Genetic progress in New Zealand dairy: past, present and future

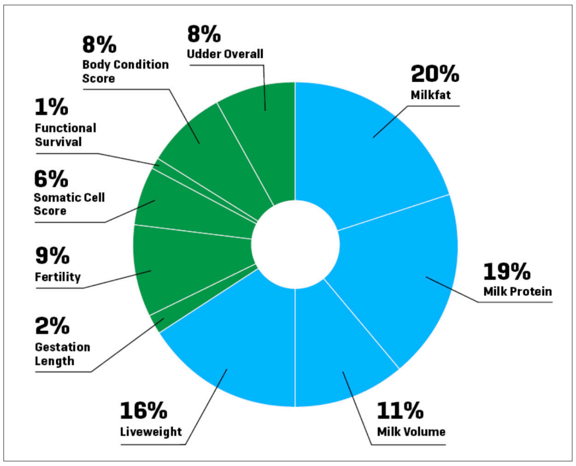
Richard Spelman
LIC

Past

New Zealand's dairy industry is globally renowned for its pasture-based farming system, and high performing genetics. The formal development of dairy genetics in New Zealand dates back to the 1950s and 60s with the introduction of artificial insemination (AI) in addition to structured herd testing. A structured progeny testing system was added in 1961, enabling systematic genetic evaluation and widespread access to elite sires. The early focus was on production traits such as milkfat and volume and milk protein was added in the 1980s.

Present

New Zealand has a national breeding objective which is to breed dairy cows that are the most efficient converters of feed into profit. Breeding Worth (BW) is the industry's index that ranks cows and bulls on their ability to meet the National Breeding Objective. BW is a composite index that combines the estimated breeding values (EBVs) of 10 traits, weighted according to their economic value to dairy farmers. These traits can be categorised as either 'Production efficiency' traits or 'Robustness' traits. The effective emphasis of the individual traits within BW are split between 66% production efficiency traits and 34% robustness traits.



Genetic improvement has been a key contributor to New Zealand's dairy productivity. Each year, genetic gain contributes an estimated NZD $6–700 million in added value to the industry, with gains compounding over time. Today's cows produce significantly more milk solids than their counterparts from three decades ago, requiring fewer inputs per unit of output.

This value extends beyond economics. Genetic progress has supported environmental and animal welfare goals. More efficient cows with better fertility traits have shorter calving intervals, lower replacement rates, and improved longevity, which reduces emissions per litre of milk produced.

The biggest change to the dairy cattle breeding has been the adoption of DNA technology to evaluate dairy cattle. In 2008 the first application of genomically evaluated sires occurred. This allowed bulls to be used commercially as yearlings which was 3–4 earlier than progeny tested sires.

Whilst the reliability of the genomic evaluation is lower than a progeny tests the reduction in generation interval enables rates of genetic gain to increase by up to 50%. There have been teething issues with the technology, but the significant investment and research has resulted in genomically evaluated sires undertaking over 50% of LIC's inseminations in 2024.

The genomic technology has now been extended to be utilised on heifers. Currently 30–35% of heifers are DNA parentage tested and now have a genomic evaluation. This is enabling farmers to select the better heifer replacements and also identify with more accuracy which heifers and cows to keep replacements from.

Sexed semen has increased in use in New Zealand making up approximately 5–8% of inseminations in 2024. Sexed semen enables targeted breeding for replacements, improving genetic gain while increasing flexibility with surplus animals. Farmers are putting greater emphasis on selecting the cows to retain replacements from and the other cows are being mated to generate dairy-beef or being mated to short gestation dairy genetics to reduce calving intervals and tighten calving patterns.

Future developments in dairy genetics

Recent advances focus on breeding for resilience, health, and sustainability. Selection for disease resistance (e.g., facial eczema and mastitis) and fertility traits has become more prominent. It would be expected that in the future, BW will include environmental traits such as nitrogen efficiency or carbon footprint, helping align breeding with regulatory and sustainability goals.

Genetic research and programmes are being undertaken for environmental traits:

- Low methane genetics: LIC and CRV have identified heritable variation in methane emissions between dairy animals. Ongoing research may result in genetics for low methane being available in the next 2–3 years.
- Slick gene for heat tolerance: This gene improves thermoregulation, offering resilience in increasingly warm climates. A breeding programme is ongoing that will introgress this gene without compromising BW.

Public consultation is being currently undertaken on genetic technologies that includes gene editing tools like CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) that offer the possibility of precisely modifying traits such as the Slick gene. This technology has potential to edit known genetic variants on to high genetic merit backgrounds in a timeframe of 2–3 years rather than traditional breeding approaches that take a decade or longer.

Conclusion

New Zealand's dairy genetics program, led by LIC and supported by industry-wide collaboration, continues to deliver world-leading results in efficiency, productivity, and sustainability. Tools such as MINDA (MINDA is a LIC software product designed specifically for New Zealand dairy farmers), liquid semen, and GeneMark (GeneMark is a product offered by LIC that focuses on genomic evaluation) have empowered farmers to breed cows ideally suited to the country's pasture-based systems.