

RESEARCH IN THE INDUSTRY – WHERE IS YOUR MONEY INVESTED?

Bruce Thorrold
Strategy and Investment Leader Productivity / DairyNZ

Introduction

Gains in productivity are vital to the competitiveness of dairy farmers. DairyNZ invests almost a third of the milksolids levy into research, with the bulk of this investment to help increase productivity. But we are a small investor internationally. New Zealand dairying operates in an international technology environment. We source technological innovation both locally from NZ companies such as LIC, PGG Wrightson and Gallaghers, and from off-shore companies including Pioneer, DeLaval, Lely and Pfizer. So we don't need to (and can't afford to) buy all the research that the dairy industry needs.

Innovation isn't all based on technology that you can buy off the shelf. A lot of the innovation on NZ dairy farms stems from systemising knowledge. The Feed Wedge, Spring Rotation planner and Supplement Feeding Guidelines are good examples of innovation that DairyNZ and its predecessors have invested research and development funds into, packaging up farm management knowledge into tools for farmers.

To get the on-farm productivity gains that the dairy industry needs DairyNZ invests in three main research activities;

- Systems research that tests the application of new ideas and technologies. This work happens on research and commercial farms.
- Component research that bridges between basic science and systems work, and provides a core of experts in the dairy industry.
- Partnerships with agri-business and industry that share risk, access government funds and focus private investment on farm systems solutions.

Examples from the past – animal genetics and robotic milking

While we can import technologies, it is important that these are tested in NZ grazing conditions. Research in several Holstein-Friesian Strain comparisons demonstrated that the cow genetics that were superior when fed a Total Mixed Ration performed poorly in the System 1-3, grass dominated, NZ dairy systems.

This was due to the inability of the overseas genetics to eat enough pasture to support their higher liveweight and productive potential, along with overall poorer fertility that could not maintain a seasonal calving pattern. Detailed research on cow fertility and grazing behaviour provided a clear understanding of why these problems occurred. The poor fertility of the overseas cows was related to poor conception rates despite cows cycling early – the exact opposite of the NZ genetics that had a longer anoestrus period, but good fertility once they were cycling. Researchers found that this conception rate problem was genetically controlled, and recent work has identified potential marker genes.

Researchers observed cows 24 hours a day to discover that the overseas cows had a strong drive to graze, but were unable to eat enough in the time available. A wide range of research trials have shown that as ruminants increase in size or genetic merit it becomes increasingly difficult for them to consume enough pasture.

Changes to the industry controlled Breeding Worth (BW) system in the late 1990's and early 2000's ensured that the sires of cows with high liveweight relative to production and poor fertility were identified and excluded from the bull teams available to NZ dairy farmers. This also allowed the valuable aspects of overseas genetics, particularly protein production, to be captured into the NZ sire gene pool.

While overseas cow genetics struggled to fit the NZ environment, research that paved the way for the introduction of robotic milking to NZ has been highly successful. Robotic milkers (also known as voluntary milking systems or VMS) were developed in Europe with a total focus on housed systems. By the time research started in NZ in the early 2000's the technology to use robots to put cups on cows was well proven.

The question for NZ grazing systems was how to combine pasture and animal management with cow movement to have a voluntary milking system on pasture. Seven years of research at Greenfields developed a set of linked management rules and engineering (based around controlled gates) that allowed cows to move around the farm under automatic controls. Once the movement challenge was solved, decision rules and management systems were developed to ensure high levels of pasture harvest were maintained – in the final two years of the trial the VMS systems achieved the same level of pasture harvest as benchmark DairyNZ farmlet trials run under conventional management.

The results of this research are now being made available to NZ dairy farmers as they begin to adopt VMS systems. This transfer of knowledge involves DairyNZ working with Lely and deLaval (the suppliers of VMS technology in NZ) as well as the early adopting farmers.

Looking forward – plant improvement

Improvement in milksolids production from home-grown feed is a key industry target. While clear gains have been made in the last twenty years from the use of N fertiliser and forage crops such as maize, there is mixed research evidence on the gains from improved genetics in ryegrass and white clover. Component trials show increased ryegrass and clover production, and beneficial changes in season growth patterns. However system level experiments have not shown benefits other than from the use of novel endophytes such as AR1, and in the northern North Island the benefits of AR1 have been compromised by problems with ryegrass persistency under drought and insect pressure. DairyNZ is investing in the plant improvement pipeline in a way that is designed to complement government and seed industry investment. This is illustrated in Figure 1 which shows four parts to the pipeline.

1. Pre-commercial research is focused on plant material and plant improvement methods that will be used in subsequent breeding programmes. DairyNZ investment in this area (often in partnership with government) aims to develop options for all plant breeding companies to use, fostering both innovation and competition. Examples of the DairyNZ investment include research that is
 - a. Testing the use of hybrid breeding methods (as used in maize breeding) to accelerate genetic progress in ryegrass and clover breeding.
 - b. Developing a method to measure differences in fibre breakdown rate between different grass cultivars and species. This would allow selection of plants that support increased intake rates.
 - c. Identifying and importing overseas genetic material with the potential to be used in plant breeding programmes.
 - d. Using genetic modification methods to develop ryegrass and clover plants with greatly improved drought tolerance and quality traits. The Pastoral Genomics programme is jointly funded by industry and government.

The Government (through Ministry of Science and Innovation or MSI) also invests in pre-commercial science particularly with AgResearch and Plant & Food.

2. Commercial Plant Breeding is the domain of agri-business. Currently this process is guided by in-house breeding targets, but DairyNZ is working with the plant breeders' industry group (NZPBRA) to develop a Forage Value Index and Evaluation System (analogous to Animal Evaluation) that will provide all parts of the industry with much better information to make breeding and purchasing decisions.
3. System level testing is mostly funded by DairyNZ with supporting investment from government and the dairy processing companies (DCANZ) through Pastoral21. This work

aims to take plant material that is available to farmers and both test the value and develop options for profitably using it. Recent and current examples of this research include:

- a. Comparisons of pasture persistency, yield and animal performance between AR1, AR37 and wild-type endophytes.
 - b. Pastoral21 systems trials comparing ryegrass and tall fescue, with and without lucerne and chicory paddocks as part of the farm system.
 - c. Research on crop yield and cropping integration on the milking platform and wintering blocks.
 - d. Research on the feeding of fodder beet in South Island wintering systems.
4. Research and development that is required to ensure the success of any material that comes down the pipeline. Recently there has been a large increase in investment in ryegrass persistency studies especially in the North Island. Clover root weevil monitoring and release programmes for the parasitic wasp have been running in the South Island for the last 5 years as the weevil has spread south.

Together these four platforms aim to ensure that both industry and government support a plant breeding industry that is focused on the needs of dairy farmers. DairyNZs aim is that commercial investment occurs in an environment where the dairy and seed breeding industries have robust systems in place to test and evaluate the available plant material so that farmers can make profitable use of it. This is not just testing, but includes solving underlying problems such as insect pressure and pasture renewal methods. Having farmers well informed on their choices and management systems to apply is central to success.

Looking forward – cow reproductive performance

Cow fertility – expressed (perhaps unfairly to the cow) as 6 week in-calf rate, is another industry target that we know we are off the pace on. The industry target is to achieve an average of 78% of cows in-calf after 6 weeks of mating. While this is achieved on many farms, the industry average is sitting in the mid-60s. In the case of cow reproduction, DairyNZ is confident that most of the technical issues are understood, and we can point to farms that are achieving great results using existing knowledge. For this reason DairyNZ has focused investment mostly at increasing the rate at which farmers adopt these practises. Figure 2 illustrates where DairyNZ is investing and how we are working with other partners to help farmers achieve reproduction targets.

1. The role of basic Research is more limited in this example, but work on the genetics of fertility and uterine health is being carried out in a project jointly funded with MSI. Other

research projects are looking at BVD and ways to improve the fertility breeding value in BW through better data collection of cow performance (phenotypes) on farms.

2. There is large investment by both commercial companies and DairyNZ in products and services.
 - a. DairyNZ has invested in the development of the InCalf resources and training programmes. InCalf aims to provide both farmers and their advisors with the technical knowledge and systems to improve in-calf rate. This has included the development of the Fertility Focus Report which is imbedded in commercial information Systems such as MINDA, MISTRO and InfoVet.
 - b. Animal genetics has an important contribution to make – and farmers can inspect and choose the fertility of the bulls they are offered by AI companies.
 - c. There is a range of products available to farmers, mostly supported by commercial research that includes heat detection aids and cycling and synchrony programmes. On occasions DairyNZ will invest to test the effectiveness of these products.
3. Delivery to farmers is mostly in the hands of commercial advisors, either vets or farm consultants. Their work is supported by a focus on reproduction at DairyNZ funded Demonstration projects and in Farm Systems Groups.
4. Underpinning this delivery channel is a range of DairyNZ funded work that includes the fertility Breeding Value in BV and a range of projects, many co-funded with government through the Sustainable Farming Fund (SFF) that are
 - a. Testing the ability of the InCalf programme to support on-farm change.
 - b. Examining the unique problems of large herds including LUDF.
 - c. Examining the effect of management systems including supplement types and OAD milking on cow nutrition, BCS and fertility.

The investment focus that DairyNZ has in this area reflects our view that we need to change the way that reproductive performance is tackled, rather than discover new technical solutions. Despite farmers routinely identifying fertility as a big issue, change at industry level seems to be very slow. So InCalf and the active partnership between DairyNZ, vets and consultants aims to both give farmers confidence that gains are possible and better support those farmers who are motivated to improve in-calf rates on their farms.

Further reading

DairyNZ Targets in Detail

http://www.dairynz.co.nz/page/pageid/2145868652/DairyNZ_Targets_in_Detail

Current DairyNZ Investment

http://www.dairynz.co.nz/page/pageid/2145861511/Current_Investment

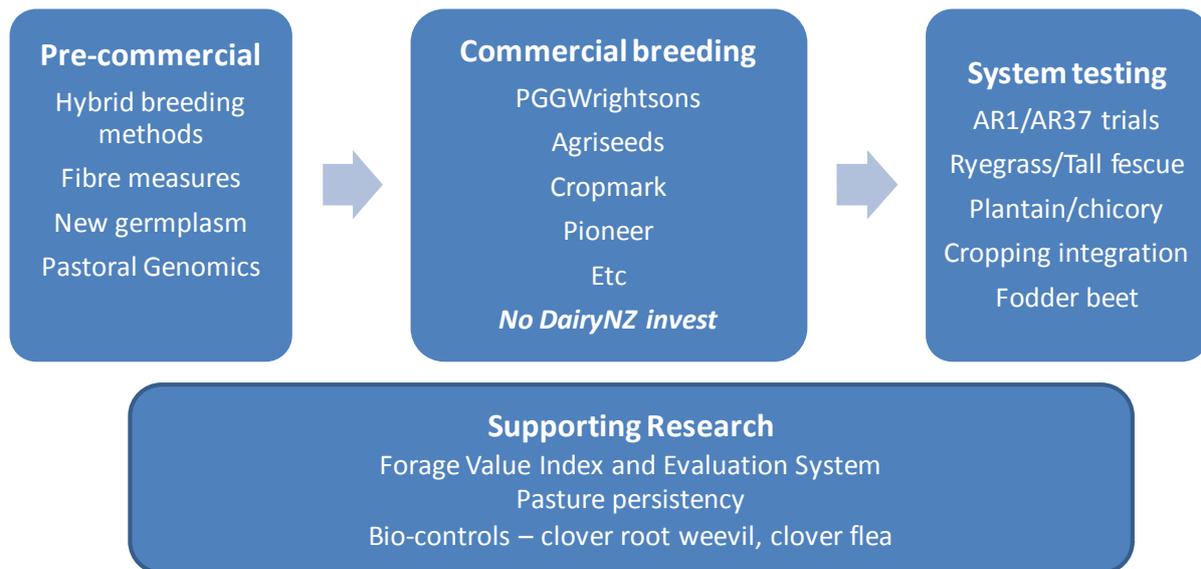


Figure 1. The place of DairyNZ investment in the plant improvement pipeline

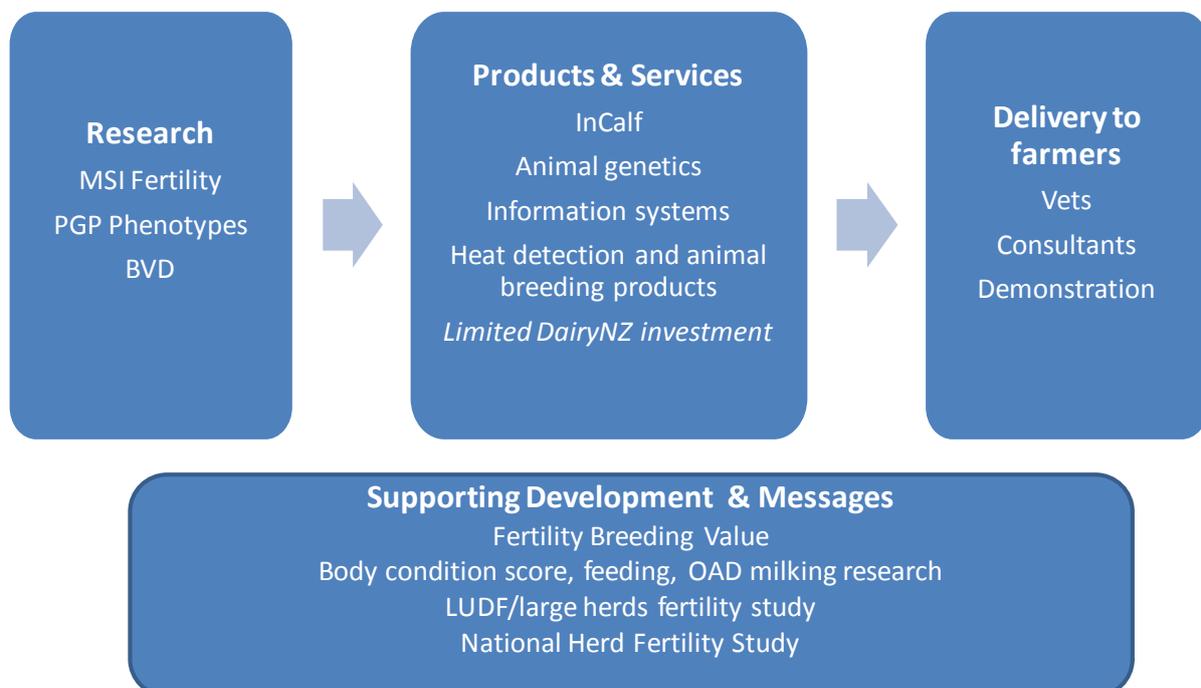


Figure 2. The place of DairyNZ investment in improving cow reproductive performance