



MARBLED GRASS-FED BEEF PRIMARY GROWTH PARTNERSHIP FINAL REPORT OCTOBER 2019

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1. EXECUTIVE SUMMARY

1.1 Introduction

Prior to the start of the Marbled Grass-fed Beef (MGFB) programme in 2012, New Zealand's beef industry was known as a producer of undifferentiated, commodity beef, much of it utilised for manufacturing purposes (e.g. for burger patties). Beef cattle numbers had been consistently declining year-on-year due to reduced beef returns and improved returns for alternative land uses, particularly for dairy.

The Red Meat Sector Strategy Report (2011) identified a number of challenges for the industry, as well as a number of opportunities. The key challenges and issues identified could be summarised by the following points:

- Fragmented and ineffective supply and value chains.
- A disconnect between producer and consumer.
- A lack of control of products in-market (messaging, positioning and pricing).
- A lack of differentiation and New Zealand owned brands in export markets.

The report concluded the returns for the red meat sector could be lifted by overcoming the above challenges through the following:

- Improved market focus and a better understanding of customers within key markets.
- Financial resources to fund new initiatives and invest in relationships.
- Alignment of objectives along the supply chain and improved security of product and supply.
- More viable markets for high value, differentiated products.
- Market the New Zealand product story through a connected value chain.

The aims for the MGFB Primary Growth Partnership (PGP) programme were in response to challenges and opportunities identified by the programme partners First Light Foods and Brownrigg Agriculture, which aligned strongly with those identified in the Red Meat Sector Strategy Report.

1.2 Programme Vision

The vision for the programme was;

"To have New Zealand beef prized globally as the best grass-fed beef in the world, a high quality, specialty 'centre of the plate' meat."

This would be achieved through the development of a high quality, marbled, grass-fed beef product that was produced as part of an integrated value chain, connecting the farmer to the consumer. This beef product would have marketable attributes that covered eating quality, production (grass-fed, non-GMO and antibiotic free), provenance, animal welfare, health benefits and environmental sustainability. It would be positioned as a premium product delivering additional returns to all parts of the value chain.

Key Facts

Programme start – August 2012

Length – 7 years

MPI PGP Funding - \$11 million

Commercial Partner Funding - \$12 million

Commercial Partners – Firstlight Foods Ltd (FLF), Brownrigg Agriculture Group (BA), Firstlight Wagyu NZ Ltd (FLWNZ)

Developing the MGFB Programme

With international consumers starting to show signs of seeking out grass-fed beef, the point of difference for this premium product would be the incorporation of the Wagyu breed of cattle into New Zealand grass-fed beef production. This would produce consistently highly marbled, high quality grass-fed beef unlike anything else produced in New Zealand or elsewhere in the world.

Wagyu beef, which originated in Japan, is well known internationally for its high marbling, superior eating quality and premium image. The programme partners saw an innovative opportunity to design a new beef product using 100% Wagyu genetics over New Zealand dairy and Angus dams to produce cattle with 50% Wagyu genetics grown solely on grass. The First Light Wagyu Programme is therefore based on using Wagyu as a terminal sire, whether natural mate or Artificial Insemination (AI), and finishing the resulting half bred progeny (also referred to as F1 progeny).

Under the MGFB programme, New Zealand's strengths in pastoral agriculture would be combined with the programme partners' ability to access Wagyu genetics and their knowledge of a connected value chain to further develop this premium product and grow the value chain for New Zealand marbled grass-fed beef.

In addition to developing a premium product, the programme would also establish a short, direct value chain to consumers using a 'Go-Direct' model (refer to Figure 1.) for taking product to market. This would have the dual benefit of capturing greater margin on-shore in New Zealand, eliminating the margin normally taken by the importers and distributors in export markets, and allowing greater control of the messaging and positioning of the product and its unique story through to the consumer.

The programme also identified the opportunity to integrate with the dairy industry using dairy herds as a source of Wagyu-cross calves. This would deliver the additional benefit of increasing returns to dairy farmers for calves and reducing the number of 'bobby' calves destined for slaughter at 4-days of age. The dairy source would enable growth in cattle numbers with a national population of five million dairy cows compared to a declining beef herd. There would also be additional benefit to the product as the dairy cross animals were identified as having higher marbling on average than the Angus breeds.





1.3 Programme Outcomes & Objectives

The MGFB programme's short-term outcomes have been achieved and good progress made towards the medium-term and long-term outcomes, as defined in the Outcomes Logic Model (OLM). Refer to Figure 2. below for a summary of the short, medium and long-term outcomes and refer to Appendix 1. for the full Outcomes Logic Model.



Figure 2. Marbled Grass-Fed Beef Programme Short, Medium and Long-term Outcomes

Progress towards the programme's three short-term outcomes is outlined as follows:

1. Proven model for the supply of calves from the dairy industry

Initially, due to a lack of awareness of Wagyu and a strong dairy milk price, demand for matings to generate Wagyu cross animals was low and focus was on using a limited number of Wagyu bulls into Angus and dairy herds. As a result, the initial intention of the programme was to generate more bulls to increase natural mating numbers. However, largely as a result of the milk price downturn in the 2014/2015 season, (from \$8.40/kg milk solids to \$4.40/kg milk solids), dairy farmers increasingly

recognised the value of diversification and the potential revenue benefits from their calves. At the same time, the programme engaged with Livestock Improvement Corporation (LIC) who saw the opportunity to promote the use of Wagyu semen to dairy farmers through Artificial Insemination (AI). LIC also shared a desire to develop solutions to reduce the number of 'bobby' calves ahead of regulation or public pressure dictating solutions.

This enabled a shift in focus of the programme to using AI (using elite sires) rather than natural mate and with it the lift in volume of matings needed to reach targeted growth. The discovery of *Mycoplasma bovis* in New Zealand in 2017 (covered later in this report) accentuated this shift from natural mate to AI driven by biosecurity measures. Figure 3. shows how the proportion of natural matings versus AI matings has transitioned over the course of the programme.



Figure 3. Transition in First Light Wagyu (FLW) mating source from 2012 to 2019

The number and proportion of calves being supplied from the dairy industry increased significantly over the course of the programme and a model has now been proven for a sustainable supply of calves from the dairy industry with over 42,000 AI matings achieved in 2018, and 43,000 AI matings planned for 2019.

2. Proven model for the year-round production of marbled grass-fed Wagyu beef

Establishing and growing export markets in the Northern hemisphere requires year-round production of finished animals. The Northern summer season coincides with the New Zealand winter period which is climatically a more difficult time of year to reliably produce quality animals. A year-round supply has been achieved through the inclusion of seasonal winter premiums when production is typically low, and specialisation of growing phases into calf rearer, backgrounder (to approximately 20 months of age) and specialist finisher (including winter). Year-round production has also been supported by a geographic spread of farms throughout New Zealand, from Northland to Southland, with a South Island processor contracted in 2017 to improve logistics for the growing South Island supply. The programme's ability to utilise both male and female offspring also assisted with year-round production, with heifers finishing on average three months earlier than steers.

3. Proven model for go-direct marketing to NZ and international markets

One of the programme objectives was to establish a model for selling product that enabled it to be promoted to the consumer allowing the provenance story to be told and the product attributes to be highlighted, something that was getting lost in the traditional industry model which used a series of overseas owned, in-market importers, brokers and distributors. This model would also allow greater connectivity between the consumer and farmer and capture greater margins for the supply chain (up to 25%). This model has been established through the programme in the New Zealand, UK and USA markets for retail and food service, with an online VIP subscription model developed in the USA market to allow direct-to-consumer sales for the top tier of production.

1.4 Key Achievements

Below is a list of key achievements delivered by the programme to date. These are explained in further detail in subsequent sections of the report.

• Increased volume of product

- The number of calves supplied, and animals processed has been increasing over the term of the programme, with 22,000 calves expected to be weaned in 2019.
- The number of farms in the First Light Wagyu programme has grown to over 370 farms consisting of breeders, rearers, backgrounders and finishers. There are now 78 shareholder farmers in the First Light producer group.

• Increased premiums

- Sustained premiums have been delivered for calves and finished animals;
 - In 2019 dairy breeders are receiving between \$180 and \$280 per calf (minimum pick-up age 10-days old) compared to \$30 for a 'bobby' calf.
 - For finished animals the price being achieved is consistently more stable than commodity prices and for First Light Wagyu NZ's (FLWNZ) last financial year the return to farmers was a 22% premium over commodity beef.

• Genomic Relationship Matrix (GRM)

 Development of a Genomic Relationship Matrix (GRM) has facilitated elite sire selection. This involved multi-year progeny trials to develop a matrix to help rank sires by breeding values. Refer to section 3.1 Genetics for a detailed explanation of the GRM.

• Extension to Farmers

- A series of fact sheets for farmers has been published, communicating the results of programme research and aiming to assist farmers with improving on-farm performance.
- Body Condition Score (BCS) material (posters and hand-held swatches) designed specifically for Wagyu cattle, have been developed to help farmers monitor whether animals have reached prime condition for slaughter which should reflect in better marbling scores.
- Development of best practice recommendations for rearing Wagyu calves to support calf health and potential for marbling from the start of life.

The key achievements support progress towards the programme's medium and long-term targeted outcomes to increase sales price, sales volume and profitability, creating a more sustainable New Zealand prime beef industry. The key drivers for successful achievement of the long-term outcomes will be:

1. Sustained growth in the production and sale of grass-fed Wagyu beef

- To meet future production growth, forecasting to process over 30,000 Wagyu cattle per year by 2025, First Light's strategy remains to build supply across both Angus and dairy matings with a strong focus on being able to place all calves with quality backgrounders and finishers ensuring a sustainable value chain. This will require existing suppliers taking on more cattle numbers and a continued campaign to attract new suppliers to the First Light business.
- Market expansion to new territories within the USA and Canada is the immediate term focus for the First Light Sales team with a goal to increase retail store distribution by approximately 200 stores (to 390 stores) by the end of 2020.
- Other new markets are also being explored, specifically China, where consumer research will be focused to validate the market prior to considering the Go-Direct retail model in-market.

2. Adoption by others in the industry, of Wagyu or similar premium beef supply chains and other sectors, of the production and sales models developed

- There is already evidence of at least two other meat companies developing Wagyu supply with non-First Light Wagyu calves being born in 2018 and 2019.
- At least two meat companies have launched a similar premium beef supply chain initiative over the term of the MGFB programme for non-Wagyu cattle.
- There is growing interest in the Go-Direct sales model that First Light has established. Intellectual property related to the development of the sales models created through the MGFB programme is being made available on a commercial basis to third party producers and exporters of New Zealand products where there is alignment with product attributes and messaging. Third party representation with a New Zealand smallgoods manufacturer has recently been agreed with products due to be launched into the New Zealand market in November 2019.

3. Continued growth in the premiums generated across the value chain

• While the programme has delivered sustained premiums to farmers over the price of Prime Steer, achieving an average premium of \$1.18/kg in 2018, the aspirational programme target of \$2.12/kg over the prime schedule remains a long-term goal. As outlined in Section 3.2 of the report, there are a number of focus areas to support growth and ensure sustainability of premiums into the future.

"As Co-investors in the programme we identified two key success indicators early on, market pull for the product and farmer buy-in. Both of these have been realised so we have the building blocks in place to grow." **Brownrigg Agriculture Chairman, David Brownrigg**

1.5 Programme Governance & Management

The programme was governed by a Programme Steering Group (PSG) which appointed an independent chairperson, Juliet Maclean, in March 2016 following a recommendation from the programme mid-term progress evaluation. The Co-investors benefited from the appointment of an independent chairperson through the high level coordination and overview the role gave the programme. Prior to that time, the risk was that each of the Co-investors was overly focused on their own part of the programme. Having an independent chairperson assisted with alignment of the Co-investors towards the overall programme outcomes.

The Co-Investors, Gerard Hickey, Managing Director First Light Foods, and David Brownrigg, Chairman Brownrigg Agriculture, both acknowledge that the programme governance structure and associated

planning and reporting has driven focus and accountability to deliver the programme outcomes. The programme brought value chain participants together and provided the process to agree research priorities, commit resources, monitor findings and action commercially.

"There were certainly some challenges along the way which highlighted the importance of a good relationship and dialogue with the PSG." *First Light Managing Director, Gerard Hickey*

The MGFB programme was structured with milestones under four objectives; Genetics, Supply Chain, Marketing and Production R&D (see Figure 4. Below). Refer to section 2.1 Programme Partnership for a detailed overview of each of the programme partners.



Figure 4. MGFB Primary Growth Partnership Programme Structure

WBL – Wagyu Breeders Ltd (owned by Brownrigg Agriculture Group Ltd) FLF – Firstlight Foods Ltd FLWNZ – Firstlight Wagyu (NZ) Ltd OFR – On-Farm Research Ltd Figure 5. provides a snapshot of the programme objectives and a pictorial view of the key activities and achievements within each objective.



Figure 5. MGFB PGP Objective Overview

2. BACKGROUND

2.1 Programme Partnership

An opportunity for New Zealand to produce and supply the best grass-fed beef in the world led to the creation of the Marbled Grass-fed Beef Primary Growth Partnership programme in 2012.

Three programme partners and a key research provider collaborated with MPI support to achieve this goal. The partnership was conceived as an opportunity to take a differentiated, quality beef breed, Wagyu, and introduce a new model to the traditional New Zealand beef industry. This involved the development of an integrated supply chain, with breeders, finishers and marketers working closely together through the entire value chain, refer to Figure 6. below.

The programme partnership identified the following challenges at the beginning of the programme:

- Identifying a source of sufficient numbers of breeding cows to meet expected demand for F1 Wagyu progeny.
- Identifying the genetics in Wagyu sires most suited to producing offspring with good marbling and growth rates when fed on grass.
- Developing the feeding and farming practices required to ensure farmers are able to produce quality animals that the market demands on a continuous basis when fed on grass.
- Developing the logistics and marketing infrastructure required to support a premium product in key markets.



Figure 6. First Light Wagyu Integrated Value Chain

First Light Foods (FLF)

Established in 2003 Firstlight Foods Ltd (FLF) is a privately owned and operated premium grass-fed meat company supplying grass-fed Venison and Wagyu beef to local and international markets. First Light currently employs 40 staff in New Zealand with sales representatives in the USA and Europe. Under the MGFB programme, FLF pioneered the creation of New Zealand's first commercial 100% grass-fed Wagyu beef programme and is the exclusive supply chain and marketing agent for Firstlight Wagyu NZ Ltd (FLWNZ) which is 50:50 co-owned by farmer shareholders and Firstlight Foods Ltd.

An export-based meat business, FLF was established to meet a market need for branded, differentiated, added-value meat products with its primary focus to improve market and supplier returns by identifying and creating niche export opportunities.

First Light Wagyu New Zealand (FLWNZ)

As mentioned above, FLWNZ is a 50:50 partnership between First Light Foods and the farmer shareholders. The entity has an exclusive management agreement with FLF to supply 100% grass-fed Wagyu beef. Benefits from the grass-fed Wagyu programme are shared across the whole First Light value chain. As participating farmers own their product right through to market, increased returns are therefore paid directly to these farmers. Farmer shareholders of the producer group (FLWNZ) are also able to access additional returns via an annual pool payment. The pool payment is the operating profit of the group at the end of each financial year. The pool amount for each supplier is a function of the supply chain stage and liveweight gain added to the cattle by each shareholder. There are currently over 370 farms involved in the First Light Wagyu producer group, of which 78 are shareholders. Refer to Figure 7. for an overview of the First Light Wagyu NZ business model.



Figure 7. First Light Wagyu NZ Business Model

Wagyu Breeders Limited (WBL)

Wagyu Breeders Ltd (WBL), established in 1998 expressly for participation in international Wagyu supply chains, is a New Zealand Wagyu breeding stud wholly owned by programme partner Brownrigg Agriculture Group (BA). BA and WBL have pioneered the export of Wagyu cattle and Wagyu beef from New Zealand over the last 25 years, initially through establishing a relationship with a Japanese family-run Wagyu production business. WBL currently farms the largest Wagyu stud in New Zealand. As the exclusive supplier of genetics for the First Light Grass-fed Wagyu programme, WBL uses a comprehensive range of full blood Wagyu genetics, originating from Japan, enabling FLWNZ to currently operate as the largest commercial producer of grass-fed Wagyu cross animals in the world.

On-Farm Research (OFR)

The key research partner for the MGFB programme was On-Farm Research (OFR), with the production research and development objective of the programme led by Dr Paul Muir. OFR is a private research business established in January 2003 as a joint venture between Dr Paul Muir and Brownrigg Agriculture Group. The business is based at the Poukawa Station (previously an AgResearch site) and is a contract research provider with a focus on applied research. OFR has experience and expertise in genetics, ruminant nutrition, farm systems development, meat quality, agronomy, calf rearing, and beef production. This has included extensive involvement in cattle growth and beef quality, and many years' experience in designing, evaluating and demonstrating systems for calf rearing, studies on meat quality and factors affecting marbling, running progeny trials, and evaluating forage feeding options in lambs and calves.

2.2 Origin of Wagyu Beef

Wagyu literally means "Japanese cow". The Wagyu breed originated in Japan where Wagyu cattle were raised as cart oxen for over 2,000 years. Selection for draught capabilities probably improved intramuscular fat, being a more readily available energy source than subcutaneous fat. Historically, Japanese families only had a few Wagyu cattle which were of very high value, so they were treated well with frequent brushing to improve appearance and softness of the coat and massaging to relieve the stress of confinement. There are four recognised Wagyu breeds: Japanese Black, Japanese Brown (also known as Japanese Red), Japanese Poll and Japanese Shorthorn. The First Light Wagyu programme uses only Japanese Black Wagyu genetics.

In Japan, breeding schemes started at village level and by 1968 performance and progeny testing had been initiated which resulted in a steady improvement in marbling. The first exports of Wagyu cattle from Japan occurred with four bulls exported in 1976 to the United States. In the 1990's some 200 additional cattle were exported from Japan to the United States, driven primarily by Australian interests. Most exported Wagyu cattle came via the United States because of bi-lateral export-import protocols in place. The Wagyu breed was introduced to New Zealand through imports of semen and embryos from Australia beginning in 1992, and directly from the United States in 1993 and 1995.

2.3 What is Marbling?

Marbling refers to the small flecks of intramuscular fat distributed through the muscle of cattle. Marbling is valued because it positively influences flavour, juiciness and tenderness. The association of marbling with superior eating quality is why consumers globally will pay premiums for greater levels of marbling. This key factor influences how First Light Wagyu suppliers are financially rewarded. There is a direct relationship between the marble score achieved and the payment received for their finished cattle.

Generally, marbling is graded on a subjective visual basis, assessed and scored against marbling reference standards. First Light uses the AUS-MEAT system for grading where marbling scores range from 0 (nil) to 9 (abundant) and are assessed based on the amount of marbling present in the eye muscle. Figure 8. shows some photographic examples of Marble Score (MBS) grades in First Light grass-fed Wagyu beef.



Figure 8. Examples of MBS grades in First Light grass-fed Wagyu beef

3. PROGRAMME ACHIEVEMENTS & LEARNINGS

3.1 Genetics

Objective Overview & Key Learnings

The Genetics Objective priorities:

- To accelerate the development of Wagyu genetics for the express purpose of producing high quality grass-fed marbled beef under New Zealand pastoral farming conditions.
- To identify all relevant genetic improvement initiatives and technologies and invest in those offering most promise.

Objective Overview

Use of genomic technology to improve the elite cattle selection process was seen as a priority. This involved substantial work running multi-year progeny trials to help rank sires by breeding values and develop a Genomic Relationship Matrix (GRM), which essentially combines information gathered from DNA testing (genotypes) and physical measurements (phenotypes). Refer to Figure 9. for a detailed schematic showing development of a GRM. The outcome of this work now informs the selection of elite sires for New Zealand wide dairy Artificial Insemination (AI) matings and will continue beyond the programme. Early consideration was also given to methods and tools to allow rapid multiplication in the number of Wagyu bulls to achieve the mating targets, through use of sexed semen and embryo transfer technologies. However, a decision in Year 5 was made to halt activity on sexed semen trials as, while proof of concept was established, costs would prevent commercial use in the short term. Coupled with a growing interest by LIC to work with the programme the focus shifted to using AI through a partnership with LIC.

A Genetics Steering Group (GSG) was established during the programme to guide ongoing improvement of Wagyu genetics being supplied to First Light Wagyu NZ. The group consists of two independent geneticists, including LIC's Chief Scientist, and representatives from both WBL and FLWNZ and is tasked with steering decisions to improve the genetic potential of the grass-fed Wagyu animals.

Milestone Achievements Summary

Milestone 1.1.1 Identification of best genetics for marbling in grass-fed beef

• The programme enabled significant progeny tests to be undertaken. Three Wagyu sire progeny trials were completed, evaluating 16 Wagyu bulls and approximately 1,000 of their progeny, born across years 2014, 2015 and 2016. Phenotypic data

Genetics Terminology

GRM - Genomic Relationship Matrix

Genomics - analysis of individual genomes and genetic relatedness to a reference population

Genome - the complete set of genes or genetic material present in a cell

Phenotype - the observable (physical) characteristics of an individual e.g. coat colour

Genotype - the genetic makeup of an individual which determines one of its characteristics (phenotypes)

gEBV – Genomic Estimated Breeding Value, a breeding value estimator based on genomics

50k SNP Chip - a tool that analyses a DNA sample of an individual and identifies the presence of 50,000 unique genetic markers

AI - Artificial Insemination

Sexed Semen - semen that has been sorted by X (female) and Y (male) chromosomes and then used to produce a calf of a specific sex

Embryo Transfer - an advanced reproductive technology where an embryo (fertilised egg) is implanted into a donor female, used to multiply elite genetics quickly for lifetime performance and meat quality data was collected at slaughter and the animals were also DNA sampled and genotyped.

- Further progeny test programmes are underway. These are planned to be annual and ongoing. Approximately 450 progeny from these later cohorts have been slaughtered and analysed as at the end of July 2019.
- Using the data collected from the progeny trials a Genomic Relationship Matrix (GRM) has been created to allow genomic Breeding Value predictions for the WBL full-blood Wagyu herd. Genomics technology is the analysis of individual

genomes and genetic relatedness to a reference population (as depicted in Figure 9.).

- The GRM has been combined with traditional physical breeding worth assessment and target traits have been given economic weightings in the form of a Genomic Index (GI).
- All stud animals have been genomically analysed (using 50k SNP chips) and the results run through the GRM generating a Genomic Index for each stud animal.

"In the genetics objective we were able to be quite aspirational, reaching out for direction and advice from industry leading geneticists. The resulting WBL Genomic Relationship Matrix is a world class decision support tool." **Brownrigg Agriculture Chairman, David Brownrigg**

Genomics Relationship Matrix

Primary drivers of the Genomic Index are the traits deemed to have the highest economic importance for the grass-fed Wagyu supply chain, these include marbling score potential, growth rate (days to slaughter), gestation length and eye muscle area. Individual animals are allocated a GI expressed in dollars of supply chain value per carcass and enables the identification of high merit sires and dams.

Figure 9. Schematic showing development of a Genomic Relationship Matrix and gEBVs



Milestone 1.1.2 Application of new and developing technologies to the beef and dairy industry

Sexed Semen

The programme evaluated the use of sexed semen to accelerate the production of Wagyu bulls for natural mating. Ten bulls were evaluated by comparing their semen characteristics before and after sexing to determine whether the best bulls for use of sexed semen could be predicted. Compared with non-sexed Wagyu semen, the quality of sexed Wagyu semen was highly variable between bulls in both quality (assessed post freezing) and in fertilisation ability when examined over three years. Improvements in the sexing process are needed before sexed Wagyu semen can be reliably used for AI in the dairy industry but it remains a potential option for use in embryo transfer programmes. The commercial viability of its use will depend on the cost and requirements for bulls by the dairy industry.

• Embryo Transfer (ET)

Over three years donor selection was examined to maximise the production of embryos from embryo transfer. This looked at use of liveweight and pre-screening for follicle development in the donors to maximise egg production. This has allowed the development of best practice methodologies for Wagyu for use in multiplication of high genetic merit Wagyu for bull production if required, although the current focus remains AI in the dairy industry.

• Semen Quality

The performance of Wagyu semen is proving equal to that of other breeds. Semen quality continues to be assessed by LIC as part of the AI programme and recent analysis of Non Return Rates (NRR) in the 2018 matings had the Wagyu breed average sitting at 4.2% above the dairy breeds average. LIC are screening young bulls for semen quality and selecting those bulls which have the highest likelihood of producing good conception rates in dairy animals. Semen from these selected bulls has been widely used and compares well with other semen used in the industry.

3.2 Supply Chain

Objective Overview & Key Learnings

The Supply Chain Objective priorities:

- To develop a producer group model across New Zealand capable of producing a consistent year-round supply of grass-fed Wagyu beef.
- To integrate with the dairy industry to ensure sufficient Wagyu x dairy calves are sourced from the industry each year to meet forecasted market demand.

Objective Overview

Developing an integrated supply chain from 'farm to plate' was central to successfully delivering the MGFB PGP programme. As previously highlighted in the report, more than 370 farmers are now involved in the First Light Wagyu programme, including dairy farmers, calf rearers, and finishers.

Farmer numbers have increased significantly in the South Island where processing commenced in 2017 to optimise logistics.

The programme has also provided a potential solution for utilising calves that, when slaughtered at 4 days old, are frequently considered a 'by-product' of the dairy industry. Many dairy farmers have already proven success in using First Light Wagyu to provide a sustainable and economic alternative to 'bobby' calves and are proud to be part of a programme promoting excellence in animal welfare within the industry. Partnering with LIC in 2016 to exclusively supply Wagyu x dairy calves was instrumental to the programme achieving its growth objectives. LIC provided market creditability in the eyes of dairy farmers as well as access to an established nationwide sales team and over 80% of New Zealand's dairy herds. LIC are acknowledged as experts in animal breeding and data collection for the New Zealand dairy industry.

Mating and Animal Numbers

The first indicator and measure of the growth in animal numbers is the number of matings. While there was slower than expected initial uptake of dairy matings early in the programme, there has been good progress in building mating numbers over the last three years. This has resulted in a corresponding increase in the number of calves born and animals due to be processed.

Approximately 15,500 calves were born in 2018, with a forecast 22,000 calves to be born in 2019. While mating numbers for 2019 are expected to result in a similar number of calves in 2020 as the current year, the forecast remains to build to 30,000 calves born by 2023 (for processing in 2025). Processed cattle numbers have also been steadily increasing over the course of the programme with an average 3 year period from mating to processing (with an average age at slaughter of 2.5 years). Refer to Figure 10. which shows the actual and forecast growth in calves and processed cattle.



Figure 10. Calves and processed cattle numbers (FLWNZ financial year)

Original growth numbers were reassessed in Year 2 of the programme as the original target of 32,500 processed cattle in 2019 was considered unachievable due to the limited number of Wagyu bulls available and limited initial interest from the dairy industry. A revised target was agreed at 15,000 processed cattle for 2019/20, delaying the 32,500 target to 2025. The actual number forecast to be processed in 2019/20 will be approximately 11,290 cattle, which is short of the revised target due to lower than planned initial matings earlier in the programme.

The following drivers are viewed as supporting further growth in animal numbers:

- The LIC partnership will continue to provide greater access and improved services to dairy farmers through their established network and joint marketing efforts with First Light.
- There is growing awareness and interest from dairy farmers in First Light Wagyu genetics, driven by a desire to diversify returns and social pressure to find an alternative to 'bobby' calves. Many of these dairy farmers are showing interest in farming their offspring through to processing as a diversified income stream.
- There is significant growth in new suppliers buying weaners, with a forecast increase of 100 suppliers across 2019 and 2020.
- It is expected that some existing suppliers will increase their numbers once they process their Wagyu cattle and are satisfied with their results.
- The Genomic Relationship Matrix will assist with selection of genetics that provide the most desirable traits for breeders, e.g. shorter gestation and smaller calves.

Premiums

The First Light Wagyu programme has delivered significant premiums for Wagyu-cross calves, particularly for those from the dairy industry. Dairy farmers are currently receiving between \$180 - \$280 per calf (minimum pick-up age 10-days).

The programme has also delivered sustained premiums to farmers over the price of Prime Steer, achieving an average premium of \$1.18/kg in 2018 against the original programme target of \$2.12/kg. Refer to Figure 11. for an overview of historical farmer payments throughout the programme.

The following considerations and focus areas will contribute towards the aspirational target of \$2.12/kg:

Auburn Farming – (Canterbury)

Les and Annette Tindall and their son Alan, run a 240ha mixed stock and cropping farm, Whyalla, near Ashburton. Les and Annette's grandson Ryan Cockburn partners with his uncle Alan (trading as Alburn Farming) to farm approx. 350 Wagyu x dairy cattle on the Whyalla land. The Tindall family have been involved with First Light for over six years and were the First Light Wagyu 'Suppliers of the Year' for 2017/18.

Ryan says that, "we chose First Light because we wanted to be involved with a product we could see from start to finish, get feedback on how to better our performance and get rewarded for the effort we put in." First Light Wagyu also "gives us a stable cash flow we can rely on rather than wondering what the price may do."

The temperament of the Wagyu x dairy cross animal is highlighted by Ryan; "they are beautiful animals to work with and make going out to shift break fences enjoyable when you get to see happy quiet animals enjoying every day."

Ryan visited the US Market as part of the Farmers to Market visit in 2018, "being able to tell the consumers about our product, giving them the life story of an animal, really did tie the whole farming cycle together for me, from the day the calf turns up to seeing the meat sold in the counter."

With a goal to grow supply to an average of 20 finished Wagyu cattle per month, Ryan also notes that, "we are committed to doing whatever we can as a Focus Farm to help improve overall knowledge for the greater Producer Group."

- Increasing the retail network, particularly in the USA, providing critical mass.
- Extracting greater returns and developing new products from the '5th quarter' (the trim, bones and offals of the carcass).
- Improved marbling results providing a more valuable product to market.
- First Light developing markets, channels and products that will increase overall meat value.

"This year (2019), on average, our shareholders are getting more than \$7/kg return. It's about 25% over commodity on average, so that's breaking into a new bracket, which has been our aim for the last five years. We know many farmers are fed up with the status quo of commodity beef. They want to be rewarded for individual quality and performance, not to be averaged and reliant on a volatile commodity market, so on that basis, we pay on quality measured by marbling – so we reward effort to produce a top-quality animal." **First Light GM Wagyu, Matt Crowther**



Figure 11. Farmer payments vs average P2 steer (\$NZ/Kg CWT)

Mycoplasma Bovis (M. bovis)

The programme became affected by the *M.bovis* outbreak in May 2018. FLWNZ took immediate proactive action by reaching out to both MPI and Beef+Lamb NZ and implementing biosecurity protocols across its business. While there are still some negative impacts on the programme, (as at 31st July 2019, 390 cattle have been slaughtered under the MPI eradication plan), FLWNZ's approach is expected to provide downstream benefits for the business in terms of supplier confidence with animal traceability provided by the supply chain management. The systems and processes implemented to protect farmers and cattle will potentially become the base for uptake from other cattle businesses.

The *M.bovis* mitigation measures employed by the programme include:

- Reducing the number of calf pick-ups by replacing all 4-day old dairy cross calf contracts with a minimum of 10-day old. This had the added benefit of reducing early mortality rates of calves as they are stronger upon pick-up.
- Single pick-ups of dairy calves from individual sources to minimise potential contamination from transportation.
- Contract calf rearers are required to rear only Wagyu or as a minimum separate Wagyu calves from other breeds in their operations. This led to a reduction in the number of rearers from 26 to 12 nationwide in 2019.
- LIC require bulk milk testing results for *M.bovis* to be clear prior to calf pick-ups.

Milestone Achievements Summary

Milestone 2.1.1 Understanding farmers motivations

- Farmer surveys were conducted by Lincoln University in 2015 and 2018 providing insight into supplier relationships and supplier perspectives and motivations. Being able to compare survey data between 2015 and 2018 highlighted key findings as below:
 - There has been a significant increase in the number, type and location of suppliers since the 2015 survey. Breeders and rearers now make up a third of the supply base.
 - The South Island, particularly Canterbury, has grown considerably.
 - The growth in supplier numbers, and the fact they are new and require greater support and education initially, has placed pressure on maintaining adequate service levels with a net reduction in relationship quality levels noted since the last survey. To address this, the Livestock team was restructured in late 2018 to provide a customer centric service model supporting the in-field Relationship Managers (RMs). The restructure combined the Breeding and Finishing field team roles, with each regionally based RM now covering both these areas of the supply chain.
 - Suppliers are aware and broadly supportive of increasing environmental and animal welfare concerns from the market.
 - Suppliers want the linkage to the marketplace (transparency), want to work together as a value chain team, are seeking price stability and see First Light Wagyu as innovative and leading edge.

Milestone 2.2.1 Producer Group Establishment and Operations

- A Producer Group model has been developed incorporating 78 shareholder farmers and 23 non-shareholder suppliers as at July 2019, this totals 101 producer group farmers, (see Figure 12. below for geographic spread), versus the original programme target of 180. With the current supplier growth plans, the business is likely to reach this target and grow beyond.
- In addition to the 78 current shareholders, there are another 30 pending shareholders that are expected to join the business once their cattle are processed by 2021. A change in policy occurred during the programme whereby suppliers were encouraged to defer the decision on becoming a shareholder until they had some experience with farming the cattle and until both parties had the opportunity to gauge each other's suitability. It remains important that only truly suitable suppliers, who fit the producer group model, whose property is capable of

farming Wagyu cattle and who share First Light's values, become shareholders. The First Light values are; "Profitable and Sustainable Returns for All, Integrity and Humility, Respect our Animals and Environment, Innovation and Be Happy".



Figure 12. Geographic spread of producer group farms throughout New Zealand, July 2019

- Four Focus Farms were introduced in late 2017 to provide knowledge extension across the supply group. These are based in Northland, Manawatu, Canterbury and Southland. The Focus Farms play an important role in the establishment, growth, performance and maintenance of the Wagyu Producer Group, and are selected from the best-performing properties managed by motivated farmers. Summaries of performance results from the Focus Farms are shared with other producer group members.
- Supplier hub days are held at least twice yearly with good attendance. An annual AGM and conference provides opportunity for the Producer Group shareholder suppliers to share information and receive progress updates on activity across different parts of the business.
- Due to an increasing number of South Island suppliers processing capability was established in the South Island in late 2017. Logistics efficiencies and welfare have been improved as finished cattle from the South Island no longer need to be transported to the North Island for slaughter. Currently production is split approximately 65% in the North Island and 35% in the South Island. However, this is projected to change to 50:50 over time as the number of suppliers and cattle in the South Island continue to grow.
- As the business has grown over the term of the programme the Livestock team structure has evolved. This is now headed by the GM Wagyu with a National Livestock Manager leading a team of five Regional Relationship Managers with Communications and Administration support. A National Beef Performance Manager and Supply Planner were also employed in the last year of the programme.
- A web-based communications platform for farmers is still in development. The initial phase of online tools and communications involved development of an online Supply Planning tool,

named 'The Loading Ramp', utilising Farm^{IQ} technology which was released to farmer suppliers in July 2019.

• An app based First Light 'Community' platform will be launched in 2019. The social communication will enable farmers, the supply chain team and selected customers to share knowledge, celebrate success and meet the First Light founders' original objective of seamlessly connecting the best farmers with the best customers, wherever they may be.

Milestone 2.3.1 Integration with the Dairy Industry

Relationship with Livestock Improvement Company (LIC)

- The LIC relationship was established in 2016 for the exclusive supply of Wagyu x dairy calves with plans to grow to 60,000 matings by 2020, (noting that approximately 2.4 matings are required to generate a calf). Significant growth was achieved in the 2017 and 2018 seasons through dairy AI with approximately 36,000 matings in the 2017 season and 43,000 in the 2018 season.
- Being able to identify a calf as Wagyu is critical, especially when calves are grouped with other dairy calves. A best practice calf identification fact sheet was developed to assist farmers with visual identification and in 2018 LIC developed a Wagyu genetic marker enabling positive Wagyu calf identification through DNA testing.
- An external PR consultant was engaged over the course of the programme to develop targeted marketing and advertising for Spring and Autumn matings and weaned calf placements.
- The proportion of Wagyu x dairy animals now makes up 80% of animals processed, with the balance from Wagyu x Angus. Refer to Figure 13. for the proportion of Wagyu x dairy animals versus Wagyu x Angus animals processed.



Figure 13. Proportion of Wagyu animals processed - Wagyu x dairy vs Wagyu x Angus

Programme learnings from integration with the dairy industry:

- A deeper understanding of the type of dairy dam breed (Friesian vs Kiwi cross vs Jersey) has been attained. The preferred dairy dam breed for Wagyu is considered to be Kiwi cross due to availability, consistent mature weight and beef quality.
- It is important that calf rearers become more involved in the programme. Australian research has highlighted that the first four months of age are critical to marbling cell development. Feeding of colostrum in the first 24 hours of life has also been reinforced and random colostrum testing on dairy farms will be undertaken from the 2020 season onwards.
- In the latter years of the programme there has been increased enquiry from dairy farmers who are looking to not only generate Wagyu calves, but also retain them on their run-offs or grazing blocks as a diversification to their single source of milk income. Environmental pressures are likely to continue to add to this interest. This 'breed to finish' model means that the Wagyu calf is then integrated through to processing with no weaner to place, which also offers cost advantages due to lower transaction costs and improved farmer returns.
- The programme has seen a shift to using more semen (AI) versus bulls to generate Wagyu calves, with FLWNZ now promoting AI ahead of natural mate bulls. This has been supported by best WBL genetics being available through AI, *M.bovis* risks of bulls (if multiple use), and some dairy farmers implementing a no bull (all AI) policy.

3.3 Marketing

Objective Overview & Key Learnings

The Marketing Objective priorities:

- To develop a model for direct marketing and selling of high quality grass-fed Wagyu beef to New Zealand and International consumers.
- To establish a direct to consumer channel (e.g. subscription service) to support the Go-Direct markets and develop a channel for high marbling product.

Objective Overview

First Light have successfully proven a Go-Direct business model for marketing and selling Wagyu beef in the New Zealand, United States and United Kingdom markets. The Go-Direct model enables First Light to market their Wagyu product directly to the consumer and removes the number of other agents, such as exporters, importers and distributors, to ensure returns to farmers are more stable and greater than traditional models.

In November 2016, First Light launched its retail range into New Zealand supermarkets and demand continues to exceed sales expectations in the local market.

The USA remains the company's largest market with future plans to expand into territories outside the West Coast. Distribution and resource have increased significantly in the USA market to manage the current and planned growth in supply. The UK and Europe also continue to be significant customers for First Light grass-fed Wagyu. Figure 14. shows the proportion of Wagyu revenue by market for First Light's last financial year (1st April 2018 to 31st March 2019).



Figure 14. Proportion of First Light Wagyu Revenue by Market

Go-Direct Markets

The original programme objective was to establish five international Go-direct markets. A decision was made midway through the programme (Year 3) to invest deeper into fewer markets rather than spread resources too thinly. The key learning at this point in the programme was that for the retail model implementation to be successful and viable, a more focused approached in each market was required, therefore the USA and NZ were prioritised to maximise use of resources. The MGFB programme has therefore supported the development of a prototype Go-Direct model which has been implemented in NZ, USA and to a lesser extent the UK. The main reason for selecting NZ and USA as

the two key markets was to undertake a strategy of selling First Light branded products at retail. The First Light brand is needed to provide long term sustainable pricing and growth due to the brand providing a degree of supplier power at retail. Other markets such as the UK and UAE have not allowed the First Light brand at retail to date.



China was not selected within the timeframe of the MGFB programme as demand in this market for a natural grown grass-fed Wagyu product had not yet been found. Australian grain-fed Wagyu competition has targeted the China market and led to the Chinese consumer demanding Wagyu with soft texture and high marbling associated with long term feedlot grain feeding which differs to the natural grass-fed First Light product. First Light intend to undertake some new consumer research to explore potential for expansion of the Go-Direct model into China.

Direct to Consumer – the First Light 'Steak Club'

The focus of e-commerce development in the USA was a Direct to Consumer, VIP subscription platform to sell high marbling MBS6+ product. This has provided a channel for high marbling product which is typically too expensive to sell through traditional sales channels. The First Light 'Steak Club' was developed as a monthly subscription model targeted at high net worth individuals throughout the USA. A Steak Club app has also been created where subscribers can receive all their exclusive Steak Club information, including current offers and supporting features such as cooking techniques and recipes to enhance the consumer experience.

The 'Best Beef in the World'

The final two years of the programme delivered global recognition and supported First Light Wagyu's ultimate goal to be positioned globally as 'the best beef in the world'. In 2018 and 2019 First Light won Gold in the World Steak Challenge in the UK and Ireland and was also judged the best in brand in the NZ Steak of Origin awards in 2018.

A comprehensive article by Forbes Magazine in early 2019, titled "How this Tiny New Zealand Company is Producing the Best Beef in the World", provided excellent PR that was widely distributed

both locally and globally. The article outlined the history and reasons for developing the First Light Wagyu value chain model, and highlighted key aspects such as grass-fed, animal welfare, the eating experience and potential health benefits. Targeted at the American reader, the article also recommended the First Light Steak Club and identified markets and restaurants where consumers can get a taste of the "best beef in the world".

"As to be expected with any naturally-raised product, though, there's a spectrum. And here, it boils down to the intensity of marbling. To that end, First Light has adopted a scale ranging from 2 (the leanest) to 9 (the richest). Because First Light's baseline standards are far superior to what you've probably been eating, you'll discover even the leanest cuts are downright delicious and deeply satisfying. (And if you're lucky enough to come across a chop with a marbling score of 7 or higher, be prepared to put your socks back on)" **Forbes.com**

First Light Wagyu Product Attributes

Along with the Wagyu breed, First Light delivers product with attributes that are demanded by the consumer, who is also willing to pay a premium for these attributes. In 2014 First Light became a founding member of the non-GMO beef programme, and in 2018 became the first organisation in New Zealand to gain Certified Humane accreditation. "The Certified Humane programme is dedicated to improving the lives of farm animals in food production from birth through slaughter," *certifiedhumane.org*. The FLF attribute portfolio also includes 100% grass-fed, no Antibiotics or added Hormones ever and Non GMO (see Figure. 15), with plans underway to develop future attributes around human health, social responsibility and the environment.

Figure 15. Timeline for First Light Wagyu product attributes



In the beginning First Light benchmarked their grass-fed Wagyu product against grain-fed beef. However, it has become clear that the First Light USA consumer is more aligned with the domestic organic grass-fed beef consumer, which is at a higher price level. Both grass-fed Wagyu and domestic organic trade at a premium over USDA prime of around 20%. This illustrates that First Light's target USA consumers will pay a premium for desirable attributes.

New Product Development

Early in the programme FLF identified the value of developing retail products, to build a retail brand and to manage carcass balance. Initial NPD (New Product Development) activities were outsourced, then in 2018, the first Food Technologist was employed to drive NPD, sensory and shelf life projects. This accelerated the launch of products into the range and included development of a trained sensory panel for in-house product assessment.

Milestone Achievements Summary

Milestone 3.1.1 Establishment of a global virtual office

• In Year 4 the new financial system for stock control, sales and logistics was installed for the Go-Direct markets. This system provides important information and reporting links between head office and the sales teams located globally.

Milestone 3.2.1 New Zealand Market

- Following the successful launch of the New Zealand retail range in November 2016, sales and distribution have continued to exceed expectations. As at the end of July 2019 First Light retail product was available in 209 retail stores, which included New World, Countdown and Pak'nSave stores throughout New Zealand and Farro stores in Auckland.
- The Direct to Consumer channel for the New Zealand market was not established with efforts instead focused on developing a Direct to Consumer channel in the USA. Customer research

Meeting the demands of the conscientious consumer, particularly in First Light's largest market, the USA, is critical to success of the Wagyu programme.

New Seasons – Pacific Northwest

Derik Briggs, Meat Manager at New Seasons, notes that "100% Grass-Fed along with the Wagyu breed is a unique offering that First Light has in the marketplace. No Antibiotics or added Hormones ever and Non-GMO Verified are also very important to our customer and by First Light having all these attributes, again with the Wagyu breed, makes for a strong statement in the meat case."

Derik is an advocate for Farmers visiting the market, "Farmers in the stores show the partnership between the brands and helps with storytelling to staff and customers".

Berkley Bowl – California

Dylan Poteger, Director of Meat & Seafood Operations for Berkley Bowl says, "our customers love the First Light product and we have no record whatsoever with a complaint or return from this line."

Dylan visited NZ in August 2017, "the experience that I had not only touring farms and facilities but meeting 3rd & 4th generation farmers and their families, seeing the passion, dedication and hard work put into what they obviously love to do was something that will stay with me forever and gives me the peace of mind that I am offering every one of our First Light customers the best quality grass-fed beef that I can." undertaken in NZ and USA showed that the direct to consumer model should focus on the highest quality and priced cuts pitched at the high net worth customer. With the help of a partner (and First Light Foods shareholder) based in Los Angeles, the decision was made to design and launch an e-commerce platform in the USA, with other markets to follow.

• A Wagyu carcass optimisation model has been developed and is commercially operational utilising costing and forecasting programmes. This model provides optimal decision making capability for how to best bone each Wagyu carcass for yield and marbling score, providing analysis of carcass returns by cut and primal group to aid costing and valuation for each market.

Milestone 3.3.1 UK/EU Market

• Sales of First Light Wagyu into the UK have continued through major UK retailers in burger form. The high cost of duty (€3.043/kg plus 12.8%) has made the sale of higher value cuts largely prohibitive.

• A retail range for a French retailer was developed in Year 5 of the programme and launched into French retail stores in June 2018. However, this was stopped soon after launch due to a breakdown in communication with the retail buyer.

Milestone 3.4.1 UAE Market

• Early in the programme First Light helped to set up a butcher shop in the UAE with a local resident. Currently the UAE butcher shop continues to operate in-market (as an independent retailer stocking First Light Wagyu beef) contributing to a small amount of annual sales (see Figure 14.).

• The experience in the UAE market provided some important insight about the consumer. While there was strong demand in this market for high-marbled grain-fed beef, this did not translate to demand for a high-marbled grass-fed product, as the consumer in this market had not yet become informed on attributes associated with grass-fed, antibiotic free, animal welfare, health and environment. Although this market provides future opportunity, the immature retail market in the UAE supported the decision to focus more on USA and NZ midway through the programme.

Milestone 3.5.1 USA Market

- Over the seven years of the MGFB programme the USA market has grown considerably and is now supported by three Sales Representatives and a Sales Support administrator in market. First Light product is currently in 190 stores across the West Coast and Texas. Strong longterm relationships with key USA customers have been supported by Farmers to Market visits and Customer to New Zealand visits.
- First Light have developed a unique model and system for sales representatives to manage their stores and the First Light brand according to store scope and sales.
- First Light has opened a USA company, First Light Foods USA, and established logistics, processing, cold storage and distribution networks.
- The Direct to Consumer VIP platform, the 'First Light Steak Club' was initiated in the final year of the programme. The 'Steak Club' launched to 60 founding members with a monthly subscription fee. As at the end of July 2019 the 'Steak Club' has grown to 103 members with a waiting list of 70 people. This is a key sales channel for First Light and refinement and expansion of the 'Steak Club' remains a high priority.

3.4 Production Research and Development

Objective Overview & Key Learnings

The Production Research and Development Objective priorities:

- To evaluate the performance of Wagyu progeny from dairy dams to support supply chain growth through the dairy industry.
- To investigate a range of feeding systems with the aim of improving growth rates and marbling.
- To compare efficiencies of Angus versus Angus x Jersey beef breeding cows.

Objective Overview

The production research and development objective focused on demonstrating capability and returns from crossing high marbling Wagyu sires with dairy dams and developing best practice management and feeding guidelines. Research was also undertaken to demonstrate the performance of Angus x Jersey cows and their Wagyu progeny. Over the course of the programme the need for improving the marbling score and measuring marbling became a key area of research. Refer to section 2.3 'What is marbling?' for a detailed explanation of marbling.

Analysing the First Light carcass database on an annual basis provided insight into trends over time and supports continued efforts to improve animal performance. One of the long-term trends identified was the gradual reduction in carcass weights and associated drop in marbling scores as farmers prioritised growth rates initially, aiming to finish Wagyu cattle prior to the second winter. In 2019 a minimum age of processing and weight-based incentives and penalties were introduced to arrest this decline. The analysis also identified that Wagyu x dairy animals on average continue to marble higher than Wagyu x Angus (refer to Figure 16. below).



Figure 16. Change in Marble Score; Wagyu x dairy vs Wagyu x Angus animals

Achieving the desired level of marbling consistently has been a key challenge. The significant decrease in marble score during 2016 (see Figure 16. above) was due to a thorough recalibration of marbling assessment, where methods for aligning with the AUS-MEAT standard and routine calibration of graders were introduced. A targeted focus over the second half of the programme has improved the understanding of factors affecting marbling and meat quality, and reinforced that many drivers must be implemented together to improve overall marbling of a Wagyu animal. The primary drivers of improved marbling are genetics, nutrition, net energy intake, growth rate, carcass weight and mature live weight;

- Progress has been made in improving the genetic potential and early life nutrition. The genetic gains made have started to reach the finished cattle being processed, particularly in the Wagyu x dairy cattle, with an average marble score of 4.0 for finished Wagyu x dairy cattle over the April to June 2019 quarter, (total average MBS over this period was 3.8).
- High energy crops, within the 100% grass-fed standard, have contributed positively to marbling.
- Initial results from a specialist winter finishing trial over winter 2019 in the North Island are also encouraging, with an average marble score of 4.4 across 257 animals processed in July 2019, during a time of the year where marbling had previously declined.
- Restrictions and incentives on age and carcass weights are expected to continue to further improve marbling.

Milestone Achievements Summary

Milestone 4.1 Utilisation of surplus dairy calves for prime beef production

Three main dairy genotypes, (Friesian, Kiwi cross and Jersey cows) were mated to Wagyu and the progeny benchmarked against each other in terms of animal performance (growth rate and meat quality) and financial returns. The results of this trial work completed in 2017 showed that there was little difference in marble score and profitability between progeny of Friesian and progeny of Kiwi cross cows, (returns were 18.5 and 18.9 cents/kg DM consumed respectively). It was found that growth rate and timing of supply had bigger influences on profitability than whether an animal's dam was a Friesian or a Kiwi cross cow. However, it should be noted that a smaller trial earlier in the programme (2015) showed marbling increased, but carcass weight decreased going from Friesian to Kiwi cross to Jersey dams, and consistent feedback from the field is that Kiwi cross dams are considered the "sweet spot", producing progeny that are easiest to finish as two year old cattle and producing consistent high meat quality.

Milestone 4.2 Improving returns through alternative forages and management systems

- Over the first couple of years of the programme a number of feeding trials were carried out to test different forages in winter and summer across Wagyu of varying ages. This work led to a monitoring programme being initiated in 2015 and completed in 2017 with R1 steers and heifers on 4 properties. Key findings were:
 - There was a general trend for animals on higher quality feed to be slaughtered earlier.
 - Profitability was directly linked to growth rate.
 - In the older growing animal, there is a linear increase in marbling if there are no growth checks.
 - Cattle fed fodder beet were better marbled and had more than twice the rib fat depth of other cattle which were older and had heavier carcass weights.
 - Regular weighing has significant benefits for animal performance and in planning of stock for slaughter.
- Carcass data collected by First Light Foods was analysed each year for quality, supplier and seasonal trends and compared to previous years. Findings from the data analysis has helped to shape future research focus and activity.
- Research was undertaken in 2015 and 2016 to compare marbling predicted by ultrasound on live animals to results collected at slaughter. This showed that the ultrasound technology available at the time was unreliable as a tool to accurately predict the degree of marbling in Wagyu animals.
- As tenderness is an important factor in the overall meat eating experience, a study into the relationship between marbling and tenderness in Wagyu x dairy heifers was undertaken;
 - 110 samples were collected with marble scores ranging from 2 to 9.
 - All samples had shear force measurements of less than 8 meaning they were all considered "tender" by NZ Meat Industry standards.

- As marbling score increased, steaks became more tender and the tenderness became less variable.

Farmer Fact Sheets

A series of Farmer Fact Sheets to extend some of the key findings from the MGFB programme's production research were published in 2018 and updated in July 2019, and are available to farmers through the Livestock Relationship Managers.

Six farmer fact sheets were created as listed below:

- Origin of Wagyu Beef
- Maximising Growth Rates
- Summer Feeding of Weaner Calves
- Factors Affecting Marbling
- Identifying Wagyu Calves
- Rearing Wagyu Calves

Milestone 4.3 Efficient beef cows

• Angus cattle are the most popular beef breed in New Zealand, due to their ability to thrive in all kinds of country and the cows being highly fertile and good mothers. However, over the past 20-30 years the body weight of the Angus cow has increased with no increase in calf weaning weight or cow performance, resulting in lower economic returns. The objective for this milestone was to investigate whether there was a place in the supply chain for a lighter weight Angus x Jersey breeding cow. Jersey cross cattle are also known to have better marbling and usually perform very well in taste panel tests. However, there is a stigma against the size and shape of the Jersey cow (even as a cross bred) which would need to be overcome by traditional New Zealand beef farmers preferring their traditional Angus breeding cows.

To compare relative profitability, three cohorts of Angus x Jersey cows were mated with Wagyu bulls and run alongside Angus cows of the same age on three properties. The Wagyu cross progeny from the two cow breeds were then farmed together until slaughter.

- The calves reared by the Angus x Jersey cow had slightly higher calf weaning weights (215 vs 211kg).
- In spite of being slaughtered at lighter carcass weights, progeny from the Angus x Jersey dams consistently marbled slightly better than the progeny from the Angus dams (3.5 vs 3.3 for heifers and 3.3 vs 2.9 for steers).
- Average returns from running the breeding cow and finishing the progeny showed a small advantage in favour of the Angus x Jersey progeny (17.6 vs 17.1 cents/kg DM).

At this point results from the comparison trials do not appear to be compelling enough to motivate traditional beef farmers to consider the Angus x Jersey cross as a breeding cow for F1 Wagyu progeny.

4. PROGRAMME INVESTMENT

4.1 Financial Summary

At a high level the programme met original budget expectations for the overall MPI PGP funding investment of \$11M, with Co-Investor funding slightly under budget at \$11.5M. The total programme spend for the MGFB programme was \$22.6M.

Refer to Table 1. below for a breakdown of the programme financials by objective and milestones.

Table 1. Summary of Marbled Grass-Fed Beef Programme Financials by Objective

PGP Year (1 July to 30 June)	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	
	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Totals
Programme Total	898,459	1,867,597	2,485,133	3,493,252	3,836,338	4,497,854	5,473,364	22,551,996
MPI PGP	467,748	1,056,719	1,195,192	1,695,242	1,671,043	2,319,369	2,605,881	11,011,194
Co-investors Total	430,711	810,879	1,289,940	1,798,010	2,165,296	2,178,482	2,867,482	11,540,801
1. Genetics								
1.0 Project Mgmt		27,135	29,934	55,190	96,566	39,375	48,668	296,868
1.1 Genetics	128,236	333,751	242,531	378,944	360,074	198,672	78,608	1,720,816
1.2 New Technologies	,	290,046	121,300	296,055	41,017	174,133	,	922,551
1.3 Genomics						484,642	774,524	1,259,166
Subtotal Genetics	128,236	650,932	393,765	730,190	497,657	896,822	901,800	4,199,402
MPI PGP	64,118	343,869	157,221	361,249	242,117	448,411	450,900	2,067,885
Co-Investors	64,118	307,063	236,544	368,940	255,540	448,411	450,900	2,131,516
2. Supply Chain								
2.0 Project Mgmt	12,367	18,061	43,080	59,490	87,327	74,995	67,637	362,957
2.1 Understanding Farmers	49,716	41,222	17,664	25,674			13,970	148,246
2.2 Establishing PGs	163,920	323,045	259,437	293,873	411,176	795,199	708,418	2,955,068
2.3 Integration Dairy		16,134	246,815	682,115	605,159	925,705	1,635,888	4,111,816
Calf risk mitigaton provision						34,540		34,540
Subtotal Supply Chain	226,003	398,462	566,995	1,061,153	1,103,662	1,830,439	2,425,913	7,612,627
MPI PGP	106,817	287,560	357,361	606,610	803,390	1,343,335	1,566,250	5,071,323
Co-Investors	119,186	110,902	209,634	454,543	300,272	487,103	859,663	2,541,303
3. Marketing								
3.0 Project Mgmt	12,792	20,726	27,131	46,607	24,000	28,432	22,901	182,589
3.1 Virtual Global Office	25,365	312,674	365,605	370,302	134,598	103,395	150,950	1,462,889
3.2 New Zealand	42,047	112,796	74,151		432,996	357,658	372,545	1,392,193
3.3 UK/EU	133,825	77,009	210,047	218,612	256,630	356,933	222,969	1,476,025
3.4 UAE	13,030	71,654	124,492	64,144	20,429	662		294,411
3.5 USA Value Added	23,294	2,838	146,306	408,005	877,794	532,987	977,445	2,968,669
3.8 Market Development			99,550	58,946	36,720	40,240	30,186	265,642
Subtotal Marketing	250,353	597,697	1,047,283	1,166,616	1,783,167	1,420,307	1,776,996	8,042,418
MPI PGP	164,470	338,321	436,003	501,264	366,605	326,205	405,149	2,538,017
Co-Investors	85,883	259,377	611,279	665,352	1,416,562	1,094,102	1,371,847	5,504,402
4. Production R&D								
4.0 Project Mgmt	41,519	15,264	8,461	11,501	10,026	25,952	59,613	172,336
4.1 Benchmarking	82,623	39,914	30,602	48,628	23,570	12,090	16,388	253,815
4.2 Forages and Management	79,359	76,851	225,746	194,074	163,676	148,397	153,615	1,041,718
4.3 Efficient Beef Cows	21,866	22,191	42,767	60,943	29,653	33,744		211,164
Subtotal Production R&D	225,367	154,220	307,576	315,146	226,925	220,183	229,616	1,679,033
MPI PGP	98,093	53,826	159,850	116,045	146,467	136,367	114,063	824,711
Co-Investors	127,274	100,394	147,726	199,101	80,458	83,815	115,553	854,321
			· · ·					
Programme Mgmt GFW	68,500	66,286	169,514	220,148	224,927	130,103	139,039	1,018,517
MPI PGP	34,250	33,143	84,757	110,074	112,464	65,051	69,519	509,258
Co-investors	34,250	33,143	84,757	110,074	112,464	65,051	69,519	509,258

5. ECONOMIC BENEFITS

Original Economic Assessment 2012

As part of developing the business case for the MGFB programme, independent economic analysis was undertaken to forecast the expected economic benefits that could be generated. This assessed the benefits that would accrue to the:

- **Co-investors:** the fees received for the use of Wagyu genetics (Brownrigg) for natural matings and AI, and the processing/marketing fee (First Light).
- **Dairy industry:** the premiums paid for calves, Wagyu x Angus and Wagyu x dairy.
- **Beef industry:** gross margin over prime steer per kg.
- Wider economy: the wider economic benefit as a result of increased employment and household income as a result of the investment and increased production activity and returns generated by the programme.

Table 2. below summarises the cumulative benefits that the economic assessment (2012) forecasted the MGFB programme could generate.

Table 2. Summary of Cumulative Economic Benefits for 2013-2028

CATEGORY	ORIGINAL CUMULATIVE BENEFIT
CO-INVESTOR BENEFIT	\$94.4 MILLION
DAIRY INDUSTRY BENEFIT	\$102.3 MILLION
BEEF INDUSTRY BENEFIT	\$654.1 MILLION
WIDER ECONOMY	566.2 MILLION
TOTAL GDP INCREASE	\$1,417 MILLION

NB: These figures are stated in 2012, they have not been discounted

The key drivers and targets for the economic benefits as part of the programme were:

- Calf numbers:
 - Wagyu x dairy: 60,000 by 2019, 200,000 by 2028
 - Wagyu x Angus/Jersey: 10,000 by 2019, 32,000 by 2028
- Calf premiums: \$60 over the existing price received by dairy and beef farmers
- **Processing numbers:** this included the number of animals processed by First Light, as well as wider industry adoption of Wagyu genetics by other producers in the New Zealand beef industry as a result of the programme;
 - Wagyu x dairy: 20,000 by 2019, 200,000 by 2028
 - Wagyu x Angus/Jersey: 12,500 by 2019, 120,000 by 2028

Note that the total forecasted processing number for 2019 was originally 32,500 cattle and this was dropped to 15,000 in Year 2 of the programme.

- **Price premiums:** an existing price premium of \$1.30/kg for Wagyu over prime steer, plus the following being achieved:
 - \$0.32/kg premium due to production gains (improved marbling and productivity)
 - \$0.50/kg premium due to greater margin being captured through the go-direct model
- This gave a gross target of \$6.32/kg for Wagyu compared to \$4.20/kg for prime steer at the time of writing the business case. This was later revised to a net target of \$2.12/kg over prime steer.

Revised Economic Assessment 2017

The latest independent economic assessment of the programme occurred in 2017, where a revision of the economic benefits was carried out based on actual data from 2013-2017 and forecast data for 2018 and 2019. The 2017 economic assessment is summarised in Table 3. below:

Table 3. Summary of Revised Cumulative Economic Benefits from 2017 Assessment

CATEGORY	REVISED CUMULATIVE BENEFIT	REVISED CUMULATUVE BENEFIT		
	2013 - 2019	2013 - 2028		
INVESTMENT	\$22.3 MILLION	\$42.7 MILLION		
CO-INVESTOR BENEFIT	\$10.2 MILLION	\$71.2 MILLION		
DAIRY INDUSTRY BENEFIT	\$9.3 MILLION	\$91.4 MILLION		
BEEF INDUSTRY BENEFIT	\$10.2 MILLION	\$178.9 MILLION		
WIDER ECONOMY	\$24.0 MILLION	\$218.0 MILLION		
TOTAL GDP INCREASE	\$76.0 MILLION	\$602.0 MILLION		

The amounts above were based on actual data from 2013 to 2017, which also supported revised forecasted data for 2018 and 2019. The key drivers for the 2013-2019 revised cumulative benefit figures were:

- **Calf numbers:** 12,500 calves born in 2017, and approximately 16,000 calves born in 2018 and 20,000 in 2019 based on matings undertaken and planned at the time.
- **Calf premiums:** premiums of up to \$127 paid for calves in 2017 and forecasted to increase to \$137 in 2018 and 2019.
- **Processing numbers:** processing numbers reaching 4,865 in 2017 and growing to 6,000 in 2018 and 9,800 in 2019, which was based on the number of calves already born.
- **Price premiums:** price premiums had reached \$1/kg over prime steer in 2017 and were forecast to grow to \$1.40/kg in 2018 and \$1.80/kg in 2019.

The cumulative benefit for 2013-2028 was based on a low growth scenario assuming: 20% growth in calf and cattle processing numbers year on year from 2019 to reach 60,000 animals being processed in 2028; growth in the price premium to \$2.12/kg by 2020; and, other key drivers being maintained at 2019 forecast levels. This also included assumptions around wider industry uptake of the model.

Economic Benefits Key Drivers July 2019

The programme has made good progress in the development of the production systems, development of new products and markets, and integration of the value chain. This has enabled growth in the number of Wagyu-cross calves born, calf premiums paid, animals processed, and price premiums achieved. As at the end of July 2019, the following has been achieved:

- Calf numbers: 15,500 calves born in 2018/19 (FLWNZ financial year), and a forecast of 22,000 calves in 2019/20
- Calf premiums: \$180 \$280 per calf for Wagyu x dairy
- **Processing numbers:** 7,670 animals were processed in 2018/19, with a forecast of 11,300 animals to be processed in 2019/20
- Price premiums: \$1.18/kg average return to farmer over prime steer for the 2018/19 year.

These figures largely support the benefits calculated to be generated between 2013 and 2019 as part of the independent economic assessment that occurred in 2017, with the key drivers that have not met what was forecast being offset by those that have exceeded them.

Achievement of the forecasted benefits to 2028 will still require significant growth in the model. However, this demonstrates that halfway between commencement of the programme in 2012 and the 2028 long-term 'end point', significant value is being created and distributed across the Coinvestors, dairy industry, beef industry and wider economy. The programme is currently on the cusp of a significant growth phase with considerable additional value to be realised as the Co-investors continue to invest in the growth and refinement of the production system and value chain.

6. CONCLUSIONS & RECOMMENDATIONS

The programme vision to have "New Zealand beef prized globally as the best grass-fed beef in the world, a high quality, specialty 'centre of the plate' meat", has been realised through the Marbled Grass-Fed Beef PGP programme. This was endorsed in the later years of the programme by Forbes.com who labelled First Light Wagyu beef as 'the best beef in the world', and through achieving international and local awards such as the World Steak Challenge and NZ Beef of Origin.

The MGFB programme underpinned the development of a truly integrated value chain, from Wagyu genetics through to the end consumer, with the farmer suppliers directly benefiting from a shorter supply chain and closer links with the market. Through this improved value chain and creation of the Go-Direct model, the New Zealand grass-fed beef story has been able to be effectively communicated directly to the end consumer. The Go-Direct model has also provided structure in market for other iconic New Zealand products to potentially utilise in the future.

The programme has also contributed to other noncommercial outcomes such as providing a forum for like-minded positive farmers who enjoy farming beautiful Wagyu cattle, helping to change the commodity versus value mindset and promoting leadership in the farming and meat sector.

"One of the most significant benefits to the business from being part of the PGP programme was gaining an understanding of the unique features and production attributes of grass-fed Wagyu beef, particularly when linked with the dairy sector." **First Light Managing Director, Gerard Hickey**

The programme has successfully delivered on the short-term outcomes to develop;

- A proven model for the supply of calves from the dairy industry
- A proven model for the year-round production of marbled grass-fed Wagyu beef
- A proven model for go-direct marketing to NZ and international markets

To continue the programme's success and support the ultimate long-term outcome of a more sustainable New Zealand prime beef industry, the following key actions are recommended to increase sales price, sales volume and profitability:

- Sustained growth in the production and sale of grass-fed Wagyu beef delivered through;
 - Attraction of new suppliers to the First Light Wagyu producer group.
 - Continued integration with the dairy industry with a move to dairy farmer 'breed to finish' i.e. dairy farmers becoming part of the producer group and value chain.
 - Increasing the retail network, particularly in the USA and exploration of other potential international markets including China.
- Continued growth in the premiums generated across the value chain supported by;
 - Developing new products from the '5th quarter' (the trim, bones and offals of the carcass) to extract maximum value from the whole carcass.
 - Rollout of an e-commerce model for direct-to-consumer sales in NZ and the USA and establishment of a Steak Restaurant model in the USA as channels for high value MBS 6+ product.
 - Improving marbling results through 'whole of life' (from early-life calf nutrition to finishing) to provide a more valuable product to market and improve farmer returns.

7. POST-PROGRAMME ACTIVITY

Future Challenges

The Co-investors acknowledge that while significant progress has been made towards the programme outcomes, there are still challenges to overcome to reach the longer-term targets.

Some of the key future challenges identified by the Co-investors are:

- Delivering sustainable returns to the farmer, target \$2.12/kg over prime steer.
- Reaching growth targets of 30,000 cattle processed per annum by 2025;
 - Growing the supply base to ensure all calves are able to be placed and retained within the supply chain.
- Managing ongoing biosecurity risk across the entire supply chain including mating management and calf rearing.
- Environmental requirements meaning farmers are faced with additional costs and constraints, which could motivate land use change from dairy and beef systems to other alternatives.
- The global trend for reduced red meat consumption which results in less demand for beef products.
- The need for added-value capability in the USA to ensure brand presence is maintained and additional value captured.
- The ability to keep abreast of new and emerging product attributes and stay ahead of competitors.

Across the programme Objectives, initiatives embarked on during the last seven years will continue and evolve into the future. The way initiatives evolve will be driven by the needs of the whole value chain as the commercial partners look to address value, develop opportunities and mitigate risks in a dynamic environment. The following outlines immediate plans by Objective to support achievement towards the programme's longer-term targets and help mitigate future risks and challenges;

Genetics

- Annual improvement of the WBL Genomic Relationship Matrix (GRM) as a decision support tool through ongoing cattle progeny trials. This will involve the GRM being updated annually with data from 300 – 500 animals, something that is expected to continue indefinitely. Resulting improved objective cattle selection decision making will drive incremental and compounding genetic gains into the future, providing increasing value to the supply chain.
- Annual Breeding Index enhancement. Ongoing investment in the WBL GRM will increase the potential for supply chain cattle to achieve desired cattle performance and beef quality attributes. The economic value of these attributes, as incorporated in the Breeding Index, will enable the selection of bulls that confer most value to the supply chain.
- Benchmark WBL genetics globally. As first step, this is underway with the largest Wagyu producing nation (outside of Japan), being Australia.
- The Genetic Steering Group (GSG) consisting of key staff from WBL, FLF, Abacus Bio (consultant geneticists) and LIC will continue to meet 3-4 times per year. The purpose of the

group, representing all supply chain stakeholders, is to provide the best genetics advice to guide the development of WBL's annually updated Genetics Improvement Plan. The GSG will retain input from multiple experts and ensure robust economic analysis of trait values to enhance the Breeding Index.

• The WBL data management systems upgrade will be completed to include customised reporting functions by December 2019.

Supply Chain

- Continue initiatives to increase the number of suppliers in the producer group by at least 100 new suppliers and support growth within the existing supplier base.
- First Light are planning for a Quality Assurance Manager to be employed in early 2020 to implement an aspirational 'Farmed-with Care' programme. This role will support First Light Wagyu suppliers to produce Wagyu beef that complies with current market attributes and encourages farming practices that will fit with future regulatory, environmental and market requirements.
- The 'Loading Ramp' collaboration with Farm^{IQ} will be rolled-out by October 2019. This will provide a data capture platform for suppliers to record stock on hand and weights that enable more effective planning of finished cattle for processing.
- Calf rearing trial through Spring 2019 with a specialist large scale Wagyu calf rearer in the South Island. The purpose of this trial is to refine and develop a Wagyu Calf Rearing model and then roll-out this model as the exemplar nationally.
- Complete the analysis of the 2019 winter finishing trial. Develop and roll-out specialist winter finishing standard operating procedures.
- Membership and leadership in a red meat industry collaboration to support roll-out of learnings across environmental, health and social responsibility areas.

Marketing

- First Light have partnered with NZTE through an International Growth Fund (IGF) to expand USA territories and growth in the USA beyond the West Coast. This is a 3-year project due to be completed in 2022.
- Expansion of supply into more HiHo Cheeseburger stores in the USA. The HiHo restaurant business uses 100% grass-fed Wagyu beef exclusively from First Light for its award-winning burgers.
- Expansion of an e-commerce store model across USA and then into other global markets including potentially in NZ, UK and China.
- Exploration of potential new international retail markets outside the USA and UK including China.
- Invest in operational capability in the USA for secondary processing and logistics.
- Identify 3rd party representation opportunities where 'like-minded' products and brands can be marketed through existing channels.
- 5th Quarter project to develop an in depth knowledge of all non-meat components of the Wagyu carcass and use this knowledge to increase revenue through adding value.
- Roll-out of seasonal NPD activity as per the NPD plan.
- Research into development of health based and environmental attributes.

Production R&D

- The National Beef Performance Manager role is tasked with increasing the average MBS from 3.6 to above 4 by the end of 2020 by analysing and reporting on the influences of marbling from genetics, early nutrition to farm management and supporting extension to suppliers.
- Continue analysis of the First Light carcass database on an annual basis to review trends and shape future research focus and activity.

8. ACKNOWLEDGEMENTS

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And finally, a very special thank you to Juliet Maclean, the programme Chairperson from 2016 to 2019, whose governance and experience was invaluable to the programme.

For more information on the programme and commercial partners please visit the following websites: <u>www.mpi.govt</u>, <u>www.firstlight.farm</u>, <u>www.brownrigg.co.nz/livestock/wagyu-breeders/</u>



Appendix 1. Outcome Logic Model

Outcome Logic Model for Marbled Grass-fed Beef PGP Programme

