



Northern New York Agricultural Development Program 2019 Final Project Report

Surveillance of Johne's Disease in High Risk Sheep Flocks in NNY

Project Leader:

Betsy Hodge, Livestock Educator, Cornell Cooperative Extension St. Lawrence County,
2043B State Highway 68, Canton, NY 13617; 315-379-9192, Bmf9@cornell.edu

Jessica Scillieri Smith, DVM, Field Veterinarian
NYS Department of Agriculture and Markets, 10B Airline Drive, Albany, NY; 315-414-7367,
Jessica.scillierismith@agriculture.ny.gov

Collaborator(s):

- Linda Barron, LVT, SUNY Canton

- NYS Department of Agriculture and Markets Division of Animal Industry
 - Patrina Ashley, DVM
 - Roger Ellis, DVM
 - Melanie Hemenway, DVM

- Livestock Educators
 - Sara Bull, Clinton County
 - Jessica Prosper, Franklin County
 - Alyssa Couse, Jefferson County
 - Melissa Spence, Lewis County
 - Carly Summers, Essex County

- Private Practice Veterinarians
 - Jennifer Nightingale, DVM, Lewis County
 - Johanna Kingsley, CVM, St. Lawrence County
 - Carolyn Pierce, DVM, St. Lawrence County
 - Sarah McCarter, DVM, Clinton County

- Wisconsin Veterinary Diagnostic Laboratory
 - Jennifer Cooper

Cooperating Producers:

Flock names and owners are confidential:

<u>County</u>	<u>Survey Responders</u>		<u>Tested Flocks</u>	
	<i><u>Number of Flocks</u></i>	<i><u>Total Sheep</u></i>	<i><u>Number of Flocks</u></i>	<i><u>Total Sheep</u></i>
Jefferson	3	761	3	761
Lewis	1	253	1	253
St. Lawrence	18	687	9	463
Franklin	4	307	3	210
Clinton	7	160	3	88
Essex	5	253	2	171
Total	38	2421	21	1946

Background:

Johne's Disease is a common disease in the dairy industry caused by the bacteria *Mycobacterium avium* subspecies *paratuberculosis* (MAP), causing diarrhea, weight loss, and subcutaneous edema in cows. However, the clinical signs in small ruminants are much more nonspecific and frequently the only sign to producers is weight loss (Pugh, 2002).

While there is significant research on Johne's disease in bovines, research into the prevalence and significance of this disease in sheep and goats is minimal. Research into an estimation of prevalence of MAP infections in the sheep and goat population of Ontario, Canada, in 2010 estimated that 86% of dairy goat herds and 66% of dairy sheep flocks have animals infected with the disease (Bauman, et al, 2016). Similar research in Cyprus showed a prevalence of almost 50% of goat herds and 61% of sheep flocks to be infected (Liapi, et. al., 2013). These numbers are similar to the 70% of herds estimated with the disease in the dairy industry in the United States (USDA-APHIS-VS, 2008).

The economic impact of MAP is not well understood, but in Italy the presence of the infection in dairy herds and flocks decreased profit efficiency by up to 20% due to impacts on feed efficiency, veterinary care, and labor costs (Sardaro, et. al., 2016). This is supported by studies showing that vaccination for Johne's disease in countries where the product is approved results in a significant increase in body condition scores (Huttner, et. al., 2012) and that there is research that finds that MAP infection can decrease fertility (Kostoulas et al., 2006c).

Johne's disease is spread through fecal-oral transmission of the organism from infected adults to susceptible neonates (Whittington and Sergeant, 2001). Modern bovine dairy operations go to great lengths to protect the newborn calf from infection through intensive management of cows close to parturition and immediate removal of calves to a feces-free environment (Windsor, 2015). In contrast, the majority of sheep flocks and goat herds used for purposes other than dairy do not remove newborns from adults. In addition, sheep and goats are frequently kept on pasture where the organism can be spread via ingestion of contaminated pasture (Sweeney, et. al., 2012).

Furthermore, there is less focus on biosecurity measures on small ruminant operations, with more movement of animals between facilities, increasing the risk of spread of disease between farms. Testing for Johne's disease is also less commonly done where the economic production value of the animal is almost equal to the cost of testing for the disease. Testing is most

commonly performed as part of a diagnostic work-up where the animal has a higher economic value or sentimental value to the owner. Test results are also not efficiently received by the farm as the most accurate diagnosis of infection is done through fecal culture which can take up to 40 days. Surveillance of a flock or herd can be expensive and environmental testing accuracy is unknown.

In addition to the animal health ramifications of Johne's disease in small ruminants, there are concerns about potential link between Johne's disease in ruminants and human health concerns. The MAP organism has been cultured from both skeletal muscle and blood from infected ewes in New Zealand (Smith, et. al., 2011) indicating that this infection is not isolated to the digestive tract in ruminants. There are reported cases of *Mycobacterium avium* subspecies *paratuberculosis* causing zoonotic disease in immunocompromised humans (Richter et al., 2002 and Hermon-Taylor et al., 1998) and developing Crohn's disease. In addition, there is the potential that it is under-diagnosed in humans due to the difficulty in identifying the organism (National Research Council (US) Committee on Diagnosis and Control of Johne's Disease, 2003). The potential mechanism and risk of disease transmission is unknown but may include undercooked or unpasteurized agricultural products.

Methods:

A survey was developed to gather baseline data of the sheep flocks in the Northern New York region and distributed by Cornell Cooperative Extension, collaborating area veterinarians and New York State Department of Agriculture and Markets (NYSDAM) staff. The survey was used to gain insight on the demographics of the sheep industry in the region along with screening questions about each flock's eligibility along with interest in participating in this research. Thirty-eight flock owners responded to the survey, representing 2,241 sheep. All interested flocks (n=21) with the minimum number of ewes of age (15) were enrolled. This group represented 1,946 sheep total.

Participating flocks were enrolled in the New York State Sheep and Goat Health Assurance Program (NYSSGHAP) for data collection and outreach education on Johne's disease along with any other health topics of interest to the farm. At the time of the NYSSGHAP visit, 15 ewes at least 2 years of age were sampled for Johne's disease using blood and feces samples obtained by NYSDAM or private practice veterinarians. Serum was centrifuged to allow for the separation of serum and samples were refrigerated and shipped overnight to Wisconsin Veterinary Diagnostic Laboratory. Serum was tested with the Johne's ELISA and feces were tested with the Johne's culture and Johne's PCR. Fecal samples that could not be run immediately were held at -80°C. Results were reported to the farm and private practice veterinarian when available.

Results:

Demographics

Of the 38 flocks responding to the survey, flock size ranged from under 10 sheep (n=4) to >600 sheep (n=1) with the majority of flocks <50 sheep (n=25; Figure 1). The majority of sheep in the North Country are used for meat production (79% primary purpose, 11% secondary purpose) with fiber the next biggest use (10% primary, 50% secondary) and the remainder using sheep for breeding or milk production.

The majority of farms have at least another species present on the property with poultry being the most common (n=26) and cattle the most common ruminant species (n=18) but horses (n=15), goats (n=10) and swine (n=9) also potentially exposed to sheep. Eighteen breeds of sheep were identified on the survey with the most common breeds reported to be Dorsets and Katahdins (including crosses).

Many flocks are lambing their ewes in groups situations, either on pasture (n=7, 18%) or in a group pen (n=26, 68%) with only a few reporting to lamb with individual lambing jugs (n=3, 8%).

Consumption of dairy from sheep flocks is still less common in the region with only 8% of responders consuming raw milk or products at home and 3% selling a sheep's milk product off the farm.

Record keeping is variable with most farms (n=35, 92%) keeping lambing records but under half (n=18, 47%) keeping health/treatment records. Parasite management also varied in the approach with lots of different techniques utilized, see Figure 2. Of the 38 flocks that responded to the survey, 23 had deaths from unknown causes and 13 reported to have had animals die with signs consistent with Johne's disease (see Figure 3).

Disease Surveillance

From the flocks included, 15 semi-random ewes over the age of 2 years were tested yielding a sample size of 319 ewes. On the ELISA test, 7 were identified as positive (2.2%) and 17 ewes were identified as a suspect (5.3%) with an overall non-negative rate of 7.5% (Figure 4). This represented 5 flocks with at least 1 positive animal (23%) and 7 flocks with at least 1 suspect (33%), resulting in 57% of flocks with at least 1 non-negative animal. On the PCR test, 6 ewes were positive (1.9%) from 5 farms (23%); one farm had 2 animals positive. Combining the two tests:

- 13 farms had at least one animal positive (62%)
- 30 ewes had non-negative results on at least one test (9.4%).

Figure 5 is a visual of the results of all 13 flocks with at least one animal with a non-negative result on at least one test.

At this time, no cultures from the project have been positive for growth (one farm still pending). However, this organism can be difficult to grow in culture depending on the strain of Johne's disease.

Conclusions/Outcomes/Impacts:

- Johne's disease is present on some Northern NY flocks, although the level of infection may be low.
- Additional statistical analysis is needed to truly estimate the level of infection in the region and will be done in the near future.
- Flocks can protect themselves from Johne's by only buying animals from herds with known negative Johne's status. If that is not possible, testing animals before bringing

them into the flock or quarantining and testing after purchase can help reduce the risk (false negatives means that risk is still there).

- Flocks with known Johne's can limit exposure of lambs to positive adults and make sure food and water are difficult for the animals to contaminate with manure.
- More aggressive approaches may be appropriate for some flocks and can be developed with your flock veterinarian with support from the **NYSSGHAP** program.

Outreach:

Regional:

- Three informational meetings have been scheduled around the region to spread awareness about Johne's disease and share the results of this survey. They are scheduled for:
 - January 28, 2020: Plattsburgh
 - February 5, 2020: Canton
 - February 11, 2020: Watertown
- Invited lecture at Franklin County's 2020 Winter Horse and Goat Symposium
- Distribution of one-page handout (see Appendix) on Johne's disease and the results of this NNYADP-funded survey at above events and at local sheep/goat sales.

Statewide:

- New York State Department of Agriculture and Markets veterinarians will be informed of the results of this study at a NYSCHAP meeting on February 4, 2020, in Ithaca.
- Outreach meeting to be recorded on Webex and posted through CCE website.
- Betsy Hodge to present finding at statewide CCE Ag-in service meeting, November 2020.

National:

- Invited presentation at "Moms with a DVM" Conference, Colorado, October 2020.

International:

- Abstract of lab results submitted to International Association for Paratuberculosis conference poster session, Dublin, Ireland, June 2020.

Next Steps:

The next phase of this project is to conduct the same level of surveillance in the Northern New York goat population. The authors feel that the goat population may have a higher level of risk of Johne's infection due to the movement of breeding bucks, which may spread disease, and the increased number of replacement females retained every year in goat dairy herds.

Another concern may be the higher level of consumption of unpasteurized dairy products and the potential link between Johne's disease and human diseases such as Crohn's. Some differences in management (pasture use, feeding practices for young stock) of sheep flocks and goat herds in the North Country may also impact infection status and warrant study to help interpret test results. The authors are working on finding a funding source for this next phase as goat producers are anxious for this information.

Acknowledgments:

The authors would like to thank the collaborating veterinarians that assisted with flock identification, sample collection, and education through the NYSSGHAP program. The flocks that were willing to enroll and have their sheep sampled were instrumental in this study and their support greatly appreciated. The Wisconsin Veterinary Diagnostic Laboratory was also instrumental in this project by offering a negotiated price which allowed for enough samples to be run to generate appropriate results within the budget.

Reports and/or articles:

An article on Johne’s disease and the results of this NNYADP-funded survey project will be published in the regional Cornell Cooperative Extension newsletters.

For More Information:

Betsy Hodge
Livestock Educator, Cornell Cooperative Extension, St. Lawrence County
2043B State Highway 68
Canton, NY 13617
315-379-9192, Bmf9@cornell.edu

Figures

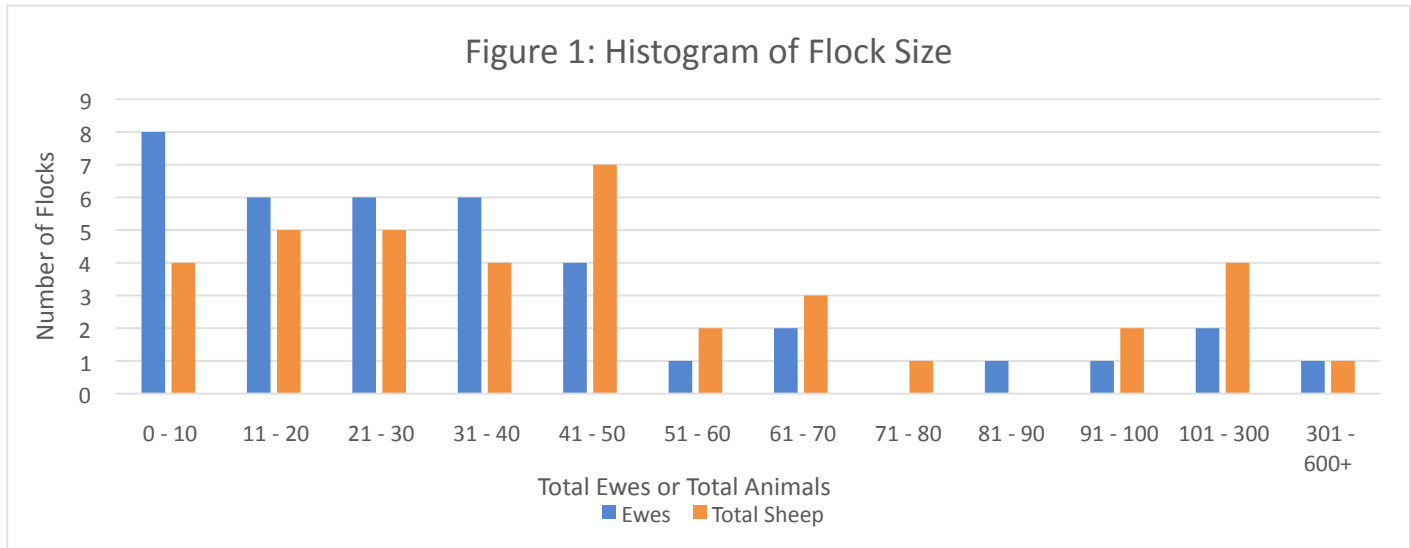


Figure 1. Flock size, Surveillance of Johne’s Disease in High Risk Sheep Flocks in NNY, NNYADP project, 2019.

Figure 2: Percentage of Responders For Each Parasite Control Method

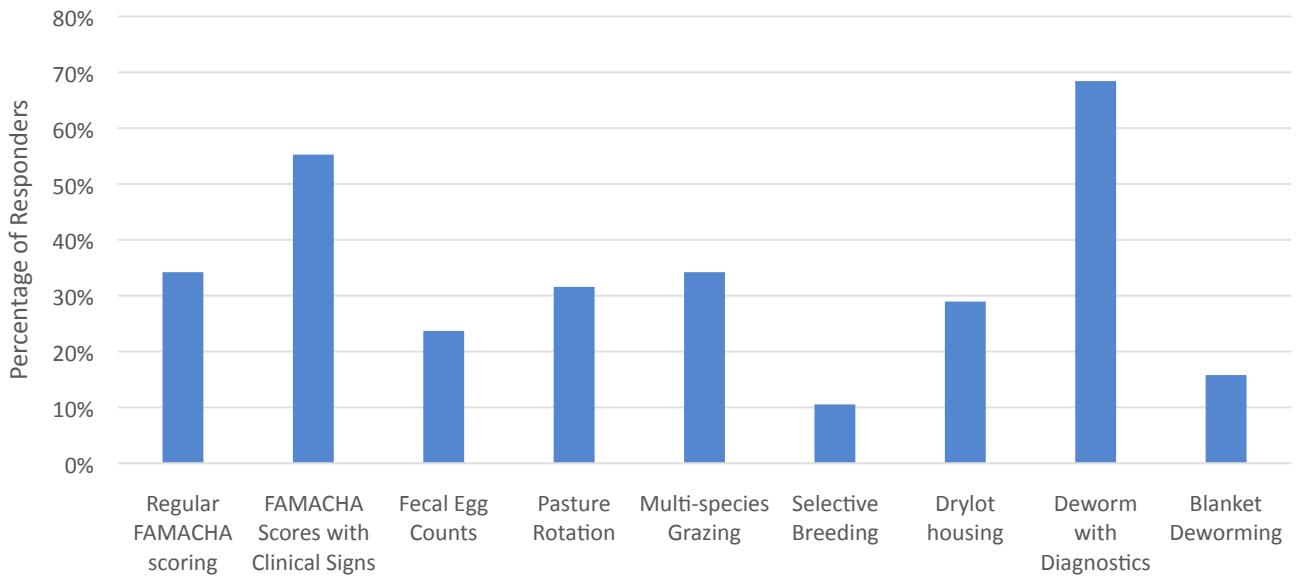


FIGURE 3: POTENTIAL RISK FOR JOHNE'S DISEASE HISTORICALLY

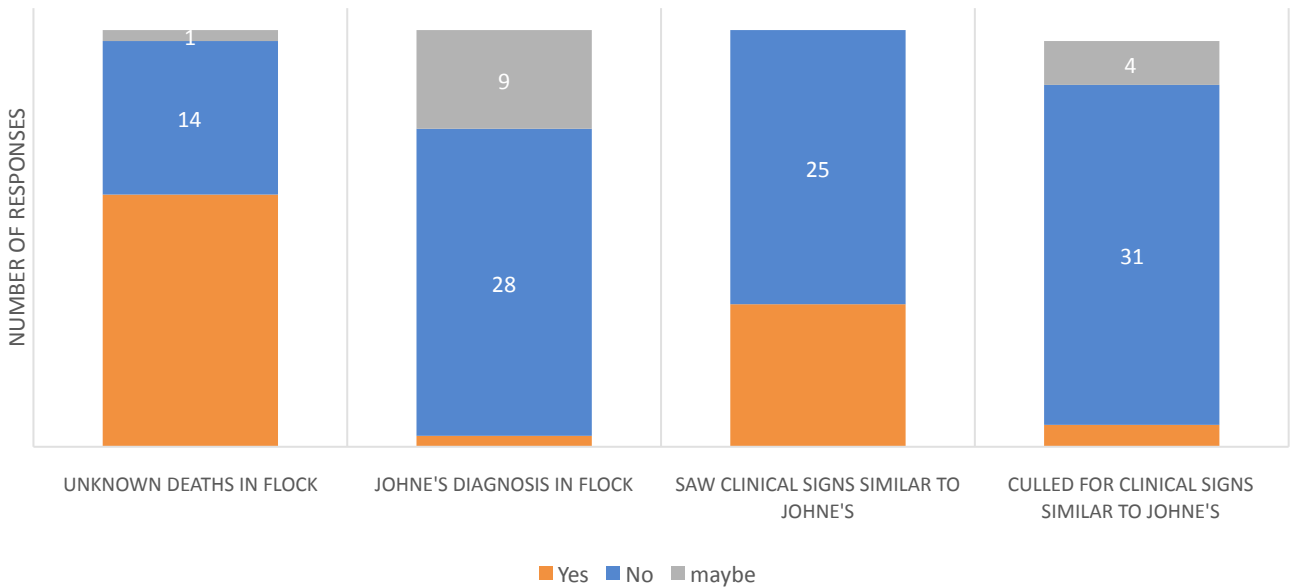
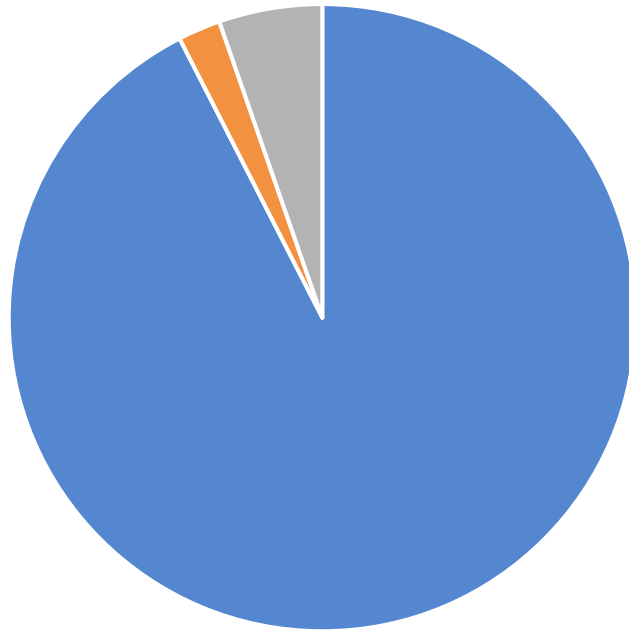
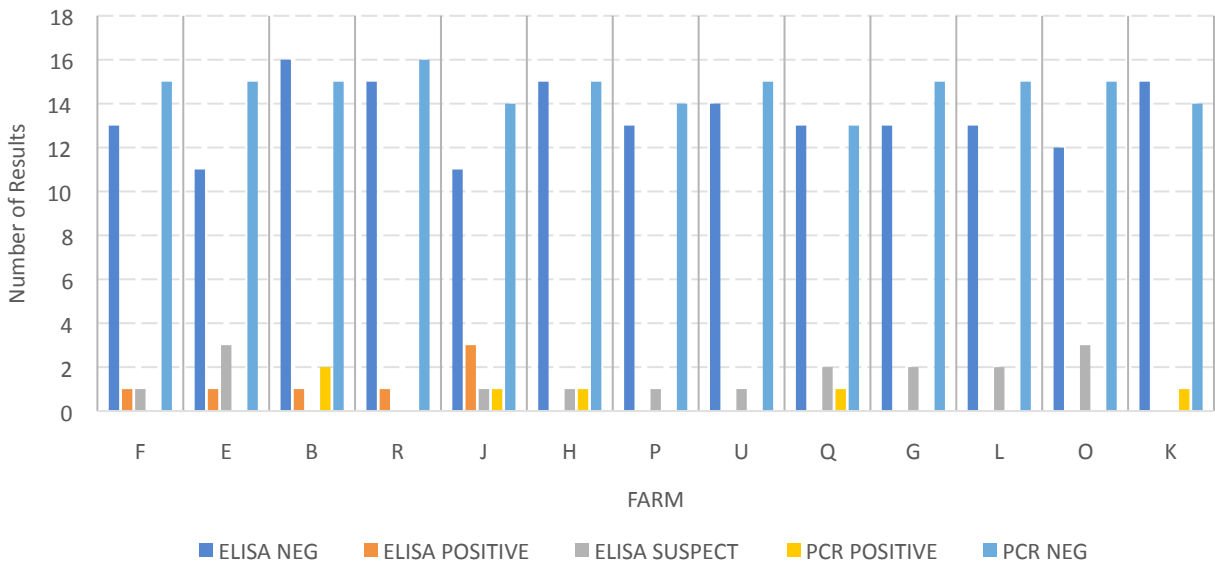


Figure 4: ELISA Results



■ ELISA NEG ■ ELISA POSITIVE ■ ELISA SUSPECT

Figure 5: Results for farms with at least one non-negative animal by ELISA or PCR



■ ELISA NEG ■ ELISA POSITIVE ■ ELISA SUSPECT ■ PCR POSITIVE ■ PCR NEG