JOHNE'S DISEASE
RESEARCH CONSORTIUM

ANNUAL REPORT 2010

Contents

Definitions: **2**
JDRC DIRECTORS **3**
JDRC BOARD OBSERVERS **4**
MANAGEMENT **4**
JDRC REPORT **5**
THE SCIENCE PROGRAMME **6**
JDRC'S 5 YEAR SCIENCE PROGRAMME **7**
Science Activity and Progress **8**
THE HIGHLIGHTS FOR 2009-10 ..... **9**
WORKING TOGETHER 10
CONSEQUENCES OF MAP INFECTION 11
HERITABILITY OF JOHNE'S DISEASE 11
COMMUNICATING OUR RESULTS **12**

Definitions:

JDRC	Johne's Disease Research Consortium
MAP	*Mycobacterium avium paratuberculosis* – the bacterium that causes Johne's disease
Paratuberculosis	Another name for Johne's disease
PTB	Paratuberculosis
UJV	Unincorporated Joint Venture

JDRC DIRECTORS

Dr Andrew MacPherson, Independent Chairman

Dr Jimmy Suttie, AgResearch Limited

Mr Richard Wakelin, Beef + Lamb NZ Limited

Dr Eric Hillerton, DairyNZ Incorporated

Dr Amanda Bell, DEEResearch Limited

Dr Steve Harcourt, Livestock Improvement Corporation

Dr Frazer Allan, Massey University

Dr Bret Morris, Otago University

JDRC BOARD OBSERVERS

Mrs Helen Sillars, Foundation of Research Science and Technology

Dr Lindsay Burton, Dairy Companies Association of New Zealand

Mrs Robyn Deacon, Meat Industry Association

MANAGEMENT

Miss Kaylene Larking, JDRC Manager

JDRC REPORT

The Johne's Disease Research Consortium (JDRC) was formed in 2008 with a mandate to deliver cost effective tools to the livestock industry to reduce the impact of Johne's disease on farm in New Zealand. In October 2010, JDRC has successfully completed the second year of activities in its 5 year research portfolio and is making good progress towards achieving its long term goal.

JDRC participants, Beef + Lamb New Zealand Limited, DEEResearch Limited, DairyNZ Incorporated, Massey University, Otago University, Livestock Improvement Corporation, AgResearch Limited, and the Foundation of Research Science and Technology, have committed $9.5 million dollars over the life of the Consortium towards the goal. The Meat Industry Association and Dairy Companies Association of New Zealand are associate participants in the Consortium.

Mycobacterium avium paratuberculosis (MAP), the obligate pathogen that causes Johne's disease is a difficult organism to study and Johne's disease itself is complex. The collaboration of New Zealand's major industry associations and research expertise to investigate solutions is vital to ensure New Zealand benefits as much as possible from investment in this area.

In 2009-10 JDRC has increased its focus on mechanisms for the delivery of outcomes to the farming sector, as the research programme matures. The organisation has also refocused the science plan to account for a reduction in funding from July 2010. In the science area JDRC has continued to deliver targeted outputs, including the completion of the diagnostics study to improve quantification of MAP infection in a range of sample types, the development of a strain typing analysis system for differentiating New Zealand strains of MAP and the completion of on farm sample collection of over 300 farms for determining the prevalence of disease on farm in NZ.

At the completion of the science programme it is our intention that JDRC will have developed a number of cost effective, practical tools for New Zealand, aimed at ensuring that Johne's disease is not a threat to New Zealand's agricultural economy or trade.

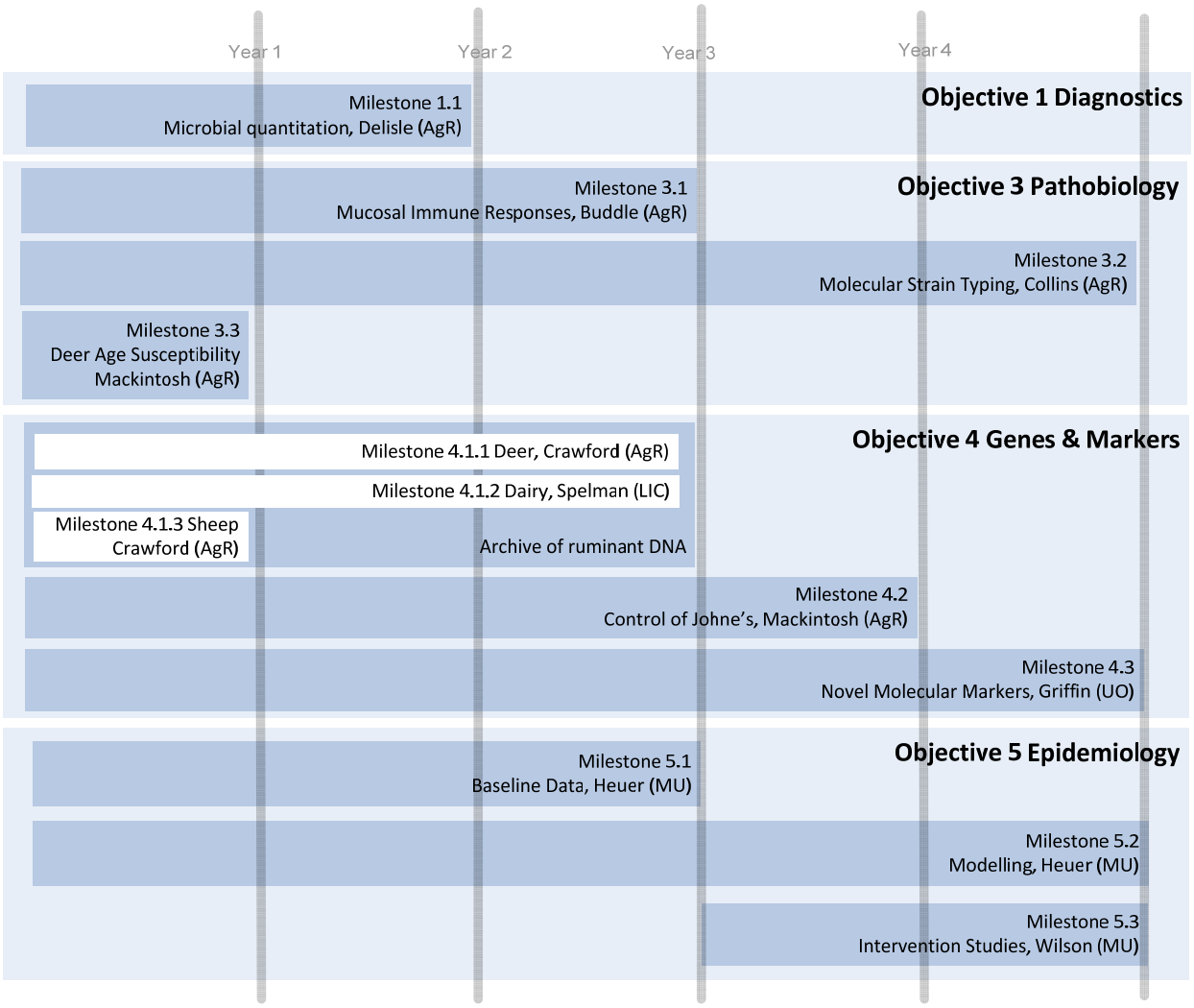
THE SCIENCE PROGRAMME

The role of the JDRC is to carry out research that produces tools to reduce the impact of Johne's disease on farm. The science plan has four major objective areas; improving diagnosis of Johne's disease, understanding the pathobiology of the disease, determining markers for genetic resistance and understanding Johne's disease epidemiology in New Zealand. The science team, experts from AgResearch, Livestock Improvement Corporation, Massey University and the University of Otago is actively working, sharing information and practical resources wherever possible to maximise the outcomes of the research expenditure. The strength of the consortium is its ability to combine the expertise of this science group with the backing of the agricultural industry and the Government to ensure New Zealand is well positioned to manage and control Johne's disease.

Johne's disease continues to be a focus for a number of major research groups around the world. JDRC is watching international developments, both contributing to and drawing from this information to ensure that the programme of work is scientifically robust and internationally relevant. JDRC utilises an international advisory group to review the science programme annually. In 2010 the group noted both the relevance and unique contribution of JDRC's programme to the global research effort, through its focus on effect of MAP on the animal host.

JDRC has increased its focus on science delivery in 2009-10, consulting veterinarians and farmers with an interest in Johne's disease control to discuss their needs and review outputs from the programme. While a diverse range of understanding exists across the sectors regarding the disease, all participants agreed that there was a need for consistent, practical information regarding disease prevalence, control and management for farmers. Famers demonstrated a preference for the development and introduction of genetic tools for the selection of resistant or resilient animals as the most effective means of combating the disease. In the coming year JDRC is planning further initiatives to improve the transfer of Johne's disease information to industry.

JDRC'S 5 YEAR SCIENCE PROGRAMME



Science Activity and Progress

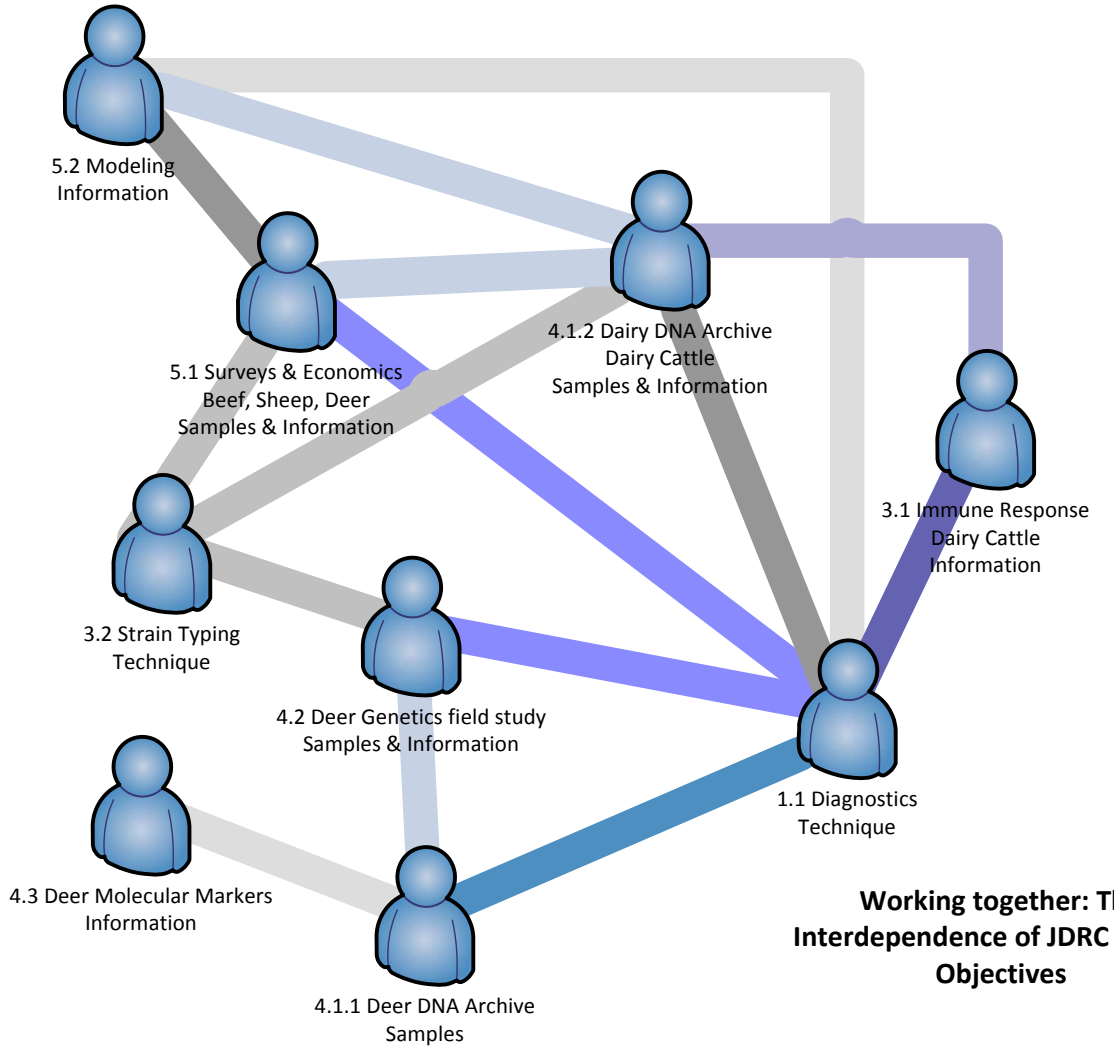
Diagnostics	The JDRC diagnostic study was completed this year and has achieved its target to provide improved capability for the quantification of MAP in bacterial cultures, tissues and faeces. The study has improved existing diagnostic techniques and the resulting procedures are being used by JDRC researchers to underpin ongoing scientific studies.
Pathobiology	In cattle both experimentally challenged with MAP and naturally infected with Johne's disease, researchers have identified a number of factors that show how the immune system of the gut responds to infection. These results point to mechanisms which may explain why some animals are susceptible to MAP, while others remain uninfected on exposure to the bacteria. Researchers have extended the MAP typing system developed for cattle strains in the first year of study to sheep strains. The typing system clearly distinguishes between cattle and sheep strains, and discriminates between subtypes within these major groups.
Genes and Markers	Sample collection for the Dairy and Deer DNA Archives is almost complete, with more than 1900 and 1200 samples collected from infected deer and dairy cows respectively. Field aspects of genetic studies have shown clear differences in disease response between deer breed from MAP resistant and MAP susceptible lines, while in the laboratory macrophages, a type of white cell key to immune response, can now be predictably isolated and cultured for study. The long term goal of both studies is to establish if there are meaningful differences between the gene expression in animals or macrophages that can be correlated to disease resistance or susceptibility.
Epidemiology	On-farm sampling for the epidemiology programme has been completed and the disease status results from individual farms reported to participating vets and farmers. Analysis of this data is expected to yield information regarding disease prevalence rates and economic effects for New Zealand beef, sheep and deer farms. Prototype computer models have been developed to evaluate the accuracy of faecal culture and Paralisa as diagnostic tests for deer and evaluate disease prevalence. The prevalence model is unique in that it will be able to simulate conditions on multispecies farms. Once complete is intended to be used as a tool for the cost effective evaluation of the effects of implementing various disease interventions.

THE HIGHLIGHTS FOR 2009-10

WHAT HAS BEEN DONE	THE RESULTS	HOW THIS HELPS	WHAT IS STILL TO BE DONE
Completion of a study to improve diagnostic capability for Johne's disease	Culture & PCR of pooled faecal samples have proven cost beneficial for determining the MAP infection status of herds & flocks.	JDRC researchers are using the improved ability to more accurately analyse samples, underpinning ongoing research programs	This work has been completed and no further studies are planned
Development of an analysis system for differentiating between strains of MAP	Approximately 20 Type C and 8 Type S sub strains of MAP have been identified in samples isolated in New Zealand.	By examining strain type researchers can analyse how the different strains of the bacteria are distributed on farm in New Zealand	Applying the strain analysis to JDRC samples collected from deer, sheep beef and dairy cattle through 2008-10
Over 1200 DNA samples have been collected from dairy cattle identified as infected with Johne's disease	Of 5000 herds screened for the archive, approximately 1% of herds were test positive & 5% of herds were classified as suspect for Johne's disease. Jersey cows show 3 times more test positive animals than Holstein-Friesians.	DNA samples will be used to develop a test for determining resistance or susceptibility to Johne's disease, while dairy prevalence data will be collated with survey data to provide up to date information about disease prevalence in New Zealand.	Genotyping studies to identify genes indicative of resistance or susceptibility in dairy cattle.
Sampling of over 300 deer, beef and sheep farms for the epidemiology survey has been completed.	Preliminary data suggest subclinical Johne's disease is having an effect on production performance in deer and that co-grazing on multispecies farms influences infection rates	Understanding prevalence and the impact of the disease on production performance is strategically valuable for New Zealand.	Sample collection from additional farms and final collation and publication of prevalence and economic data from the study.

WORKING TOGETHER

The benefits of working collaboratively to reduce the impact of Johne's disease in New Zealand are materialising as the JDRC programme matures, with an increasing emphasis on resource and information sharing between the science teams in the Consortium. One example of this dynamic is resource and expertise sharing that supports the assembly of data on the prevalence and transmission of Johne's disease in New Zealand deer, sheep, beef and dairy cattle farms. Whilst the



Working together: The Interdependence of JDRC Science Objectives

prevalence study being carried out at Massey University is focussed on deer, sheep and beef cattle, valuable information regarding dairy cattle is being gathered and passed to the epidemiologists from screening and sampling work carried out at Livestock Improvement Corporation for the Dairy DNA archive. In the coming year, deer, sheep, beef and dairy samples collected for the survey and archive will be subject to detailed strain typing using the JDRC funded diagnostic resource developed at AgResearch. This strain information will be used to determine if there are any underlying trends in disease distribution and transmission for livestock in New Zealand.

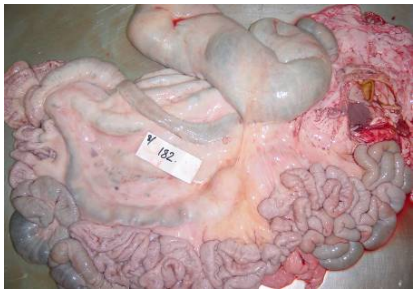
CONSEQUENCES OF MAP INFECTION

Farmers and Veterinarians participating in the JDRC Epidemiology Survey were updated in late 2009 regarding the disease status of animals on their individual farms. The full data set is currently being collated, but early data indicate that the disease is widespread through New Zealand, with economic consequences for those experiencing both clinical and sub-clinical disease. Responses from deer farms indicate decreased pregnancy and weaning rates where clinical disease is detected on farm. There is also clear evidence on multispecies farms, that when clinical disease is found in one species it is highly likely to be found in the other species on farm and these associations are strongest when the animals are co-grazed.

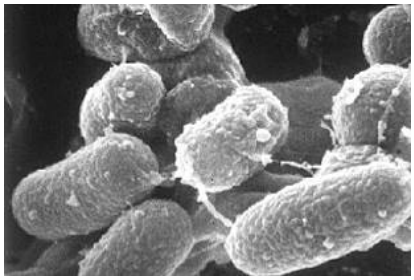
HERITABILITY OF JOHNE'S DISEASE

In the second JDRC funded genetics field trial, deer have been bred from stags identified as either resistant (R) or susceptible (S). The offspring were then challenged with an oral dose of MAP and their blood, weight and lymph nodes monitored over a period of 50 weeks before slaughter. A clear difference was noted between the two groups of offspring, with the majority of S animals developing severe disease and the majority of the R animals having no or only mild disease symptoms.

It was notable that most of the R offspring showed a lower degree of disease progression at slaughter (as determined by lymph node lesion score) than at week 13 of the trial, indicating that R animals seem to have the ability to "self cure".



Each of the R and S sires had offspring with opposite disease outcomes (i.e. an R sire with two severely affected offspring, and the S sire one offspring that was only mildly affected), but this result was not unexpected as the stags were bred across randomly selected hinds with unknown Johne's status.



These outcomes suggest that resistance to disease appears to be highly heritable. In the next stages of this study lymph node samples are being examined to look for markers that signal what the underlying genetic basis may be for Johne's disease resistance and susceptibility.

COMMUNICATING OUR RESULTS

A key objective for the JDRC is ensuring that the information developed by this Consortium is available to and used by farmers. JDRC is using existing networks and resources of its participants to distribute information to the public, including industry newsletters.

JDRC has also developed a website (www.jdrc.co.nz)

For further information please contact:
Kaylene Larking
Consortium Manager
Johne's Disease Research Consortium (JDRC)
Level 4, Wellington Chambers
154 Featherston Street
Wellington 6140
New Zealand
info@jdrc.co.nz ♦ www.jdrc.co.nz