

Using Thermo Fisher LIMS Software for flexible information management at a bovine DNA testing laboratory

GeneMark is a purpose-built DNA laboratory that is owned by the Livestock Improvement Cooperative (LIC). Primarily created to develop a commercial testing market for single genes and parentage testing for dairy cows, GeneMark required a flexible solution for the storage and processing of its samples and results. GeneMark chose Thermo Fisher™ LIMS software to record over 300,000 samples per year resulting in over 21,600,000 DNA marker results and cost savings of more than NZ\$1 million per annum.

GeneMark and LIC

The Livestock Improvement Cooperative (LIC) is the world leader in dairy herd improvement in New Zealand and for international dairy farmers. LIC is a cooperative, owned by some 12,500 New Zealand farmers, users of its products and services. LIC's head office is at Newstead in Hamilton, New Zealand with regional bases around New Zealand and branches in Australia, UK and Ireland plus agencies in South America, United States, Asia and South Africa. LIC employs upwards of 2,500 people in the peak of the season.

The cooperative focuses on the whole range of issues concerning the dairy industry in New Zealand and its expertise is used to improve dairy farming around the world. Areas of involvement include: beef, deer and dairy animal recording; dairy herd testing and milk analysis laboratories; farm automation solutions for beef and dairy; industry statistics and trends; animal health management; traceability systems for beef,



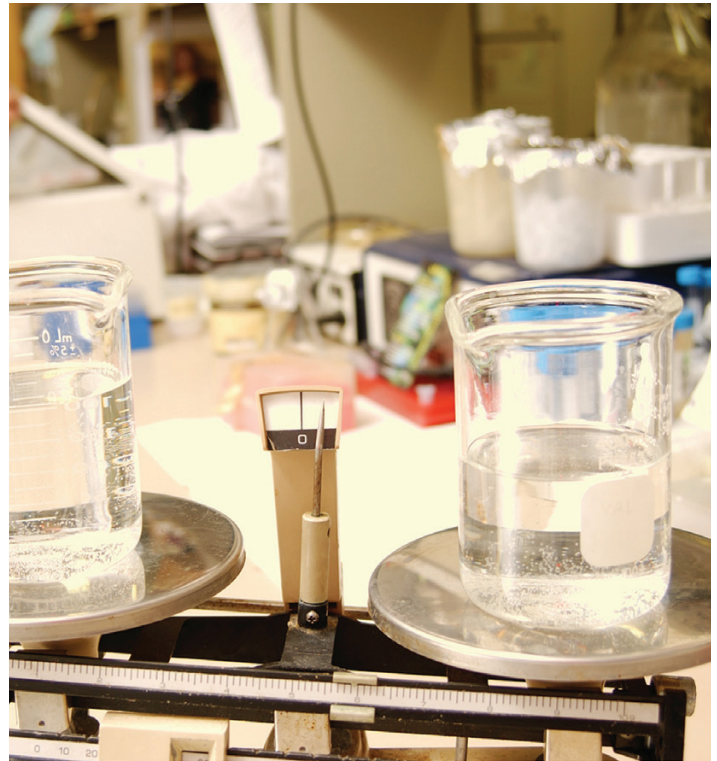
deer and dairy; on-farm consultancy service; research and development; female productive technologies for beef, dairy, sheep, pigs and goats; progeny testing of dairy and deer, DNA analysis across species—beef, deer and dairy—and artificial breeding for the beef, dairy, and deer industries.

In 1999, as part of its research and development activities, LIC launched GeneMark, the largest commercial bovine DNA analysis service in New Zealand. GeneMark's service offers dairy (bovine) farmers, breed societies and other artificial breeding (AB) companies the only completely accurate way of recording an animal's ancestry to help protect their investment.

The challenge

GeneMark offers a range of bovine DNA testing services at its purpose-built DNA laboratory, with the focus on sample processing and parent matching using DNA profiles. Tru-Parent uses DNA testing to identify and accurately record an animal to the correct sire. Many customers use the service to confirm and verify the parentage of an animal with incomplete or inaccurate herd records. Calf Trace provides farmers with a simple and effective way to match calves to sire and dam, by providing GeneMark with dam calving dates and a DNA sample. GeneMark then ensures that all calves are correctly matched and recorded, and that their parentage is verified. Production and lethal gene testing services are also carried out at the GeneMark facility.

Most inaccuracies in herd records stem from errors in recording and identification, and work in commercial herds estimates the average calving errors to be 20% and above. Approximately one in six calves has the potential to be mis-mothered, mis-tagged or mis-recorded. Inaccuracies such as this can result in inbreeding problems in herds, which can cost up to NZ\$1000 per animal in lost production, and the most at-risk animals for inbreeding problems are those with uncertain or unknown parentage.



It is essential that GeneMark has in place a system which overcomes the challenges faced when identifying bovine parentage. Accurately recording an animal to sire using Tru-Parent means that the customer receives more reliable records and a true breeding worth value to increase the herd's capital value, as well as allowing farmers to make breeding, selling and culling decisions supported by accurate records.

GeneMark processes 300,000 DNA samples per year and this number is constantly increasing. For DNA profiling, this is the equivalent of 21,600,000 DNA marker results processed annually. To cope with the growing number of samples while continuing to provide reliable DNA results, GeneMark required a Laboratory Information Management System (LIMS) capable of effectively storing and processing large amounts of data.

In processing bovine DNA samples, GeneMark uses a unique national database constructed by LIC. The system offers unparalleled traceability, world class genetic improvement systems and laboratory automation solutions. LIC originally developed its own in-house software, Aquarius, to record and retrieve genetic information stored in this database, which records a range of information including mating records and DNA profiles, and is accessible by cooperative members. Regular and detailed herd recording is encouraged for all LIC members to accumulate the widest possible data stream.



LIC was experiencing a period of rapid growth and needed to streamline its software to ensure a high throughput commercial environment. Therefore it was decided that an additional system was required to process the increasing number of DNA samples. LIC looked for a LIMS that would enable users to adapt the system as the company's requirements changed and increased.

Initially, Aquarius was developed to link LIC to the national database in order to access customer and mating records. Looking for a LIMS that would integrate with this system, LIC chose Thermo Fisher LIMS software for its flexibility and excellent reputation.

Implementation

Prior to installing the Thermo Fisher LIMS software solution, LIC did not have any real system for storing and retrieving information. When the decision to implement a LIMS was taken, LIC investigated a wide range of systems but found that none matched the benefits of the LIMS in terms of scale, flexibility, adaptability and user friendliness. Designed to meet the changing demands of laboratories today, the LIMS provides a foundation for the storage and processing of vast quantities of data. Robust and adaptable with easily configured extensions, this is the LIMS of choice for many organizations worldwide.

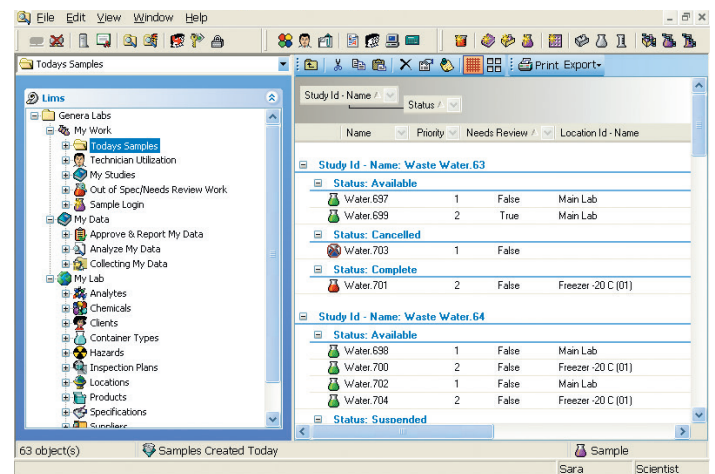
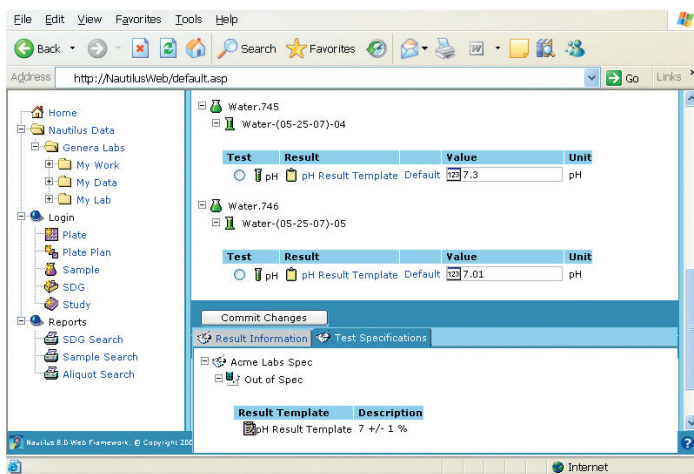
Thermo Fisher LIMS software includes patented workflows technology with a flexible and intuitive interface to graphically map laboratory workflows of the sample life cycle. The flexibility of the LIMS and its capacity to handle large amounts of data provides the ideal system for GeneMark's increasing sampling requirements. With its built-in instrument integration, the LIMS offers productivity gains right from the outset and the flexibility of the software offers the option to

build extensions in order to interface to other systems, such as GeneMark's Aquarius software.

Thermo Fisher Scientific's proven track record of approachability and strong technical support also appealed to LIC. GeneMark was able to deal with the same Thermo Fisher Scientific representative for the duration of implementation, ensuring that the process was as simple as possible for the company. Thermo Fisher Scientific provides full user training for its customers, and GeneMark also has ongoing support from the company to deal quickly with any issues that may arise.

To appropriately access and archive the vast amounts of data generated by LIC and GeneMark, the LIMS has been integrated into Aquarius. This has enabled the configuration of an automated system that receives samples, fractions them into appropriate vessels for testing, analysis and storage, and tracks and stores all data relative to the samples. Data collection, resource management and data processing are both automated, and results are stored in a central database. The LIMS can then be used to generate frequent updates and management reports. Researchers can also track sample status and download final results in real time.

Aquarius can retrieve samples from the LIMS tables, using the information to run parent matching logic, and create reports for the customer. The systems are also capable of duplicating parentage results to the national database, processing invoicing and storing staff and inventory records.



Results can be entered using the web or within the LIMS clients. The full power of the LIMS is accessible using a Windows client or a standard web service.

Laboratory Data Management Solutions



Benefits achieved with Thermo Fisher LIMS Software

Improvements in the laboratory have been made by adapting the LIMS to existing systems, and by streamlining workflows. The LIMS has kept pace with the constantly changing demands required of it and the laboratory now works only as well as the LIMS does. The business changed exceedingly quickly as GeneMark experienced rapid growth, with the attendant need to streamline the LIMS to ensure the effective processing of samples in an increasingly commercial environment. GeneMark is always introducing and developing additional tests and products which means that the ongoing flexibility of the LIMS is essential.

Unlike other LIMS, the flexibility of the Thermo Fisher LIMS software in a quickly advancing scientific world means that improvements and changes can be made with minimal cost to the business. With its intuitive user interface, the LIMS can be managed and molded into a system that is open and transparent. This means a commercial scientific business can grow rapidly without being handicapped by a rigid LIMS system.

Next steps

LIC's vision is to be an essential partner on farm and in food supply chains. With revenues of NZ\$110.5 million, LIC looks set to continue its expansion. Using the Thermo Fisher LIMS software means that LIC and GeneMark will be able to easily integrate new developments and systems, as well as expanding the LIMS to accommodate the projected increase in sampling and testing results.

Conclusion

In order to maximize profits and the efficiency of animals in a dairy herd, it is essential to record the performance of the herd using a reliable system. LIC has now put in place a complete solution to analyze and process every sample that it is given, and the LIC team continues to develop products and services using leading-edge technology. LIC's aim is to make the business of bovine farming simpler to manage and more profitable for its members. In tandem with these aims, it is crucial to have the support of a functional, flexible system to manage the vast quantity of information required to improve bovine farming. With the LIMS, LIC has succeeded in implementing a reliable information management solution in a cost-effective, efficient manner, ensuring that its database and processes are able to reflect the growth and development of the business.

Ben Crawford, LIC Diagnostics Operations Manager of GeneMark, comments, "We have been very agile in the growth of the business as a result of the flexibility of Thermo Fisher LIMS software, which has been the key to our business success. No other LIMS that we have encountered could have provided this. With two significant IT rationalization projects completed, Thermo Fisher has helped us to achieve cost savings of more than NZ\$1 million per annum."

Partnering with Thermo Fisher Scientific

Thermo Fisher Scientific is the worldwide leader in laboratory software and services, providing enterprise-wide, multi-laboratory solutions that are relied on at food and beverage companies such as Bacardi, Coca-Cola, Bulmers, Kellogg, Müller Dairies, Nestle, Purac, Sara Lee, Scottish Courage, South African Sugar and Quaker Oats. To support our Thermo Fisher LIMS software installations, we provide implementation, validation, training, maintenance and support from the industry's largest worldwide informatics services network.

Find out more at [thermofisher.com/IntegratedInformatics](https://www.thermofisher.com/IntegratedInformatics)

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