Jon Schwab, invited him to participate in the Michigan Johne's Disease Control Demonstration Project, he didn't hesitate to join with hopes of learning more about the disease and how to manage it.

West End Dairy is a third generation Holstein dairy located in Arenac County. It is currently undergoing an intergenerational ownership change. During the course of this study, the herd was expanded using both home-grown and purchased replacement heifers. The herd was expanded from 230 animals to just over 500 cows in 7 years.

Jake and his dad, Dan, joined the research project in 2003, at the same time they were beginning to expand the herd. Working to control the Johne's problem during an expansion can pose a different set of challenges, but Jake found that sticking to the basics, helped reduce the number of JD-positive animals in the herd.

"We learned that it is really tough to completely eliminate Johne's from the herd, especially when you are working to expand" Jake says. "But with relatively easy and inexpensive changes we can greatly reduce the problem."

Focusing on newborn calves and colostrum management was the first step the Fisks took in reducing the spread of JD. Newborn calves are removed as soon as possible and fed colostrum from dams that have tested JD-negative. The freshening area is cleaned between calvings and fresh bedding is added.

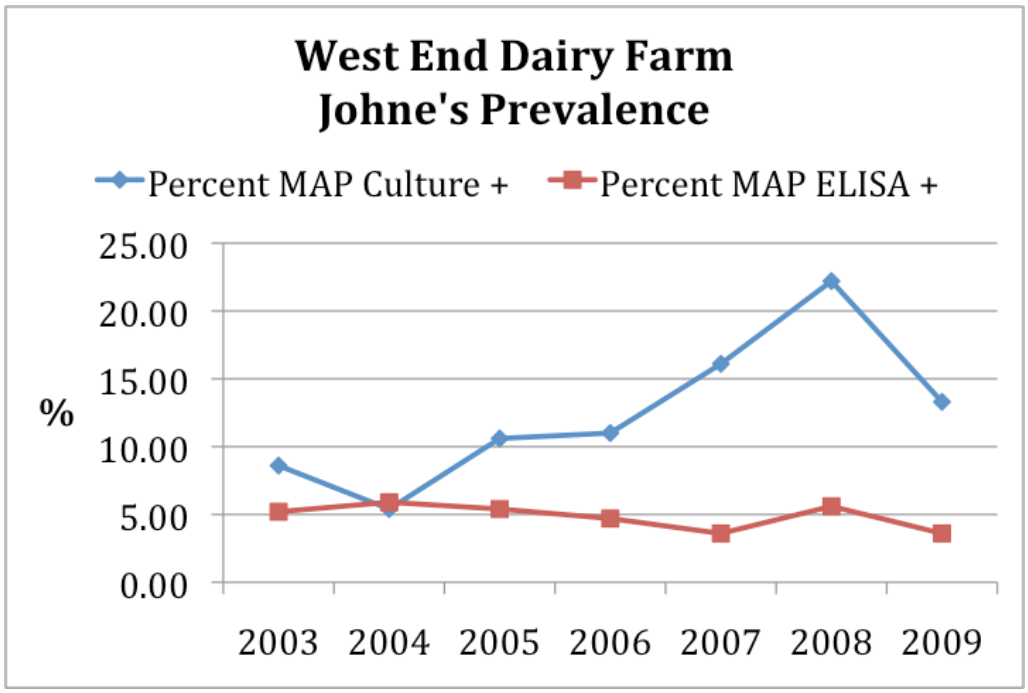
Calves and young heifers are kept in areas away from the mature cows to avoid any cross contamination. Young stock do not come in contact with older animals until they are over a year old.

"We learned that doing the right thing to control Johne's was the right thing to do anyway to prevent the transmission of disease and overall good calf health," Jake says. "We saw an improvement in overall calf health

because of the changes we made to control Johne's."

Because they were also expanding the herd, the cull rate on the Fisk farm was relatively low throughout the course of the study. They did track cows that tested positive for JD and implemented a "three-strike and you are out" rule.

"We wouldn't cull a cow just based on the Johne's test, but we would cull her if she got another "strike" against her," Jake says. "We didn't want to cull an otherwise healthy and economically viable cow from our herd."



Cows that are JD positive are tagged so that it easier to keep track of them in the herd. A separate maternity area is used for Johne's positive cows and the Colostrum from these cows is not fed to newborn calves.

"I wish I had known 10 years ago what I know now about managing for Johne's," Jake says. "We would have saved a lot of cows. Managing for Johne's doesn't have to be an all or nothing program. We have put in place changes that work for us and it has made a big difference."

Lessons Learned:

✔ During the course of the study, herd JD prevalence remained the same. However, when viewed in the context of rapid expansion that occurred during the study and given that purchasing cattle is a major risk factor for introducing or increasing the prevalence of JD, the management practices introduced likely helped to prevent the disease prevalence form increasing.

✔ Reduction of JD prevalence will take longer when herd expansion is occurring either because of the risk of bringing cattle onto the farm, or the decreased culling pressure occurring to facilitate expansion.

What we learned:

Johne's disease prevalence remained relatively unchanged over the course of this study. This might lead one to believe that the JD control program implemented on this farm was ineffective. However, it must be remembered that this herd doubled in size using both home-grown and purchased replacement cattle. The fact that cattle were being purchased from relatively unknown backgrounds and that culling pressure was low to facilitate expansion, likely prevented significant reduction in disease prevalence. The JD management control systems were designed to reduce the disease spread and the number of clinical JD cases while still allowing for herd expansion. What is most important is that the disease prevalence did not appear to get significantly worse and in fact by the end of the program, was heading down. The other positive outcome was the reduction in clinical cases of JD. Over the course of this project, JD clinical cases had decreased significantly and overall herd heath has improved. The true impact of the control program will be most evident in the next 5-10 years.

Johne's Disease Control Demonstration Project Education Initiative

Johne's disease (JD) has become endemic in the cattle population in Michigan and the United States and its control is difficult. One of the limiting factors in JD control is a lack of understanding by producers and the livestock industry in general on what JD is and what it takes to control it. As part of the Michigan Johne's Disease Control Demonstration Project, multiple outreach activities were developed to help educate the cattle industry in Michigan about JD and its control. The objectives of these educational activities were:

- To increase dairy and beef producers' knowledge about JD.
- To increase dairy and beef producers knowledge of practices to prevent and control JD on their operations.
- To increase the knowledge of industry professionals about JD, thus better equipping them to help their clients to control JD in their operation.

Michigan Johne's Disease Control Demonstration Project Field Days

Field days can be a very effective way to demonstrate ways to control problems. Using farms participating in the Michigan Johne's Disease Control Demonstration Project, four field days were held in 2009 and 2010. Participants were able to learn about JD and then tour the farms to learn and see how the owners were managing the disease. Total attendance at these field days was approximately 275 people. Evaluations completed by attendees showed that they learned about the disease and its control, and further, that they planned to implement what they learned.

"Johne's: The Disease"—Managing For a Healthier Herd

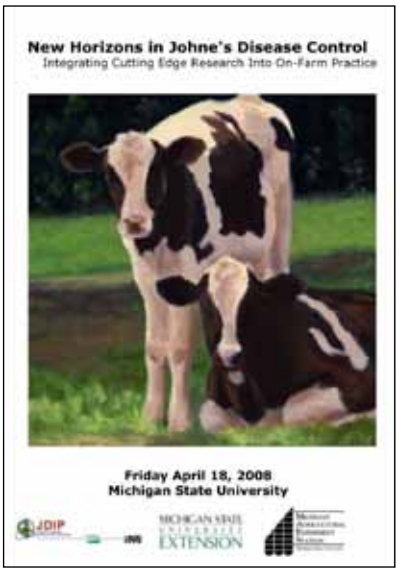
An interactive educational CD on JD and its control was developed by project personnel. Over 500 CDs were printed and distributed to dairy producers and veterinarians in Michigan.

Student and Veterinary Training

In partnership with USDA and MDA, training programs for veterinarians, veterinary students and allied industry groups were developed and presented. These workshops were developed to meet national accreditation training requirements for veterinarians to participate in the Michigan Johne's Disease Control Program. In the case of allied industry groups, the workshops were designed to give their field staff tools to further help their clients be profitable.

MJDCDP Field Day exit surveys revealed that 75% of the producers identified at least one thing they would do as a result of what they learned!

"New Horizons in Johne's Disease Control"

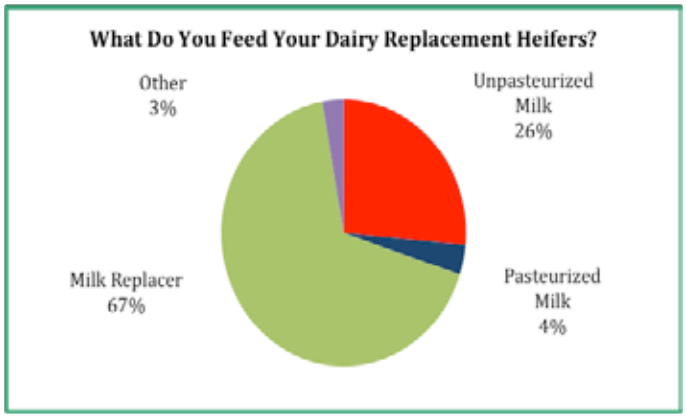


On April 18, 2008, dairy and beef industry leaders from Michigan and the Great Lakes Region gathered at Michigan State University for a one day workshop focused on new technologies and developments in the control of JD in cattle. Organized by the Michigan Johne's Disease Control Demonstration Project, this workshop attracted over 100 producers, scientists, educators and industry leaders.

"Animal Health—Managing Disease -versus- Using Band-Aids"

Johne's Disease and its control was the featured educational component of this multi-location Michigan State University Extension Dairy Team meeting which was held at 9 different locations around Michigan during the winter of 2006. The Johne's disease program incorporated unique educational tools including the use of producer panels and real time surveys to capture current management practices. One of the survey questions asked what type of milk was fed to replacement heifers. ***Surprisingly, 26% of producers in attendance answered that they fed unpasteurized whole milk to their calves, a major risk factor for the transmission of Mycobacterium paratuberculosis, the bacteria that causes JD.***

Capturing and showing this information to dairy producers in real time and then explaining the dangers of feeding unpasteurized milk help drive home the "Focus on The Calf" message that has been developed with this project.



Extension Articles

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Grooms DL. Johne's Disease Control Demonstration Project. Cattle Call 2006;11(3):2-3.

Grooms DL, Durst P, Woltanski J. Reason Number "21" for Controlling Johne's Disease: Producing a Quality Product. Michigan Dairy Review 2006 11(1):11-12.

Durst P, Grooms DL, Woltanski J. 15 Practices in Response to Johne's Disease in Your Farm. Michigan Dairy Review 2006;11(2)9.

Blair E, Grooms D, Pillars R, Woltanski J. Johne's Disease Herd Prevalence Study 2006. Michigan Dairy Review 2007;12(3):1-3.

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Research Abstracts

Association between risk-assessment scores and individual-cow Johne's disease-test status over time on seven Michigan, USA dairy herds

Pillars RB, Grooms DL, Gardiner JC, Kaneene JB.
Prev Vet Med. 2011;98(1):10-8. Epub 2010 Oct 28.

To evaluate the effectiveness of management practices implemented to control the spread of Johne's disease (JD), we conducted a 5-year observational study (January 2003 to December 2007) on seven Michigan, USA dairy herds containing cows infected with Mycobacterium avium subsp. paratuberculosis (MAP; the causative agent of the disease). The JD incidence and prevalence was monitored in each herd annually by serum ELISA and/or fecal culture of all adult cows. A JDCP was designed specifically for each herd based on the results of an initial risk-assessment. The risk-assessment was repeated annually and the control program updated as needed.

Herd risk-assessment scores were used to measure compliance with the control program and create JD-risk profiles for individual cows raised on the farms. The association between specific risk-assessment scores and the JD-test status of individual cows was evaluated using logistic regression. We accounted for clustering of cows within herds using generalized estimating equations (GEE). Multivariable models were built with purposeful selection of risk factors assessed on univariable analyses. The dataset analyzed consisted of 3707 cows raised on the respective farms, of which 616 were classified as infected with MAP based on testing positive on fecal culture or serum ELISA. Of the cows that were not exposed to the control program, 20% were classified as infected, while only 7% of cows that were exposed to the control program were infected.

The final multivariable model consisted of two factors: exposure to adult cows other than dam at birth (OR=1.09, 95% CI: 1.06, 1.13), and feeding colostrum from one cow to multiple calves (OR=1.10, 95% CI: 1.09, 1.12). Based on this study, implementing practices that minimize the exposure of newborn calves to MAP being shed by infected adult cows should take priority.

This study highlights the importance of protecting young calves from exposure to MAP. When designing a JD control program, veterinarians and producers should focus resources on preventing MAP transmission to young calves with a specific fous on the newborn calf.

Fabrication of a Novel Conductometric Biosensor for Detecting Mycobacterium avium subsp. paratuberculosis Antibodies

Okafor C, Grooms D, Alocilja A, Bolin S.
Sensors. 2008;8:6015-6025.

Johne's disease (JD) is one of the most costly bacterial diseases in cattle. In the U.S., economic losses from the disease have been estimated to exceed $1,500,000,000 per year, mainly from the effects of reduced milk production. Current diagnostic tests for JD are laboratory based and many of those tests require specialized equipment and training. Development of rapid and inexpensive diagnostic assays, which are adapted for point-of care applications, would aid in the control of JD. In this study, a polyaniline (Pani)-based conductometric biosensor, in an immunomigration format, was fabricated for the detection of serum antibody (IgG) against the causal organism of JD, Mycobacterium avium subsp. paratuberculosis (MAP). Immobilized Mycobacterium avium purified proteins in the capture membrane were used to detect MAP IgG, previously bound with Pani/anti-bovine IgG* conjugate in the conjugate membrane.

After detection, the Pani in the sandwiched captured complex bridges an electrical circuit between the silver electrodes, flanking the capture membrane. The electrical conductance, caused by Pani, was measured as drop in electrical resistance. Testing of the biosensor with known JD positive and negative serum samples demonstrated a significant difference in the mean resistance observed between the groups. This proof-of-concept study demonstrated that a conductometric biosensor could detect MAP IgG in 2 minutes. The biosensor's speed of detection and the equipment involved would, among other things, support its application towards the various point-of care opportunities aimed at JD management and control.

Identifying cows infected with JD is an important tool in the control of this disease. With the development of new technologies such as the one highlighted in this study, diagnosis and control of JD will become more efficient.

Economic evaluation of Johne's disease control programs implemented on six Michigan dairy farms

Pillars RB, Grooms DL, Wolf CA, Kaneene JB.
Prev Vet Med. 2009 (3-4):223-32. Epub 2009 May 23.

Johne's disease (JD) is an incurable, chronic infectious disease prevalent in dairy herds throughout the US and the world. The substantial economic losses caused by JD have been well documented. However, information on the costs of controlling the disease is limited, yet necessary, if producers are to make sound decisions regarding JD management.

The purpose of this paper is to describe a method for evaluating the cost-effectiveness of management changes to control JD on infected dairy farms. A 5-year longitudinal study of six dairy herds infected with JD was performed. Each herd implemented a JD control program upon study enrollment. Prevalence of JD within each herd was monitored with annual testing of all adult cows using fecal culture and/or serum ELISA. Individual cow production and culling information was collected to estimate the annual economic losses caused by JD. An economic questionnaire was developed and administered to each herd annually to estimate costs directly attributable to the JD control program.

Based on the costs of the control program, and using the losses to estimate the potential benefits of the control program, the net present value (NPV) of the control program was calculated for each herd during the study and projected into the future for a total of 20 years. The NPV was calculated for four different scenarios: (1) assuming a linear decline in losses beyond the observed period of the study with JD eradication by year 20 of the control program; (2) assuming losses and JD prevalence remain constant at the rate equal to that of the last observed year while continuing the control program; (3) assuming linear increase in losses at rate equal to that in scenario 1 with no control program; and (4) assuming losses remain constant at same level as the beginning of the study with no control plan implemented. The NPV varied greatly across the herds.

For scenario 1, only three herds had a positive NPV; and only two herds had a positive NPV under scenario two. In the absence of a control program, the NPV's were always negative. The costs of the JD control programs implemented on these herds averaged $30/cow/year with a median of $24/cow/year. The annual losses due to JD averaged $79/cow/year with a median of $66/cow/year. Investing in a JD control program can be cost-effective.

JD control requires resource investment. This study demonstrates that JD control programs can be cost effective.

Longitudinal study of the distribution of Mycobacterium avium subsp. Paratuberculosis in the environment of dairy herds in the Michigan Johne's disease control demonstration herd project

Pillars RB, Grooms DL, Kaneene JB.
Can Vet J. 2009;50(10):1039-46.

The objective of this study was to describe the distribution of Mycobacterium avium subsp. paratuberculosis (MAP) in the environment of infected dairy farms over time. Johne's disease (JD) prevalence was monitored annually in 7 Michigan dairy herds. Environmental samples were collected biannually and cultured for MAP. Of 731 environmental samples that were cultured, 81 (11%) were positive. The lactating cow floor and manure storage areas were the areas most commonly contaminated, representing 30% and 33% of positive samples, respectively. When herd prevalence was > 2%, MAP was cultured from the lactating cow floor and/or manure storage area 75% of the time. When herd prevalence was < or = 2%, MAP was never cultured from samples collected. For every 1 unit increase in number of positive environmental samples, within herd JD prevalence increased 1.62%. Environmental contamination with MAP is consistent over time on infected dairy farms, and management practices to reduce environmental contamination are warranted.

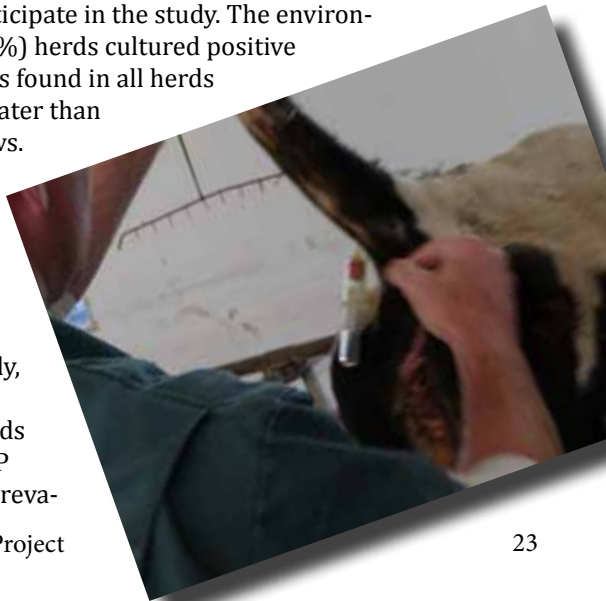
This study demonstrates the presence of MAP in the environment over time and provides evidence that it can serve as a source of disease transmission. Cattle producers need to be cognizant of environmental contamination and take steps to minimize MAP build up.

Prevalence of Michigan dairy herds infected with Mycobacterium avium subspecies paratuberculosis as determined by environmental sampling

Pillars RB, Grooms DL, Woltanski JA, Blair E.
Prev Vet Med. 2009 89(3-4):191-6. Epub 2009 Apr 8.

A cross-sectional, stratified random survey of Michigan dairy herds was conducted to estimate the prevalence of herds infected with Mycobacterium avium paratuberculosis (MAP), the causative agent of Johne's disease, in Michigan using targeted environmental sampling. One pooled sample each from the primary manure storage area and a high-traffic common cow area from each herd was collected and cultured for MAP using the ESP culture system II. A herd was classified as positive if at least one sample was culture positive for MAP. State, agricultural district, and herd size stratum prevalence were calculated. Information on past MAP testing and cattle purchase history was collected, and logistic regression was performed to determine their importance to the MAP status of the herd.

One hundred twenty-seven herds were contacted, and 94 agreed to participate in the study. The environment of 38 (40.4%) herds cultured positive for MAP. MAP was found in all herds (n = 15) with greater than 200 lactating cows. Herds that had tested for MAP or purchased cattle in the previous 5 years were 4.6 and 3.1 times, respectively, more likely to be infected than herds that had not. MAP continues to be preva-



lent on Michigan dairy farms, especially those with greater than 200 lactating cows.

The environmental sampling protocol used in this study is an economically attractive alternative for monitoring herd level prevalence and the progress of Johne's disease control programs at the state or national level. Implementation of such a program would aid states in monitoring Johne's control program progress, and guide changes over time.

JD continues to be a prevalent disease among Michigan dairy herds. This study demonstrates a low cost screening strategy for monitoring the prevalence of JD over time.

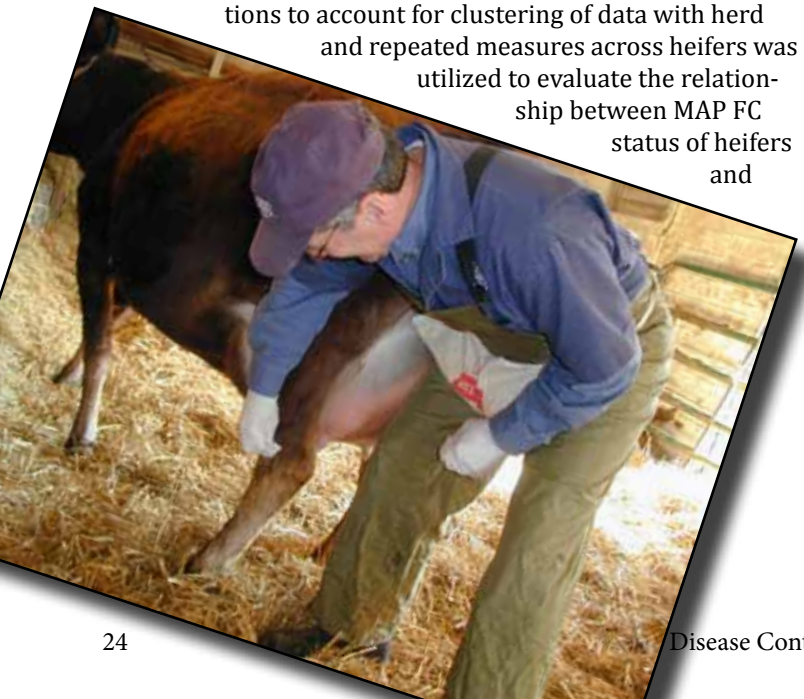
Detection of Mycobacterium avium ssp. paratuberculosis in naturally exposed dairy heifers and associated risk factors

Bolton MW, Pillars RB, Grooms DL, Mauer WA, Kaneene JB.
J Dairy Sci. Accepted For Publication, 2011

An observational prospective study was conducted to determine if fecal shedding of Mycobacterium avium ssp. paratuberculosis (MAP) could be detected in naturally exposed dairy heifers using a liquid culture system, and to determine what risk factors were associated with detecting MAP. The study population consisted of heifers from eight dairy herds in Michigan participating in a MAP control demonstration project.

Ten heifers from four age groups: 0-3, 4-6, 7-14, and 15-24 months were selected from each herd every four months for 28 months and tested for the presence of MAP by fecal culture (FC). Heifers from dams testing positive for MAP by serum ELISA were preferentially selected with the remainder of the age cohort filled with randomly selected heifers.

Logistic regression using generalized estimating equations to account for clustering of data with herd and repeated measures across heifers was utilized to evaluate the relationship between MAP FC status of heifers and herd risk factors. A total of 1842 fecal samples were collected from 1203 heifers.



Thirty-six (2%) fecal samples cultured positive for MAP, representing 27 individual heifers. Heifers shedding MAP were more likely to occur in herds with adult-cow MAP ELISA prevalence >10% (OR=4.7; 95% CI: 2.0-11.1) and herds milking >300 cows (OR=5.7; 95% CI: 2.4-13.4). MAP can be cultured from the feces of naturally infected dairy heifers. The clinical significance of these MAP FC positive heifers is unknown and needs to be explored.

Shedding of MAP is believed to be more of a problem in older cattle. This study demonstrates that replacement heifers may also shed MAP in their feces, and thus may serve as a source of MAP transmission to their cohorts. Future control programs may need to consider strategies to minimize this risk.

Case-control study: productivity and longevity of dairy cows that tested positive for infection with Mycobacterium avium ssp. paratuberculosis as heifers compared to age-matched controls

Pillars RA, Bolton MW, Grooms DL.
J Dairy Sci. Accepted For Publication, 2011

A case-control study was performed to determine if dairy heifers testing positive for Mycobacterium avium ssp. paratuberculosis (MAP) prior to two years of age by either fecal culture or serum ELISA had decreased productivity and longevity as mature cows compared to age-matched herdmates. Cases were individually matched with four controls. Survival analysis was conducted to determine differences in longevity between cases and controls. Conditional logistic regression was used to assess differences in mean 3.5% fat corrected milk, milk fat, and milk protein production, linear somatic cell count, and MAP test and clinical status as mature cows. No significant difference was found between cases and controls for any parameter assessed. Herd production performance and longevity did not appear to be impaired therefore, testing immature dairy heifers for MAP is not economically justifiable using currently available culture methods and commercial serum ELISA tests.

This study demonstrates that calves identified as shedding MAP performed similarly to calves not identified as shedding MAP when they entered the milking herd. These findings are surprising and may reflect the inaccuracy of currently available JD diagnostic tests.

Published Research From the Michigan Johne's Disease Control Demonstration Project

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Bolton MW, Pillars RB, Grooms DL, Maur WA, Kaneene JB. Detection of Mycobacterium avium ssp. paratuberculosis in naturally exposed dairy heifers, relationship to dam status, and other risk factors. J of Dairy Science. Accepted For Publication 2010.

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Grooms DL, Durst PT, Kaneene JB. Low Mycobcterium avium subsp. paratuberculosis ELISA Specificity in a Dairy Herd. Proceedings of the 39th Annual Meeting of the American Association of Bovine Practitioners, St. Paul, MN, September 21-23, 2006, p 323.

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Gehrke J, Carpenter R, Grooms DL. Isolation of Mycobacterium avium subsp. paratuberculosis From Recycled Sand. 40th Annual Convention of the American Association of Bovine Practitioners, Vancouver, British Columbia, Canada, Sept. 20 - 22, 2007, p 15.

Pillars RB, Kaneene JB, Grooms DL, Wolf CA. Cost of Johne's Disease Control Programs on Michigan Dairy Farms. 40th Annual Convention of the American Association of Bovine Practitioners, Vancouver, British Columbia, Canada, Sept. 20 - 22, 2007, p 16.

Okafor CC, Grooms DL, Alocilja EC. Detection of Mycobacterium avium paratuberculosis antibodies in serum using a conductometric biosensor. 9th International Colloquium on Paratuberculosis, Tsukuba, Japan, October 29-November 2, 2007, p 55.

Pillars RB, Grooms DL, Woltanski JA, Blair E.Prevalence of Dairy Herds Infected with Johne's Disease in Michigan as determined by Environmental Sampling. Proceedings of the 88th Annual Meeting of The Conference of Research Workers in Animal Diseases, Chicago, IL, December 2-4, 2007, Abstract # 49.

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Thesis

Bolton MW. Shedding of Mycobacterium avium subsp. paratuberculosis in naturally exposed dairy calves and associated risk factors. M.S. Thesis, 2009.

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Focus on the Calf

The Key to Managing Johne's Disease

If asked to summarize the most important take home message from the Michigan Johne's Disease Control Demonstration Project (MJDCDP), it would simply be **"Focus on the Calf."** Sounds too simple, but if we can simply reduce the risk of calves becoming exposed to the bacteria that causes Johne's disease (JD), *Mycobacterium paratueruclosis* (MAP), then we can make significant progress in reducing the impact of the disease on both dairy and beef operations.

So what evidence do we have to back this simple conclusion up? Let's start with what we know about the biology of the disease. We know younger cattle are the most susceptible to infection with MAP. We commonly say the day a calf hits the ground is the time it is most susceptible to becoming infected with MAP. As the calf gets older, susceptibility to infection with MAP decreases. So it follows that one of the most important areas to focus our attention is the maternity pen and the management activities that occur immediately after birth.

We also know adult cows infected with MAP are the animals most likely to shed the bacteria in their feces, colostrum or milk. Research conducted as part of the MJDCDP has demonstrated that implementing management practices minimizing the exposure of newborn calves to MAP shed by infected cows make the biggest impact on reducing the incidence of JD test positive cattle over time *(Association between risk assessment scores and individual cow Johne's disease test status over time on seven Michigan dairy herds. Pillars et al., Vet Prev Med. 2011;98(1):10-18)*.

We also know the maternity area can be a high risk area for disease transmission. It was the third most common area to be contaminated with MAP (Longitudinal study of the distribution of Mycobacterium avium subsp. paratuberculosis in the environment of dairy herds in the Michigan Johne's disease control demonstration herd project. Pillars et al., Can Vet J 2009;50:1039-1046). We also learned cows can be a significant source of MAP to newborn calves simply through MAP contamination of their skin as they enter maternity areas *(Detection of Mycobacterium Avium ssp. Paratuberculosis on the Exterior of Periparturient Cows and Potential Implications for Vertical Transmission. Bolton et al., 2006 World Buiatrics Meeting, Nice, France)*.

But maybe the most important piece of evidence we have supporting "focusing on the calf" is the fact that in every herd (dairy or beef) that participated in the MJDCDP, significant changes were made in how calves were managed; and in each farm, the incidence of JD was reduced significantly.

So what can be done to **"Focus on the Calf"** and reduce MAP transmission? Here are calf focused management practices for beef and dairy operations to help reduce the risk of MAP transmission.

Dairy Cattle

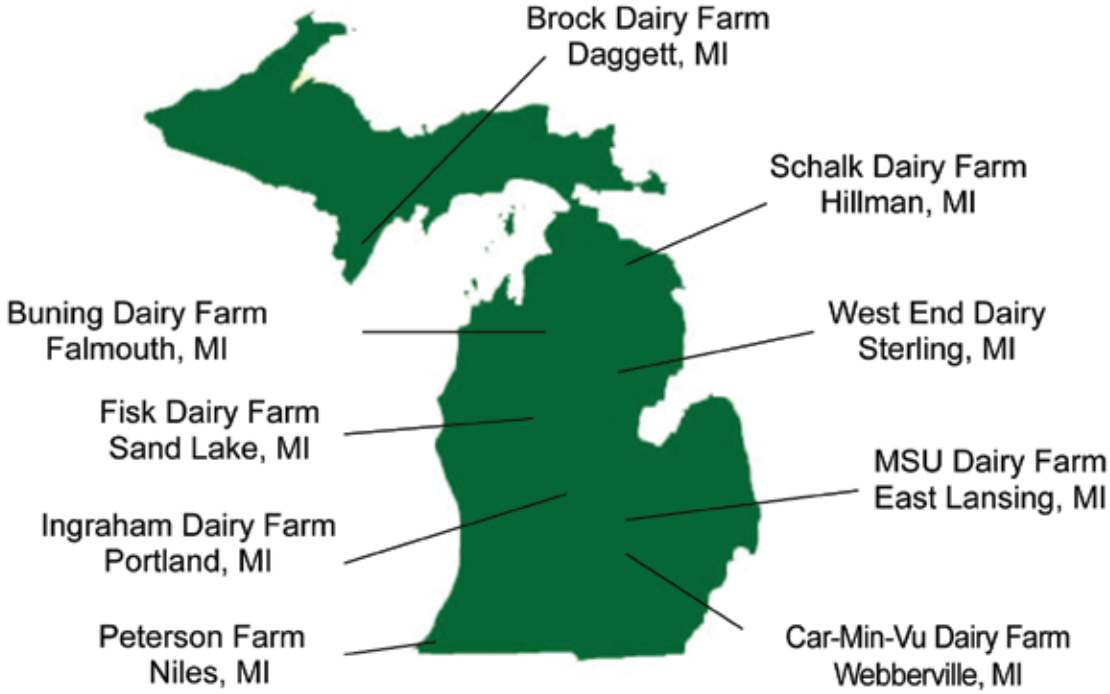
- Reduce manure build-up on close-up cows
- Clean maternity areas
- Individual or low density group calving pens
- Do not house sick cows in calving area
- Calve JD test positive cows separately
- Remove calf from cow within one hour
- Do not used pooled colostrum
- Do not feed unpasteurized whole milk
- House calves separate from adult cows
- Use separate equipment to feed calves
- Do not feed adult waste feed to calves

Beef Cattle

- Reduce manure build-up on close-up cows
- Clean calving areas
- Do not house sick cows in calving area
- Calve JD test positive cows separately
- Calve heifers separate from cows
- Provide supplemental colostrum from JD negative cows
- Move cow-calf pairs to low-stocking density areas as soon as possible
- Manage feeding/water areas to reduce manure build-up
- Weaned calves kept separate from adult cows

The take home message – by focusing resources on reducing MAP transmission to young calves, JD can be effectively managed and its impact reduced on farms.

The Michigan Johne's Disease Control Demonstration Project Team



Veterinary Clinics
- Arenac Bay Veterinary Service
  Standish, MI
- Airport Animal Clinic
  Cadillac, MI
- Dr. Barry Weiner
  Stephenson, MI
- Fowlerville Veterinary Clinic
  Fowlerville, MI
- Town and Country Animal Clinic
  Greenville, MI
- Countyline Veterinary Services
  Westphalia, MI
- Bergman Veterinary Medical Center
  Cassopolis, MI
- Switzer Veterinary Clinic
  Alpena, MI

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