

# COLLEGE OF VETERINARY MEDICINE ANIMAL HEALTH DIAGNOSTIC CENTER



QMPMS is a program within the Animal Health Diagnostic Center, a partnership between the NYS Department of Agriculture and Markets and the College of Veterinary Medicine at Cornell University.

## Scope of Work 2008-09 Fiscal Year

### Contract Objectives for 2008-2009

The Contract Objectives for the Quality Milk Production Services (QMPS) Program include four major components:

#### 1. Service to the dairy producers of New York State.

QMPS is committed to offer a comprehensive evaluation of the dairy farm operation with regard to optimal and safe production of high quality raw milk. The services include a full laboratory evaluation of submitted milk samples, along with a review of farm conditions, management practices, milking equipment testing and milking procedures. Recommendations from QMPS veterinarians and staff encourage clients and their herd veterinarians to work together to solve herd health issues. Herds required to use the QMPS Program by state law are encouraged to solve their problems and improve their raw milk quality to maintain a high quality standard for the New York milk supply.

QMPS is dedicated to operating four laboratories in the cattle dense areas of the state. Laboratories are located in Canton (Northern), Ithaca (Central), Cobleskill (Eastern) and Geneseo (Western). In Geneseo, Cobleskill and Ithaca, Mycoplasma testing is offered while molecular diagnostic services are offered at our Ithaca laboratory.

The New York dairy farmers are offered a reduced fee for services. The fees are established in a joint decision-making process between QMPS management and the Director of the Division of Animal Industry in the Department of Agriculture and Markets. Regulatory services are performed under the guide of the *Somatic Cell Count Regulation*, which states: "Quality Milk Promotion Services/Mastitis Control Program (NYSMCP) is mandated through the New York State Department of Agriculture & Markets, Division of Milk Control (Ref. 1NYCRR PART 2 of the Agriculture & Markets Law relating to the Requirements for the Production, Processing and Distribution of Grade A Milk and Milk Products; Section 2.8 and 2.60)." The federal standard for milk somatic cell counts currently is 750,000 cells/ml. We provide on-farm visits and herd evaluations for dairies to avoid losing their milk markets. These visits help dairy producers identify the etiology of the problem and make appropriate corrections to lower somatic cell counts.

The diagnostic component of the Quality Milk Production Services for both field and laboratory is the foundation of the program, which is uniform throughout the regional laboratories. Each regional laboratory is equipped to perform field and laboratory diagnostic evaluation of dairy

herd problems and provide a rapid response for laboratory results. We also offer farm personnel training services in both English and Spanish.

QMPS is committed to delivering services within the NYSCHAP framework and contributes to the success of this Program.

## **2. Research and Development**

Development of new programs and quality improvement of existing programs is a continuous need for QMPS. Development is needed in the areas of laboratory techniques, quality assurance, and on-farm services. Continuing education programs for QMPS employees are also part of the development tasks.

Research is an important component to support new programs and the general knowledge of udder health and raw milk quality. All academic staff is involved in some aspect of applied research both to further our knowledge in the field of milk quality and udder health as well as a continuing educational incentive.

## **3. Teaching and outreach.**

These programs are a natural component of a University-affiliated organization. QMPS offers a course on milk quality for veterinary students at the Cornell College of Veterinary Medicine. Continuing education for veterinary practitioners and training programs for extension agents and dairy producers are routinely offered.

QMPS has a strong commitment in programs that work with milkers and their training, both in terms of education and communication in English and Spanish.

The “Super” Milk program continues to receive wide recognition from the industry and is important to farmers. Collaborations are ongoing with other groups on the Cornell campus and throughout the SUNY system.

## **4. Support system in times of disasters that impact the dairy industry.**

During the ice storm of 1998, the QMPS Northern Regional Laboratory was instrumental in providing services for farmers who had been impacted by the adverse conditions. Provision of this type of service is extremely important. QMPS has the unique position of being located throughout the state with a force of about 40 staff to provide assistance that may be needed in times of natural disaster or disease outbreaks. Two QMPS veterinarians are USDA/APHIS certified Foreign Animal Disease Diagnosticians. The Director of the Division of Animal Industry and the Director of QMPS together decide the need for using Program staff in times of disease outbreaks.

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## 2008-09 Deliverables

### 1. Services

- The Quality Milk Production Services' Vision Statement reads: "We will continue to be a definitive resource for support of on-farm milk quality and associated food safety." To this end, our program strives to provide laboratory and field services to the dairy industry in the four cattle-dense areas of New York State to optimize raw milk quality and support dairy producers in reaching their product quality goals.
- In collaboration with the Division of Animal Industry and the State Veterinarians, we are continuing to enroll producers in the NYSCHAP Mastitis Module. Many of our farms are now in their fourth year of enrollment and continue to utilize the suggestions that have been offered to them. In an effort to increase submission of bulk tank milk samples from NYSCHAP enrolled herds plans to utilize the resources of the Bulk Tank Milk Surveillance Program are being developed. The proposed changes will ensure more timely sample submission and better handling of samples during transport to the laboratory.
- The QMPS Molecular Laboratory provides specialized research and diagnostic services as part of our mission to support the dairy industry through use of science-based methods and cutting-edge technology. We offer DNA-based bacterial detection and identification, and strain typing or "DNA-fingerprinting". This includes detection of Salmonella, shiga-toxin producing *E. coli*, and *Listeria monocytogenes* in bulk tank milk as part of the bulk milk surveillance project. We screened hundreds of bulk milk samples for MRSA (methicillin resistant *Staphylococcus aureus*) as part of the nation-wide survey by the National Animal Health Monitoring System. The Molecular Laboratory plays a key role in our *Klebsiella* research and in analysis of on-farm *Klebsiella* outbreaks. Species identification of non-agalactiae streptococci was initiated in the Molecular Laboratory and is now in the process of being implemented for routine diagnostic use. The integration of fieldwork, routine diagnostics, and specialized diagnostics and research at QMPS provides a unique opportunity to address issues raised in the field, and to generate information that is taken back to our dairy producers.
- After obtaining the accreditation by the American Association of Veterinary Laboratory Diagnosticians (AAVLD), a new Quality Manual for the Animal Health Diagnostic Center (AHDC) and 22 Quality Standard Procedures (QSP) have been rewritten by the Qual-

ity Assurance Manager and the QA Steering Committee and submitted for review to the AHDC Executive Director, faculty, laboratory managers and supervisors. Moreover, QMPS is continuing with the efforts to obtain the accreditation of its Ithaca Microbiology Laboratory by the International Organization for Standardization (ISO). The ISO/IEC 17025:2005 is for use by laboratories in developing their management system for quality, administrative and technical operations. Accreditation by ISO 17025 is a valuable component of quality assurance in diagnostic microbiology. QMPS, with the help of Ms. Denise Archer (AHDC Quality Assurance Manager) has developed a QMPS Quality Manual for ISO 17025 accreditation as well as QMPS Quality System Procedures. Ms. Belinda Gross, Mr. Brad Rauch, Dr. Carlos Santisteban and Dr. Rubén González are the QMPS taskforce executing necessary steps and will continue until completion. An external ISO audit was held on October 15-17, 2007. QMPS then reviewed its Quality Manual, documents and forms, and developed several more documents to prepare for the final visit of the ISO auditing team in the early spring of 2009.

## **2. Research and Development**

### ***Research***

- **Infection dynamics in two dairy herds (USDA funded)**

Data collection has been completed on both herds and the data is in the final stages of being analyzed. Dr. Barlow, in collaboration with Dr. Zadoks, was able to secure additional funding from the competitive USDA grant program for molecular diagnostics. Dr. Barlow presented some of the results at the Fall Dairy Conference in Auburn, NY. We are currently submitting the results to peer-reviewed publications. A paper on the infection dynamics of Q-fever in one of the two herds has now been published in the journal *Veterinary Research*. A second paper on modeling of infection in dairy herds has been published in *Preventive Veterinary Medicine*, and a third paper on the molecular epidemiology of *S. aureus* has been submitted. A final fourth paper on the molecular epidemiology of streptococcal infections is in preparation. The thesis defense of Dr. Barlow took place in the fall of 2008.

- **Economics of repeated clinical mastitis cases (USDA funded)**

The objective of this project is to estimate the economical costs of repeated cases of clinical mastitis. This project was funded through a USDA NRI grant. A PhD student is working on this project in collaboration with QMPS faculty and Drs. Tauer and Grohn. Data collection has now been completed and three manuscripts have been published. A presentation on this topic was presented as a key-note presentation at the World Buiatrics Meeting in Budapest in July 2008. The results indicate that repeated cases of clinical mastitis are associated with important economic losses as observed in milk production and culling risk. The cost of every repeated case is only slightly less when compared to the first case. Further research with this data is ongoing and will result in a number of papers to be published in the fall of 2009

- **Klebsiella Mastitis (NNYADP and industry funded)**

*Klebsiella* has replaced *E. coli* as the most deadly cause of mastitis in many New York dairies. Traditionally, *Klebsiella* was thought to come from wood products used as bedding. Use of sand reduces the risk of *Klebsiella*, but it continues to be a killer in well-managed herds. We showed that many healthy cows carry *Klebsiella* in their rumen and gut, and shed it with feces. Fecal contamination of drinking water and feed is the most likely source of *Klebsiella* in the cows' gut. Manure with *Klebsiella* also ends up in bedding and in alleys, and it splashes onto legs and teats. Pre-milking udder disinfection removes some of the *Klebsiella* from teats. Dirty cows

are especially likely to have *Klebsiella* on their teats, even after udder prep, which puts them at risk of mastitis. Alley and animal hygiene are important and neglected areas of *Klebsiella* control. In 2007, 2008, and again in 2009, our producer-driven *Klebsiella* research received funding from the Northern New York Agricultural Development Program and the College of Veterinary Medicine.

- **Chronic Coliform Mastitis (industry funded)**

A team of researchers from QMPS and Cornell University Department of Population Medicine and Diagnostics have joined to examine the question of udder inflammatory response to coliform infection during the dry period. Mastitis is commonly noted during the late stages of the dry period and into early lactation. There are currently no effective preventative procedures in place to reduce the rate of coliform mastitis in the late dry period. The team of QMPS researchers is working to address the problem of coliform mastitis during the dry period and early lactation by examining how the udder responds to bacterial infection during these critical stages. By analyzing the changes in the Th1/Th2 dominance of the immune signaling response during the transition from the dry period to early lactation, this study will provide new approaches, and perhaps new targets for the prevention of coliform mastitis that is initiated during the dry period. Several challenge studies have now been completed and the first manuscript is submitted for publication.

- **Dynamics of infectious diseases on dairy farms (RDQMA project – ARS funded)**

QMPS continues to be an important player in the ongoing Regional Dairy Quality Management Alliance (RDQMA) Research Project. More than five years of sampling has been completed on the research farm in New York, coordinated by QMPS personnel. The Pennsylvania farm (coordinated by Penn State) and Vermont farm (coordinated by University of Vermont) continue to sample on a regular basis. Samples collected from all three research farms are sent to Agricultural Research Service (ARS) laboratories at Maryland and Georgia, and University of Pennsylvania.

Dr. Jo Ann Van Kessel and Dr. Jeff Karns from the Agricultural Research Service (ARS) in Beltsville, MD have been dealing with *Salmonella*, *Listeria*, and *E. coli* culture on all fecal and environmental samples from the three dairies. In addition, Dr. Paula Fedorka-Cray and Sandra House at ARS-Georgia have analyzed fecal and environmental samples from all three farms for the presence of *Enterococcus*, *E. coli*, *Salmonella*, *Campylobacter*, and antimicrobial resistance pathogens. Further modeling work was done to understand the efficacy of control strategies such as vaccination in one of the research farms to reduce the prevalence of *Salmonella*. Continued bulk tank analyses conducted by the research team at the Penn State show the high quality of milk from these research farms along with producer's excellent stewards of their animals. Different samples collected from a research farm showed the presence of *Listeria* in the dairy environment. Dr. Alejandra Latorre, a Ph.D. student, has been working at the molecular laboratory in QMPS, Ithaca, to study the molecular subtypes of this organism using pulse field gel electrophoresis (PFGE) and to characterize the persistence of different *L. monocytogenes* strains to further investigate whether any infection transmission patterns can be observed. PFGE patterns indicated different strains of *L. monocytogenes* were present in different sources (e.g., fecal material, milk, milk filter, milking equipment). The presence of biofilms in the milking equipment has been identified with the use of scanning electron microscopy.

For the presence of MAP (etiological agent of Johne's disease in cattle), fecal and serum samples from the dairy cows were analyzed over the past years in Dr. Bob Whitlock's lab at the University of Pennsylvania. RDQMA fecal samples have been used to validate a Real-Time PCR test for the diagnosis of MAP in cattle. Collected data shows the serious impact that one MAP supershedder can have on the environment of an entire farm. Rebecca Smith, a Ph.D. student has

been working on the data from RDQMA research farms in the area of economic analysis for Johne's disease, milk production, and reproduction. The multilocus short sequence repeats (MLSSR) strain identification of MAP isolates allows us to better understand how MAP is moving around farms. We can better define which cows are infected from particular sources as well as tell which animals are contributing to environmental positives. We can also evaluate whether different infectious strains are better at surviving within animals or spreading between them. Using MLSSR technique, Aagje Kramer, Rebecca Mitchell, and Dr. Abani Pradhan evaluated whether lows shedders of MAP were pass-through animals or whether they are truly infected and whether these animals were possibly infected by the super-shedders.

Results from the labs and the data gathered on the farm in the form of economic, nutrient management, and individual cow health are continuously updated and maintained in the RDQMA database. An on-line management survey is administered quarterly at each farm visit with all data incorporated into the database. Results from this RDQMA study have recently been published in several peer-reviewed journals and multiple publications are currently in the pipeline for publication in peer-reviewed journals.

- **Several case studies**

QMPS faculty prepared several case studies for use in continuing education and student teaching. A number of these case studies are submitted for publication in peer reviewed journals. A large number of these case studies are used for extension publications. An important outlet for our extension publications is our newsletter in the Northeast Dairy Business publication (QM2). A case study on *Klebsiella* mastitis and a case study on *Listeria monocytogenes* biofilms were published recently.

- **Milk Quality, Food Safety and Animal Health on Organic Dairies (USDA funded-2 studies)**

Milk quality and udder health has been followed on four dairy farms that are making the transition from conventional to organic dairy production. Four farms have completed the field phase. Bacterial isolates collected will be evaluated for changes in antimicrobial susceptibility over time. Rapid diagnostics for foodborne pathogens in bulk milk continue to be developed. In mid-2008 a website will be launched to begin to bring information gathered from this study to the public. A second study, in collaboration with University of Wisconsin and Oregon State University has recently been launched and will assess animal health and well-being on organic and conventional farms.

## ***Development***

- **Bulk Tank Surveillance Project (A&M funding 2007-2009)**

Bulk Tank Surveillance of animal health, foodborne pathogen testing, and milk quality parameters in dairy herds using bulk milk has been a well-received concept. Producers, veterinarians, and consultants have all embraced the project. Our short-term goal for open enrollment is 100 farms by summers end.

Bulk milk collection by the milk haulers has worked well so far. We have met with milk haulers to explain the project and ask for their in-kind collaboration. Milk haulers have expressed their support of helping dairy producers by taking extra samples as directed.

A new addition to the project is the partnership between the NYSCHAP Program and the bulk Tank Surveillance Project. Over the next year, we will enroll all NYSCHAP Mastitis Module Participants into the project. This will allow producers the opportunity to schedule milk sample collection every other month (6 times per year). They will no longer have to keep track

of their vouchers; the NYSCHAP discount will be automatically applied. Producers will pay an annual cost of \$35 for which they will receive mastitis pathogen and *Mycoplasma* testing. This addition to the project will allow producers and their veterinarians an easy, inexpensive way to monitor herd health through bulk milk.

- **Molecular diagnostics test development**

The Molecular laboratory staff is continuously developing new diagnostic assays for use in routine services. The staff recently completed a multiplex PCR test for food borne pathogens. This test is now routinely offered through our Bulk Milk Monitoring System. New tests in the process of being developed include routine streptococcus speciation PCR assays and Coagulase Negative Staphylococcus speciation through sequencing of housekeeping genes. These tests are now routinely offered to our research clients. Further development is in the detection of *Campylobacter spp.* in bulk tank milk is underway. The assay has been developed and is now validated against classical culture systems.

- **Streptococcus speciation in routine diagnostics**

As of April 1st, all four QMPS laboratories now offer streptococcus speciation in their routine diagnostic services. In the last year this service has been developed under the guidance of our bacteriology staff. Addition of an Enterococcosel plate to our diagnostic panel will allow our laboratory technicians to reliably diagnose *Streptococcus dysgalactiae* and *Streptococcus uberis* and distinguish these from 'other' streptococcus species. Further work on this is funded through a collaborative grant with the Keseca Veterinary Clinic and funded through the New York Farm Viability Fund. A paper on this project was recently published in the Eastern Dairy Business.

### **3. Teaching and Outreach**

- **Two-week intensive course in Milk Quality for veterinary students**

An intensive two-week course (VM704 - Milk Quality Elective) for veterinary students was held July 28<sup>th</sup> through August 8<sup>th</sup>, 2008. Fourteen students were registered to attend the course. The program was designed by QMPS personnel and included speakers on various topics of mastitis and milk quality, milking parlor evaluations, laboratory training for mastitis diagnosis and herd visits. Student's performance was evaluated through a written final exam and an oral presentation (analysis of procedures and management of a selected dairy farm for production of quality milk) before a panel that included owners and personnel from the dairies visited. This year's participating students graded this course from very good to excellent.

- **Language Services Program**

Throughout this period, we continued to offer training and translation to our dairy farms. October through March our trainer stayed close to home with pregnancy and the birth of her baby. Nevertheless, we conducted over 50 farm trainings and meetings. Additionally, we conducted various on-farm chemical and animal handling safety trainings through our collaboration with NY-CAMH. Neighboring states continued to request our services. As well as teaching an on-farm dairy Spanish course in April and May, we completed our 5th year of teaching the Spanish for Dairy Veterinarians at Cornell's Summer Dairy Institute.

- **Laboratory Proficiency Program**

Entering its sixth year, the Laboratory Proficiency Testing Program remains an important aspect of an external quality assurance program. Diversification of the program now includes

research facilities and farms with on-site laboratories along with veterinary practices. Currently, there are 21 enrollees participating throughout the United States, as well as all QMPS laboratory technicians. Many changes are being implemented to make this program more streamlined and efficient.

- **Certified Dairy Equipment Technician Program**

Our Certified Dairy Equipment Technician Program, which operates under the auspices of the Empire State Milk Quality Council, continues to remain a successful venture with 67 technicians completing their certification to date. Four to five additional individuals are interested in becoming certified in the near future and are currently preparing for their exam. We exhibited in Syracuse at the Farm Show and also at the August Empire Farm Days Show in Seneca Falls. This helps to promote the benefits of certification for those who work with milking equipment including milk inspectors, equipment dealers, dairy veterinarians and faculty.



- **“Super” Milk Program**

There were 1,268 "Super" Milk achievers for 2008 and signs commemorating their hard work were handed out in June. Requirements for this achievement include a Somatic Cell Count (SCC) below 250,000 for at least ten out of 12 months, nomination by a certified milk inspector, and consistent standards of cleanliness and quality. This is the 19th year of this program. The Empire State Milk Quality Council (ESMQC) has 37 “Super” Achievers that have qualified for all nineteen years. Additionally, ESMQC meets four times a year to continue to recognize and support dairy industry.

- **“Super” Milk and Dairy Technician Certification Programs execution under Supervision of the Empire State Milk Quality Council**

These programs are a continuous effort of our QMPS staff. Mr. Scott Steiner chairs the Equipment Technician Certification Program. Continuously updated information on this program is available at <http://qmps.vet.cornell.edu/Programs/certifiedtech.htm>. The 'Super Milk' program is administered by Mrs. Kerry Case with support of Ms. Belinda Gross. Continuous updated information on this program is available at <http://supermilky.org/index.asp>.

- **Two continuing education programs for veterinary practitioners in collaboration with QMPS and Pro-Dairy, AHDC Field Services Section**

QMPS faculty and staff organized and contributed to a two-day seminar in May 2008 for a group of 40 dairy veterinarians from Italy. The program was sponsored by Pfizer Animal Health of Italy.

A two day training program for all QMPS field and veterinary staff was held in June 2008. The purpose for the training was to update QMPS staff on new technology and methods for evaluating milking system cleaning processes and evaluation of milking system performance. Dr. Doug Reinemann from the University of Wisconsin Milking Research and Instruction Laboratory (UWMRIL) was the principle instructor.

Two Culture Workshops were conducted for approximately 25 veterinarians, veterinary technicians and farm personnel in October 2008.

Two education programs were conducted March 2009 for veterinarians and technicians in Western (Wyoming Co.) and Central NY (Ontario Co.). Subject matter included milking procedure evaluation and diagnostics, mastitis laboratory diagnostics, and development of information based treatment protocols. The workshops were sponsored in part by Intervet/Schering-Plough.

Additional educational and training events provided by QMPS included VM665, Block VII CVM courses, Training for several Organic Dairy Production Programs in New York and other major dairy producing states.

### **Support system in times of disasters that impact the dairy industry**

At this point in time, it has not been necessary to employ our laboratories to assist in disasters that impact the industry. However, with the homeland safety issues that have dominated our concerns, we are ready to assist in any necessary manner.

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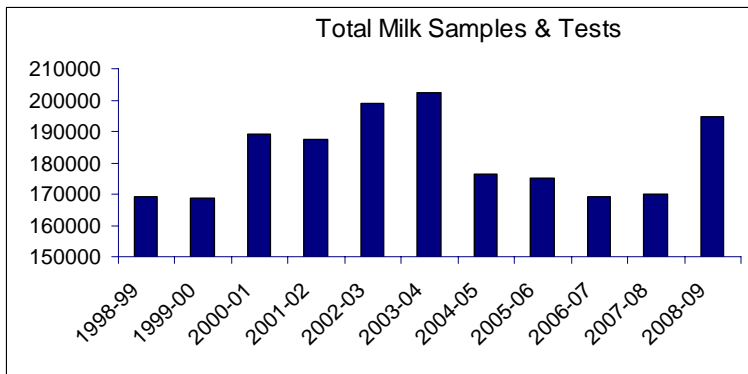
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**Appendix 1:**

**QMPS Laboratory Activities**

	<i>April 2007 – March 2008</i>	<i>April 2008 – March 2009</i>	<i>Percentage Difference from last year</i>
Milk Samples	125,343	137,990	+10%
Other Tests	7,247	13,014	+80%
<i>Mycoplasma</i> Tests	34,009	40,261	+18%
Bulk Tank Cultures	3,233	3,259	+1%
<b>Total Tests Completed</b>	<b>169,832</b>	<b>194,524</b>	<b>+14%</b>
Voluntary Surveys	494	397	-20%
Required Surveys	501	530	+6%
<b>Total Surveys Completed</b>	<b>995</b>	<b>927</b>	<b>-7%</b>

Comparison of Total Samples and Tests over Time



Ratio of Herd Surveys  
April 2008-March 2009

