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The Value of the Dairy Beef Progeny Test

A Farm Systems Modelling Review

PREPARED FOR: BEEF + LAMB NEW ZEALAND, 1 AUGUST 2022

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1.0 EXECUTIVE SUMMARY

This report details the findings from a whole-farm modelling process whereby the progeny of high-performance beef sires identified in the Dairy-Beef Progeny Test (DBPT), were compared with the progeny of industry average beef sires. Each sire had been mated via AI (artificial insemination) with a random selection of mixed-age dairy cows. The progeny of each sire was required to perform under the same conditions with respect to pasture supply and pasture growth pattern. Feed demand was matched with feed supply, and then the model was optimised so that available feed was utilised as efficiently as could be expected.

The Dairy-Beef Progeny Test (DBPT) commenced in 2015 and is independently coordinated and supervised by B+LNZ Genetics, a subsidiary of Beef + Lamb New Zealand (B+LNZ). Bull breeders submit their selected sires for progeny testing for a fee and agree to an associated set of progeny test conditions.

The purpose of the DBPT program is to discover high genetic merit beef sires with relevance and opportunity for both dairy and beef farmers. The quality of recording in the DBPT is high. Detailed and comprehensive phenotypic data is collected, analysed, and reported for traits ranging from gestation length and calving-ease through to carcass weight and carcass quality.

To date 170 beef sires have entered the DBPT and each year approximately 20 new sires are progeny tested and consequently new and better sires are continuously identified, all of which have the potential to be available on a cost-effective and commercial basis.

The 2021 & 2022 DBPT Reports revealed the top five sires ranked on carcass weight represented five different breeds. These results highlight the fact that between breed analysis is important and that no one breed dominates the beef breeding opportunities for NZ farmers.

The DBPT modelling, the subject of this report, revealed that the highest ranked sires would increase growth at 400-days and 600-days, by 15% compared to average sires and as a consequence would:

- Improve Gross Margin return between $211 and $261 per hectare; affording an increase of 16%.
- Production (kilograms of carcass weight per hectare) improved by 8-11%
- Feed Conversion Efficiency (FCE) improved by 8-9% and thereby also reduced greenhouse gas emissions per kg of product produced.

The DBPT modelling demonstrated that when the top 10-15% DBPT sires for marbling (intramuscular fat or IMF) were compared with average DBPT sires for marbling there was a 27% improvement in strike-rate for qualifying cattle. When the 27% improvement was applied as an increase in strike-rate with commercially available beef quality supply programmes, with a price premium of 30 and 50 cents per kilogram carcass weight, Gross Margin increased by $29 and $51 per hectare respectively. These returns express the differences between top sires versus average sires and do not include the returns from the average strike rates within each supply program.

When the overall advantages of supplying cattle to programs that reward beef quality are considered, by combining the average strike of each program with the top DBPT sire performance within each program, the Gross Margin increased by $91 (+7%) and $142 (+11%) per hectare for Program 1 and 2 respectively. The genetic contribution was significant and amounted to 36% and 47% of that profit.

The DBPT modelling results are particularly relevant to dairy farmers who will likely be faced with a 'no bobby calf kill' policy within the next 5-10 years. In reality if the surplus 5-day-old calf has little or no value as a beef finishing animal then it will be heavily discounted or rejected as a finishing proposition. Alternatively dairy farmers will be forced to reduce dairy cow numbers to accommodate the rearing of their surplus calves. Either way the value of the surplus calves can be raised significantly by dairy farmers utilising high genetic merit beef sires over the dairy cows which are not required to generate their dairy replacements.

The impending 'no-bobby calf' policy imposes a huge challenge to increase the value of the current 2.1m surplus bobby calves from our dairy farms, of which 83% (1.75m) are currently processed at works and an estimated 17% (0.35m) that are disposed of on-farm. In addition another 1.05m surplus dairy origin calves transfer from dairy farms to sheep and beef farms with just 48% of these the progeny of beef sires. In total there are 3.15m surplus dairy calves all of which could have their value increased by making better decisions on choice of sire. The sires identified in the DBPT afford an important link to increasing surplus dairy calf value.

At this point in time there is not a realistic opportunity to finish cattle across one-winter compared to two-winters with all pasture systems. While it was found that the ranking of DBPT sires did not change between these polices there was a significant disadvantage with a one-winter policy. The disadvantage was associated with lighter carcass weights which fell into the 160-220kg carcass weight range when killed in the November to February period when pasture supply meets feed demand. This carcass weight range is outside of the currently accepted and targeted beef grading and associated payment schedules.

A related outcome from the modelling, which is relevant to addressing the upcoming bobby calf retention challenge, was that one-winter finishing policies provided additional and related advantages over two-winter polices as follows:

- they occupy one-third the land area
- they were 15% more feed-conversion-efficient

It is noted that the high genetic merit beef sires identified in the DBPT are proven performers and only available in commercial quantities via AI (artificial insemination), and therefore the cost of AI versus natural mating must be considered. A separate analysis showed that:

- The actual cost of beef AI in dairy herds was slightly less than natural mating and afforded many more advantages to the dairy farmer. These additional advantages include:
    - the ability to use proven beef genetics with high genetic merit as previously reported. These advantages included shorter gestation length, proven easy calving and high genetic merit for the finishing of the resultant dairy-beef calves.
    - better biosecurity and work safety by not having breeding sires on farm.

The Working Group, associated with the production of this report, discussed the practical application of the DBPT results into dairy herds and onto beef finishing farms and consequently made the following observations:

- there is currently a disconnect between dairy farmers and beef finishers. This is understood to come about because:
    - Beef finishers have a preference to purchase dairy-beef weaners in the autumn rather than the spring principally because of the challenges of over-summer calf rearing.
    - In drought years the price of calves in the autumn is little different to the price of calves in the spring.
    - Dairy farmers that have produced higher quality calves have become frustrated with variable and inconsistent demand from beef finishers.

It is anticipated that the findings detailed in this report will provide:

- good reason for dairy farmers to use DBPT proven beef sires via AI, especially in relation to the impending no-bobby calf kill policy.
- a catalyst and reason for beef finishers to reconsider the opportunity to connect directly with dairy farmers and thereby enjoy the benefits of better dairy-beef genetics.

2.0 INTRODUCTION

With the Dairy Beef Progeny Test (DBPT) having now advanced to a point where a considerable number of beef sires have been identified with significant genetic merit it is considered timely to promote the opportunities that are available to the stakeholders in the New Zealand beef and dairy industries. Additionally there is increasing pressure on the sheep and beef sector to improve production efficiency, environmental stewardship, and farm profitability. That opportunity needs to be explored and characterised.

Beef industry people often talk about and focus on how to better manage livestock but are often confused about, or not aware of the genetic opportunities, which have been afforded them. There is a need to reinforce the fact that beef profit opportunities are available for both management and genetic improvement in equal proportions. We need to dispel the myth that cattle profit is 90% feeding and 10% breeding. Rather we need to reinforce the fact that you need both good management and good genetics and the two are inextricably linked to profit.

Multi-breed analysis presents an opportunity for beef and dairy farmers and the DBPT is the only avenue open and afforded New Zealand for this essential information.

Finally it was recognised that the DBPT opportunities needed to be expressed on a whole farm system basis so that farmers, extension personnel and consultants could better grasp and understand the magnitude and reality of these opportunities.

3.0 BACKGROUND

As of July 2022, 170 sires have entered the dairy-beef progeny test (DBPT), and these sires demonstrate a 14-day range in gestation length, and a 46 kg range in carcass weight. The ongoing progeny test continually identifies sires with higher merit genetics, with particular emphasis on sires that have value for all participants in the dairy-beef value chain.

Currently 1.05m calves transfer from dairy farms to sheep and beef farms each year. Allowing for deaths and missing ~1m adult cattle of dairy-origin are processed from sheep and beef farms in New Zealand each year, with this number likely to at least double as the processing of bobby calves becomes a less-accepted option. By increasing awareness of the DBPT findings to both our dairy and beef industries, by quantifying the value offered by the high genetic -merit sires, this project has the potential to add serious economic and social value to beef and dairy farms throughout NZ.

Increased use of high genetic merit sires in industry will add value to the dairy industry through the use of short gestation sires which contribute to greater days in milk, and by enabling cows to calve easily, and on time, improving re-breeding success and reducing the need for involuntary culling.

The value of the progeny test is that sires have been identified which offer these benefits to the dairy herd, but also increase finishing performance. Therefore, the growth rate, carcass weight and value of the 1.0m dairy-beef cattle finished will also increase.

This report focuses on the value of the DBPT to dairy farmers and beef finishers however it is also contended that NZ's beef seedstock producers could also benefit from utilising these results in their breeding programs.

4.0 PROJECT TEAM

There were four team members:

- Dr Rebecca Hickson, Professor of Animal Science, School of Agriculture & Environment, Massey University and recently taken up a new appointment as Animal Breeding Scientist (Cattle), Focus Genetics, Pāmu Farms NZ.
- Sam Bunny, Business Manager (Dairy), Wairakei Pastoral, Pāmu Farms NZ.
- Phil Weir, AgFirst Agribusiness Consultant, Farmer, and Nuffield Scholar.
- Bob Thomson, Agribusiness Consultant and Beef & Sheep Specialist, AgFirst NZ Ltd.

5.0 POLICIES MODELLED

The policies were all based on purchasing spring-born dairy-beef calves on 7th December, with equal numbers of heifers and steers purchased at 90-kilograms and 100-kilograms liveweight, respectively. The early December purchase date was chosen because it was considered that in the majority of cases the dairy farmer would target the early and higher Breeding Worth cows for breeding dairy replacements and then use beef sires or beef semen for 'tail-up' mating.

There were three main policies considered:

- Selling prime at 27-30 month of age following the second winter.
- Selling prime at 16-22 months of age following the first winter.
- Selling store as yearlings at 15-17 months of age.

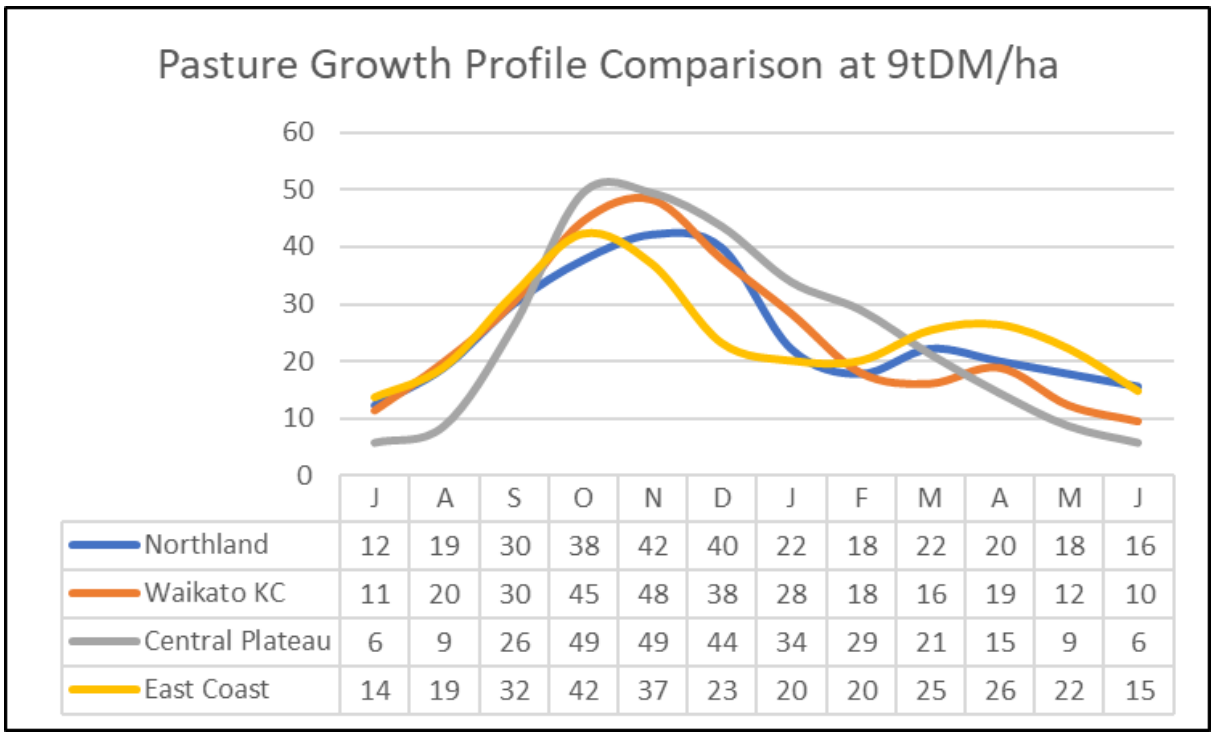
The policies were modelled on a whole farm basis and only included cattle specific to the nominated policy.

It was problematic trying to market cattle prime following the first winter at 16-22 months of age because:

- There were no other stock classes to buffer and offset the high autumn and winter feed demand which in turn negatively impacted winter stocking rates due to lower autumn pasture covers.
- Higher winter liveweight gains meant lower winter stocking rates and consequently contributed to high late spring and early summer pasture surpluses. In essence this led to a poor match between feed demand and feed supply.
- The above-mentioned factors negatively impacted on the ability to produce an acceptable carcass weight and a therefore competitive Gross Margin under current beef grading and market conditions.
- It should be noted that the current NZ Beef Classification System, and the associated payment system, should be reviewed with urgency for three main reasons:
    - Does not meet current farm production challenges which demand less environmental impact in relation to water quality and GHG's. In practice that means over-wintering lighter cattle, farming lighter cattle on steep erosion-prone hills and as a consequence farmers will be faced with killing cattle at lighter weights.
    - There is increasing acceptance that by 2030 we will be challenged with raising circa 2m bobby calves and that requirement. The demand to finish these cattle will create huge pressure on land resources and in turn farmers will be pressured to finish cattle at younger and lighter weights. As has already been pointed out – one winter systems require half the land of two-winter systems.
    - There has been no substantive change with the NZ Beef Carcass Classification system since at least 1996. Since that time carcass weights have increased and markets have changed e.g. 10-years ago we exported insignificant volumes of beef to China and now China leads the USA as these two countries lead our export beef volume.

6.0 PASTURE GROWTH RATES & FEED SUPPLY

Representative and realistic pasture growth rate profiles are important when modelling farms, polices and systems. Clearly not one single pasture growth profile can describe all situations and therefore a number of environments need to be considered. The starting point for this project was with the Farmax library of pasture growth by region. Four representative pasture growth curves were selected and calibrated to 9-tonne of annual dry-matter per hectare (kgDM/ha). These are shown in the graph and table above for four representative North Island regions.



	J	A	S	O	N	D	J	F	M	A	M	J
Northland	12	19	30	38	42	40	22	18	22	20	18	16
Waikato KC	11	20	30	45	48	38	28	18	16	19	12	10
Central Plateau	6	9	26	49	49	44	34	29	21	15	9	6
East Coast	14	19	32	42	37	23	20	20	25	26	22	15

The graph and table show that when annual pasture production is standardised to 9-tonne DM/ha there is a small difference between Northland and Waikato but larger differences between the dry summer East Coast and the cold winter Central Plateau. As a consequence of this comparison it was decided to limit the modelling to three broadly based pasture profiles as follows:

- Relatively good summer and winter environments which are represented by Northland, Waikato, and Bay of Plenty. It may further be reasoned that other North Island regions like King Country, Manawatu and Whanganui would also fit this pasture growth profile.
- Summer Dry environments including coastal Hawkes Bay, Gisborne and Wairarapa.
- Winter Cold environments including the Central Plateau. It is noted that the pasture profile for this environment is similar to much of the South Island.

While 9-tonne of annual pasture production may be considered too high or too low it is an academic discussion when looking to compare different policies. This is because average annual pasture production can easily be modified up or down, but the pattern (profile) of pasture growth remains the same. In essence all that will change is the number of animals carried, as the pattern of sales and purchases will need to match the pasture supply and pasture profile on offer.

A 7-tonne per hectare summer greenfeed crop was grown on 10-percent of the farm area on all policies for four main reasons:

- The Project Team believed that one of the main reasons beef farmers prefer to buy weaner calves in the autumn at 180-200 kilograms liveweight, instead of 90-100 kilograms liveweight in the spring, is because calves are difficult to manage over summer. This is due to the difficulty of maintaining acceptable growth rates in the face of falling pasture feed quality and quantity with increasing animal health challenges e.g. parasites, facial eczema. In drought years autumn weaner price is little different to spring weaner price.
- Over-summering dairy-beef calves is especially challenging in cattle dominant systems where calves often need supplementary feed in the form of meal and/or as a summer crop.
- Internal parasite challenge, with potential worm resistance, needs to be considered and the summer crop provides one solution with the majority of calves being fed on crop (without drench) for 70-90-days from January to mid-March.
- In summary, the Project Team believe that a no-till or low-till summer crop is a sustainable solution for effective over-summer management of dairy-beef calves.

For simplicity and ease of modelling, annual ryegrass was sown and utilised between summer green feed crops. In reality it would not have mattered whether the summer crop was followed with permanent pasture or annual ryegrass.

While nitrogen could easily have been utilised to advantage, both strategically and tactically, it was not applied for any policy under any circumstances. This approach meant that another source of variation was removed from the modelling. In reality the practitioner farmer would have nitrogen in their farming ‘toolbox’ as a way of addressing feed deficits in challenging seasons and years.

And finally, with modelling crops in different regions, it was found that in dryland east coast environments, when cattle were wintered just once, more than 10% of the farm was needed in summer crop to over-summer the majority of calves. It was concluded that in these sorts of environments that with one-winter systems, farmers would be better advised to either purchase calves in the autumn or purchase autumn-born calves. These options have not been modelled and therefore are not reported.

7.0 SCHEDULES & PRICES

An average season benchmark schedule price of $6.00 per kilogram carcass weight has been set as the long-term price for beef for modelling purposes. Some of the modelling files were not updated from the 2021 and these files have an average benchmark schedule price of $5.50 per kilogram carcass weight.

Farmax has comprehensive in-built pricing schedules which account for variations in price between months for each stock class whether transacted store or prime. The price files are based on 20-years of historic prices with emphasis on the last 5-years.

8.0 MODELLING STRUCTURE & PROCESS

A 100-hectare farm was established, and the pasture growth curve applied to that farm according to the environment being modelled.

Farmax Advantage was utilised for modelling, and this enabled a Farmlet approach whereby the 10% area of the farm that was cropped was placed in a Farmlet.

Cattle were transferred onto crop for a 70-day period as from 1st January and cattle numbers were adjusted and matched with crop availability. Crop feeding was based on priority starting with the lightest calves and progressing through to the lightest 1-year-old heifers so that all crop was utilised. For one-winter polices around two-thirds of the calves could be fed on crop. With two-winter policies all calves were fed on crop and up to half of the lightest 1-year-heifers.

The regional pasture growth curves were applied to each of the three policies and optimised. These were each named 'Base' and provided the base from which files could be modelled to incorporate genetic improvement opportunities.

A 'Base' animal growth rate profile was also determined for each age and sex class for each month of the year on the following basis:

- Minimum winter growth rates of at least 0.3 kilograms of liveweight gain over the worst 2-3 months of winter.
- Realistic and maximum spring and early summer liveweight gains were established with Base growth rates no more than 1.1 kgLW/day for rising 1-year-olds and 1.8 kgLW/day for rising 2-year-olds.

With one-winter policies, where carcass weight was found to be too low and under 170-kilogram carcass weight, these lightweight animals were instead pre-emptively sold store at 14-15 months of age.

When applying the genetic advantages of sires from the DBPT the process was as follows:

- For growth rate, a 15% increase in growth rate compared to the Base was applied to growth rates for all months.
- Marbling or IMF was the only beef carcass quality attribute that currently attracts a market premium. There are two companies paying a premium at present: SFF with the EQ programme and the Alliance with the Hand-picked programme. The company premium was applied according to the expected increase in strike-rate for cattle based on the highest scoring DBPT bull. It was assumed the high marbling DBPT sires were average for liveweight gain and interrogation of the data suggested this was realistic.

The average carcass weight of cattle finished from the DBPT was 276 kilograms at an average age of 870 days or ~30-months of age. By industry standards this weight is considered low as the average NZ steer carcass weight was 313 kg (B+LNZ Farm Facts 2020). While not reported by B+LNZ it is assumed this average would include younger cattle. When considering the expression of genetic advantage it is well accepted that the better you feed and manage cattle the more expression you will have of their genetic potential. Therefore, the 15% growth advantage above industry average from better genetics applied in this analysis is considered to be conservative.

9.0 ACRONYMS USED IN TABLES

Acronym	Meaning
N	Northern North Island Pasture Growth e.g. Northland, BOP, Waikato, King Country
C	Cold North Island Pasture Growth e.g. Central Plateau
D	Dry East Coast of North Island pasture growth e.g. Hawkes Bay
W1	One winter policy
W2	Two winter policy
PRM	Prime cattle policy
STR	Store cattle policy
BASE	The policy from which others are compared i.e. base level genetics
+15%	Utilising beef genetics that afford and increase of 15% in the liveweight gain of progeny
Q6	Utilising beef genetics that afford an increase of 6cpk on carcass value for all progeny killed
Q20	Utilising beef genetics that afford an increase of 20cpk on carcass value for all progeny killed

10.0 BASE POLICIES COMPARED

The tables below are the Base policies from which the genetic gains will be compared.

FARMAX YOUR ADVANTAGE
RM 8.1.0.42

Compare Gross Margin
Jul 21 - Jun 22

			N_BASE_W1_STR 1	N_BASE_ W1_PRM 1	N_BASE_ W2_PRM 1
Revenue	Beef	Sales - Purchases	144,965	96,994	137,130
		Capital Value Change	0		
		Total Beef	**144,965**	**96,994**	**137,130**
	Total Revenue		**144,965**	**96,994**	**137,130**
Expenses	Crop & Feed	Forage Crops	15,800	15,800	15,800
		Total Crop & Feed	**15,800**	**15,800**	**15,800**
	Stock Costs	Animal Health	3,415	2,862	2,279
		Total Stock Costs	**3,415**	**2,862**	**2,279**
	Interest on Capital (livestock & feed)		11,619	11,793	13,362
	Total Variable Expenses		**30,833**	**30,455**	**31,441**
Gross Margin			**114,132**	**66,538**	**105,689**
Gross Margin per Total ha			**1,141**	**665**	**1,057**

Summary for Northern North Island Base:

- One winter with store sales was the most profitable followed by two-winter prime sales and the lowest was one-winter prime.
- The reason the one-winter prime was the worst performer was associated with having to kill cattle that were too light and too heavily discounted on current schedule pricing, even when 25% to 50% were pre-emptively sold store as yearlings in spring.
- The conclusion was that one-winter prime should be excluded from this analysis.
- These Gross Margins are presented to show the differences in policies and do not include any genetic advantages from using better beef genetics.
- Please note that these files are based on a benchmark beef schedule of $5.50/kgCW.

11.0 REGIONS COMPARED

Only the two-winter prime policy was compared for all three Regions, where all heifers and steers were marketed to works from November to February.

The following tables show the Base policies from which the genetic gains will be compared.

FARMAX YOUR ADVANTAGE
RM 8.1.0.42

Gross Margins - Regions Compared
Jul 21 - Jun 22

			N_BASE_ W2_PRM	D_BASE_ W2_PRM	C_BASE_ W2_PRM
Revenue	Beef	Sales - Purchases	143,796	141,190	123,727
		Total Beef	**143,796**	**141,190**	**123,727**
	Total Revenue		**143,796**	**141,190**	**123,727**
Expenses	Crop & Feed	Forage Crops	15,800	15,800	15,800
		Total Crop & Feed	**15,800**	**15,800**	**15,800**
	Stock Costs	Animal Health	2,174	2,157	1,972
		Total Stock Costs	**2,174**	**2,157**	**1,972**
	Interest on Capital (livestock & feed)		12,806	12,436	11,718
	Total Variable Expenses		**30,780**	**30,393**	**29,490**
Gross Margin			**113,016**	**110,797**	**94,237**
Gross Margin per Total ha			**1,130**	**1,108**	**942**

11.1 Summary of Base Policy Gross Margins

The two-winter prime policy was similar in profit for the Northern North Island (N) Region and the Dry Summer Coastal Region (D). However the Cold Central North Island (C) Region was much less profitable because winter pasture growth was very low and accordingly stocking rate was also low.

No supplementary feed was conserved, purchased or fed-out.

Please note that these files are based on a benchmark beef schedule of $5.50/kgCW.

12.0 ONE WINTER STORE NNI VERSUS + 15% GROWTH

Northern North Island (NNI) compared with +15% animal growth rate with store yearling sales. Stocking rate had to be reduced for the higher growth animals to allow their genetic potential for growth to be met from the same feed supply.

This comparison relates to using top sires for liveweight gain compared with the bottom sires in the DBPT (which had genetic merit for liveweight gain to the average unrecorded bull available in NZ). Note that the average unrecorded bull used for dairy mating may have lower liveweight gains than average if these sires have been sired by sires that have been specially and exclusively bred for low birthweight and short gestation.

FARMAX YOUR ADVANTAGE RM 8.1.0.42

Gross Margin - NNI One Winter Store Base v +15% LWG

Jul 21 - Jun 22

			N_BASE_W1_STR	N+15%_ W1_STR	Difference
Revenue	Beef	Sales - Purchases	144,965	160,929	15,964
		Capital Value Change	0	0	0
		Total Beef	**144,965**	**160,929**	**15,964**
	Total Revenue		**144,965**	**160,929**	**15,964**
Expenses	Crop & Feed	Forage Crops	15,800	15,800	
		Total Crop & Feed	**15,800**	**15,800**	
	Stock Costs	Animal Health	3,415	2,931	-483
		Total Stock Costs	**3,415**	**2,931**	**-483**
	Interest on Capital (livestock & feed)		11,619	10,891	-728
	Total Variable Expenses		**30,833**	**29,622**	**-1,211**
Gross Margin			**114,132**	**131,307**	**17,175**
Gross Margin per Total ha			**1,141**	**1,313**	**172**

12.1 Summary of one-winter store policies

A Gross Margin profit of $172 per hectare, an increase in profit of 15%.

These results are solely related to better beef genetics.

Please note that these files are based on a benchmark beef schedule of $5.50/kgCW.

13.0 TWO-WINTER PRIME COMPARISON

Northern North Island (NNI) two-winter prime with average industry sires compared with:

- the top 15-20% of DBPT sires for carcass weight that deliver an increase of 15% in liveweight gain. The benchmark industry average schedule price has been set at $6.00 per kilogram carcass weight.
- The top 15-20% of DBPT sires for quality beef supplied through two different programs:
    - Program 1 has an average 30% strike rate and a 30cpk premium for qualifying cattle and this delivers an overall premium of 9cpk above benchmark price ($6.09/kgCW). When progeny from top marbling sires are finished the strike rate increases by 27% and the average premium lifts to 17cpk above benchmark price ($6.17/kgCW).
    - Program 2 has an average 50% strike rate and a 50cpk premium for qualifying cattle and this delivers an overall premium of 25cpk above benchmark price ($6.25/kgCW). When progeny from top marbling sires are finished the strike rate increases by 27% and the average premium lifts to 39cpk above benchmark price ($6.39/kgCW).

FARMAX Comapre GM NNI; Base V. +15%LWG, +9cpk, +17cpk, +25cpk, +39cpk

Jul 21 - Jun 22

			N_+Q0_ W2_PRM	N+15%_ W2_PRM	N_+Q9_ W2_PRM	N_+Q17_ W2_PRM	N_+Q25_ W2_PRM	N_+Q39_ W2_PRM
Revenue	Beef	Sales - Purchases	163,216	184,359	166,711	169,818	172,925	178,363
		Total Beef	**163,216**	**184,359**	**166,711**	**169,818**	**172,925**	**178,363**
	Total Revenue		**163,216**	**184,359**	**166,711**	**169,818**	**172,925**	**178,363**
Expenses	Crop & Feed	Forage Crops	15,800	15,800	15,800	15,800	15,800	15,800
		Total Crop & Feed	**15,800**	**15,800**	**15,800**	**15,800**	**15,800**	**15,800**
	Stock Costs	Animal Health	2,174	1,974	2,174	2,174	2,174	2,174
		Total Stock Costs	**2,174**	**1,974**	**2,174**	**2,174**	**2,174**	**2,174**
	Interest on Capital (livestock & feed)		13,970	14,161	14,180	14,366	14,552	14,878
	Total Variable Expenses		**31,944**	**31,936**	**32,154**	**32,340**	**32,526**	**32,852**
Gross Margin			**131,272**	**152,424**	**134,558**	**137,478**	**140,399**	**145,511**
Gross Margin per Total ha			**1,313**	**1,524**	**1,346**	**1,375**	**1,404**	**1,455**

Farmax Red Meat 8.2.0.10

13.1 Summary of Two-Winter Prime Finishing

All Gross Margins are to be compared with the "Base' (N_+Q0_W2_PRM) Gross Margin (shown in the table above) which represents average industry genetics. All the remaining Gross Margins results are solely due to better beef genetics.
With two-winter prime policies a 15% increase in liveweight gain, achieved through the use of top DBPT sires, achieves a Gross Margin increase of $211 per hectare or a 16% increase in profit. This option was shown to be the most profitable albeit by a small margin over supplying progeny from top DBPT sires for beef quality to Program 2 where rewards for quality were the highest.

An increased strike-rate for beef quality of 27%, through the use of top DBPT sires, realises an average increase for:

- Program 1; +8cpk in average schedule price, an increase in Gross Margin of $33 per hectare and a 2.2% increase in profit.
- Program 2; +17cpk in average schedule price, an increase in Gross Margin of $62 per hectare and a 3.6% increase in profit.

Key points from this modelling process, with regard to utilising top sires from the DBPT, are as follows:

- The best overall return, by a relatively small margin, comes from using the top sires for carcass weight.
- While the use of top sires for beef quality (marbling) increased strike rate significantly, the increase in profit was small within a beef quality supply program. However, when you consider that the cattle are already processed through a supply program with a reward for average performance, in addition to the rewards for increased beef quality, then the overall profit is significant. In the case of Program 2 the Gross Margin advantage was $142 per hectare an 11% increase in profit.

For reference the benchmark beef schedule has been set at $6.00 per kilogram carcass weight for all files reported in the reference table shown above.

14.0 EFFICIENCY, PROFIT & GHG COMPARED

The table below is a physical summary of two policies: one-winter store and two-winter prime. Each policy has an associated file which adds 15% to growth rate as a result of using top DBPT sires for growth rate. Each of these files has +15% in the header.

The differences in profit are shown in the Gross Margin line and these have been explained elsewhere in the report.

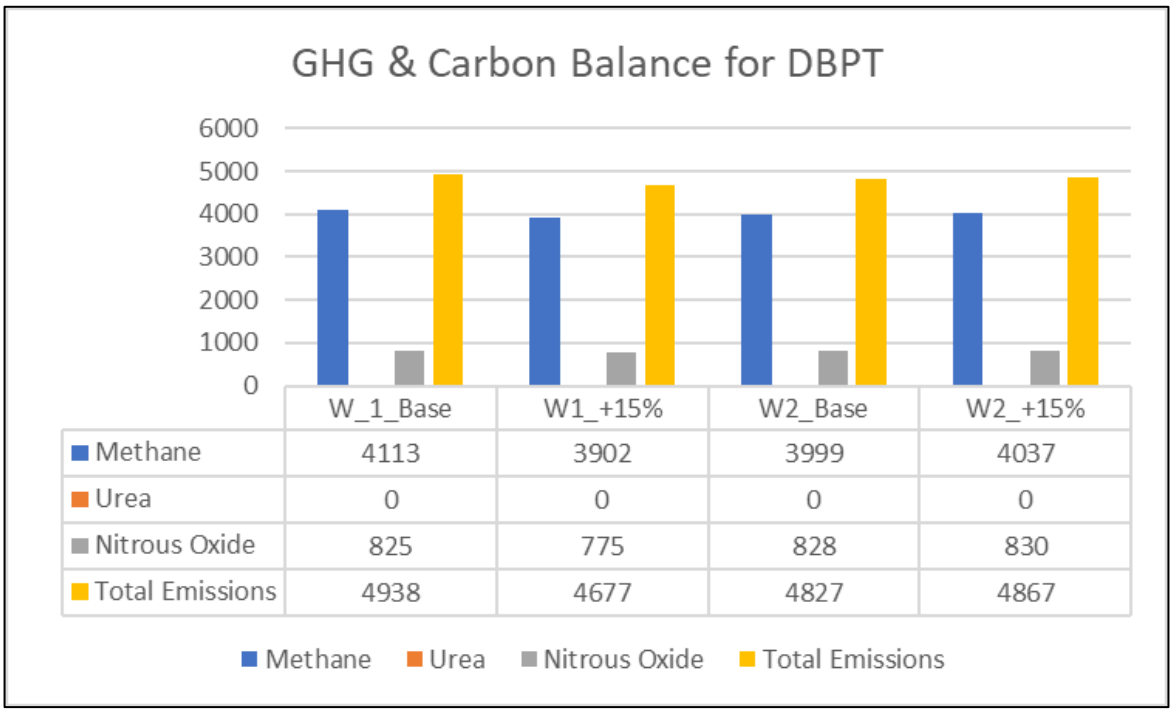
The key points to note from this table are that:

- Feed Conversion Efficiency (FCE) is best with the one-winter policies which consume 87% less feed per kilogram of carcass weight.
- FCE improves with increasing animal growth rate. For both one winter and two winter polices a 15% increase in liveweight gained translates to ~10% increase in FCE.

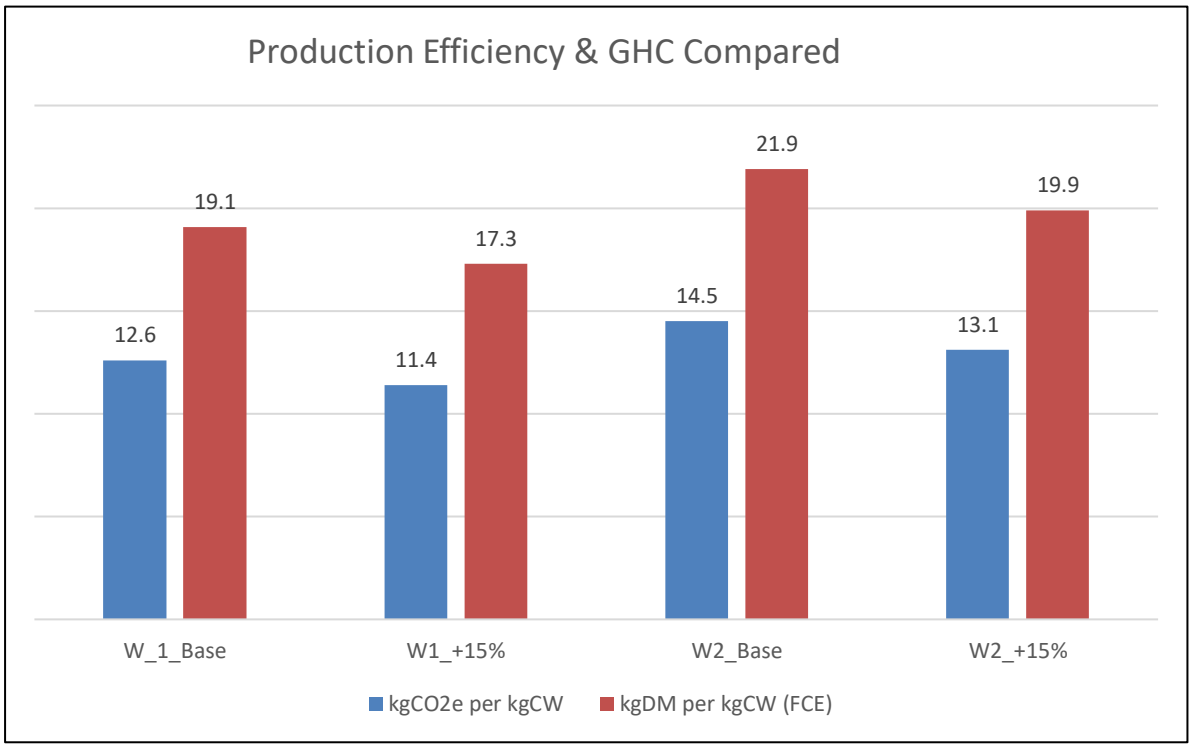
Base compared to +15% Growth	Northern North Island Performance Compared			
	1-Winter Store	1-Winter +15%	2-Winter Prime	2-Winter Prime +15%
Stocking Rate (SU/Total ha)	13.9	13.2	13.5	13.6
kg Total Carcase/ha	437	458	371	412
Feed Conversion Efficiency	19.4	17.6	22.3	20.2
Gross Margin ($/Total ha)	1141	1313	1130	1355
Difference in FCE +15% - Base	-1.8		-2.1	
Difference in GM +15% - Base	$172		$225	

The following table shows the Carbon Balance and Greenhouse Gas (GHG) output (CO2-e) from each of the above polices and subsets. The key points from this table are that:

- High performing progeny of DBPT sires do not contribute to higher GHG when compared to progeny from average sires.
- FCE is correlated to GHG output and therefore the best GHG performing policy is the one-winter+15% liveweight gain.
- Methane output is of most interest with pastoral livestock systems and this is shown to be similar or lower levels for high performance progeny versus average performance progeny.
- Methane output represents 83% of total GHG by CO2-e with all policies compared.



The next table compares production efficiency with GHG output based on kilograms of CO^2 -e per kilogram of carcass weight and kilograms of dry-matter per kilogram of carcass weight. As can be seen the two criteria are closely related with kgCO2-e/kgCW representing 66% of kgDM/kgCW for all polices.



15.0 BEEF QUALITY, STRIKE RATES & PREMIUMS

Analysis of the DBPT beef quality results undertaken by Dr Rebecca Hickson shows that an increase in marbling of 27% was achieved by the top marbling DBPT sires compared to the average. Based on the fact that marbling is the single most limiting factor for cattle failing to gain a premium, in Meat Company programs which reward beef quality, it was assumed a 27% increase in marbling would translate to a 27% increase in strike rate for the commercially available beef quality programs.

The following table shows a matrix of price premiums and strike rates for qualifying carcasses.

	Strike Rates & Price Premiums					
	Base	Strike Rate % for Qualifying Cattle				
	$6.00	*30%*	*57%*	*50%*	*77%*	+27% SR
Price Premium $ per kg	$6.30	$6.09	$6.17			$0.08
	$6.35	$6.11	$6.20			
	$6.40	$6.12	$6.23			
	$6.45	$6.14	$6.26			
	$6.50			$6.25	$6.39	$0.14
	$7.00			$6.50	$6.77	$0.27

	Current Market Situation	
Program	Ave. Strike Rate	Price Premium
Program 1	30%	$0.30
Program 2	50%	$0.50

The taupe-coloured cells and the green coloured cells are indicative of two commercially available beef quality programmes in NZ. The first programme has a ~30cpk premium for qualifying cattle and a ~30% average strike rate. The second programme is reputed to pay a 50cpk premium and an average strike rate of ~50%. Program 1 effectively pays $6.09 per kg CW (9cpk over the base price) and Program 1 pays $6.25 per kg CW (25cpk over the base price). These are the average prices that would be paid for all cattle supplied at the premiums and strike rates quoted. Strike rates are achieved by a combination of management and genetics. Marbling is the single most limiting factor contributing to failure to reach higher strike rates.

While the increase in strike-rate from better beef genetics is significant the increase in profit was not. In fact with Program 1, where the current premium was 30cpk, the Gross Margin increased by just $29 per hectare and in Program 2 where the premium was 50cpk the Gross Margin increased by $52 per hectare.

Unfortunately marbling (or IMF) and carcase weight are neutrally correlated – neither positive nor negative. As a practical example the top ten sires ranked on carcase weight in the DBPT do not also rank in the top 10 for marbling score. However there are sires that rank in the top twenty for both carcase weight and marbling score but for each there are considerable compromises. For the purposes of the modelling it was assumed that the sires used to generate higher marbling offspring were average for carcase weight. When selecting sires for generating finishing stock breeders are encouraged to review the DBPT results to ensure that in their quest to increase marbling that they do not compromise carcass weight.

An increased strike-rate for beef quality of 27%, through the use of top DBPT sires, realises an average increase for:

- Program 1; +8cpk in average schedule price, an increase in Gross Margin of $29 per hectare and a 2.2% increase in profit.
- Program 2; +17cpk in average schedule price, an increase in Gross Margin of $52 per hectare and a 3.6% increase in profit.

While the use of top sires for beef quality (marbling) increased strike rate significantly, the increase in profit was small within a beef quality supply program. However, when you consider that the cattle are already processed through a supply program with a reward for average performance, in addition to the rewards for increased beef quality, then the overall profit is significant. In the case of Program 2 the Gross Margin advantage was $142 per hectare an 11% increase in profit.

For reference the benchmark beef schedule has been set at $6.00 per kilogram carcass weight for all the resulted reported for beef quality.

Summary of Beef Quality Opportunities

While the top DBPT sires afford a significant increase in strike-rate for quality beef the market premiums must be high to warrant preferential selection for beef quality in place of liveweight gain and associated carcass weight. However it must be stressed that beef finishers should not be discouraged from pursuing reward from supply programs with beef quality price premiums.

To demonstrate the overall benefits from supplying beef to either Program 1 or Program 2 the Gross Margins are shown and reported. For Program 2 when the benefits of finishing cattle sired by top DBPT sires for beef quality are combined with the average strike rate and price premium the Gross Margin profit was increased by 11% (+$142 per hectare Gross Margin)

As time progresses there are several factors that will change the emphasis on bull selection and associated farm profit:

- Genetic improvement is cumulative and permanent meaning that the top sires will increase in genetic merit as breeders strive to make genetic gain. The gap between the top sires and average sires will increase and therefore so will the profit from their offspring.
- Price premiums through beef quality programs may increase, and when coupled with programs that already have a high average strike rate, there would be considerable upside.
- The DBPT is continuously proving sires, and some are found to be 'curve benders' through progeny testing meaning they are found to excel in two or more traits that may not be positively correlated. For example there are already individual sires that are represented in the top 20 for both carcass weight and marbling in the DBPT. As time progresses more and more high-performance sires will be discovered and through AI they can be utilised extensively, with confidence and without limits.

16.0 UTILISING BEEF IN A DAIRY HERD - AI VERSUS NATURAL MATING

Currently the very best of the beef genetics are available 'in a straw' and not 'on the hoof' in just the same way as with dairy genetics. This comes about because:

- AI sires can be more highly selected.
- a naturally mated bull may sire up to 30 calves each year in comparison to a bull available via Artificial Insemination (AI) where the number of progeny is only limited by the number of straws that can be collected and the associated demand and use of that bull.
- there is an additional cost/investment to have a bull progeny tested to prove the breeding merit of that bull. Before progeny are measured, an individual bull's merit can only be predicted with moderate accuracy.

The DBPT has identified beef sires with short gestation, that also contribute to above average growth and carcass quality. These DBPT sires afford the dairy farmer an easy calving, 5-days shorter gestation length translating to 5-days more in milk, plus a very marketable calf to on-sell to a beef finisher.

Despite many high genetic merit sires being identified through the Dairy Beef Progeny Test there has been a relatively low uptake of these sires. One of the reasons relates to the perceived lower cost of natural mating with sires compared to AI. Details of the costs of AI and natural sires are shown in Appendix 1 however the following table summarises the results.

Summary of Beef AI Versus Beef Bulls in a mixed-age Dairy Herd			
Item	AI	Bull	AI Advantage
Cost per in-calf Cow	$62.69	$85.92	-$23.23
Cost per calf at 4-days	**$75.00**	**$100.74**	**-$25.74**
Cost per weaned calf at 100kgLW	$531.60	$558.37	-$26.77
Advantage (✓) and Disadvantage (×)	**AI**	**Bull**	
Cost per calf	✓	×	
Manual Heat Detection	××	✓✓	
Difference in quality of genetics	✓✓	××	
Proven Easy Calving	✓	×	
Less Empty Cows (heat detection issues?)	×	✓	
Proven Short Gestation	✓	×	
Bobby Calf Solution - the value of DB calves	✓✓	××	
Biosecurity	✓	×	
Bull Injury	✓	×	
Worker Safety	✓	×	

This analysis shows that there is a small cost advantage to AI in comparison to natural mating. However, because dairy farmers are under considerable work stress in spring following calving, calf rearing and then commonly a 6-weeks (2-cycle) dairy-based AI program, they are often reluctant to continue with AI to generate non-replacement dairy-beef calves. This means that that they often resort to natural mating following 6-weeks of AI. These naturally mated sires may be beef or dairy, leased or purchased, but are usually cheap to buy, non-recorded and of low genetic merit from a beef production perspective. These follow-up sires are effectively mobile inseminators; however the resultant offspring are of low genetic value for beef production purposes and are often slaughtered either on-farm or at works at less than a week of age.

The advantages and disadvantages of AI versus a bull naturally mated are shown in the table above and illustrate the main advantage to naturally mating over AI is with heat detection. For farms where heat detection is a challenge, this is likely to flow onto reduced empty rates from using natural mating. While it is accepted that heat detection is a major impediment to dairy farmers using AI, it is contended that the advantages far outweigh the disadvantages. Furthermore, assuming that the current practice of slaughtering bobby calves will become an unacceptable practice within 10-years, the value of bobby calves will be in their value as a beef finishing animal whether processed at 80-kilograms carcass weight or 380-kilograms carcass weight.

17.0 MATTERS ARISING FROM WORKING GROUP DISCUSSIONS

Anecdotally there is a view that dairy farmers are increasingly becoming frustrated that despite their attempts to reduce bobby calves by producing more marketable dairy-beef calves, many claim the resultant calves remain hard to sell, and end up on the bobby truck or sold at a low price. The solution for this frustration is not clear but clearly there is a disconnect between dairy farmers and beef finishers which was detailed in bullet point 11 in the Executive Summary.

Given the improvements in Gross Margin outlined in this report, it is anticipated beef finishers will be increasingly seeking calves with finishing potential over beef-cross calves of unknown merit. The genetic merit of dairy-beef calves will increasingly determine their value. The best value propositions for dairy-beef will be with calves sired by beef sires with high genetic merit and the best of these will likely be available 'in a straw' and not 'on the hoof'.

It is noted that there are individual sires that have been discovered in the DBPT that provide the dairy farmer with proven shorter gestation and proven easy calving. Furthermore there are sires discovered that could safely be mated to dairy heifers. In both cases these same sires, with shorter gestations, also have good post-birth growth rates thus providing value propositions for both the dairy farmer and the beef farmer.

A simple calculation for assessing the value from gestation length can be undertaken as follows. Gestation length reduction (days) times milk production (kg milk solids per day) times price per kg milk solids e.g. 5 days x 1.7 kgMS x $7.50 per kgMS = ~$64 per cow). By utilising proven DBPT sires the dairy farmer can enjoy this benefit. On the 'flip side' sires of unknown genetic merit can potentially increase gestation length and calving difficulty thereby incurring a reduction in profit.

The Project Team associated with producing this report have been encouraged to develop a calf value index whereby calves are rated on their potential contribution to the beef finisher. Factors in the Calf Value Index (CVI) would include calf size, age, health status, and breeding value. It is envisaged that an index system would be developed whereby the value-based contributors are assigned to an economic value to create an Index in much the same way as a Terminal Sire Index or Self-Replacing Index is currently calculated for beef cattle.

A formal Index would provide dairy farmers with a reality check on calf value and a focus for producing better quality dairy-beef calves. Additionally, the beef finisher would have the confidence to seek out better quality calves knowing that they would contribute more profit in the finishing process. Ultimately the CVI would assist dairy farmers to comprehend what the minimum requirements are for calves that can be retained for rearing, and finishing, versus those that are not suitable and would be destined to be killed as bobby calves. In the short term this may be the difference between paying for calves to be taken away versus realising a small profit. In the longer term it may be the difference between being able to supply milk to a dairy company or not.

Appendix 1 Details of AI versus Natural Mating

The Cost of Beef AI in a mixed-age Dairy Herd

Sep-21

Cost per pregnancy and a 4-day old calf	Cost	Comment
Cost of semen	$27.78	per cow in-calf
Cost of AI	$12.69	per cow in-calf
Heat Detection	$22.22	per cow in-calf
Tagging EID	$5.00	NAIT requirement as from 2012
Cost per Cow In-Calf AI	**$62.69**	
Cost per Calf sold at 4-days AI	**$75.00**	As per 'Success Factor to 4-days'

Calf Rearing Costs 37-40kgLW to 100kgLW		
Labour	$75.00	Normally $70 - $80 per calf
Calf pick up	$10.00	From Dairy Farmer
Milk Powder	$170.00	1.5 x 20kg Bag
Straw	$5.00	For rumen development
Meal	$100.00	4 x 20kg Bag
Pasture (170kgDM @ 20cpk)	$34.00	
Animal Health	$10.00	Vaccination and B12
Bedding/power etc	$10.00	
R&M on Calf Sheds	$10.00	
Deaths	$17.60	Based on Death Calculations
Commission on sale	$15.00	When Agent is invloved in sale
Total cost to rear	**$456.60**	
Cost to breed and rear via AI to weaning	**$531.60**	

Cost Assumptions for AI		
Item	**AI**	**AI Rate**
Semen per straw	$15.00	
Insemination	$6.85	1.9
Heat Detection	$12.00	

AI Rate is No. AI'd per Pregnant Cow

Success Factor for Calves to 4 days old		
Pick-up	**Survival**	**Success**
95%	95%	90.3%

Death Calculations for Rearing at		4%
4%	of purchase price	$3.00
4%	of labour	$3.00
4%	of pick-up	$0.40
4%	meal	$6.80
4%	Straw	$4.00
4%	Animal Health	$0.40
Total cost of deaths per weaned ca		**$17.60**

Whole Herd Performance Dairy AI & Beef AI			
AI Subm'n per Cycle		**AI Concep'n per Cycle**	
80%		54%	
Cycles	**Cows**	**In-calf**	**Percent**
1 Dairy AI	310	134	43%
2 Dairy AI	176	76	43%
Dairy AI in-calf		210	68%
80%		54%	
Cycles	**Cows**	**In-calf**	**Percent**
3 Beef AI	100	43	43%
4 Beef AI	57	25	43%
Beef AI in-calf		68	68%
Overall Total in-calf		**278**	**90%**
Overall Empty		32	10%

Notes

1 Assumed 2-cycles Dairy AI followed by 2-cycles of Beef AI
2 Empty rate for cows relates to last 2-cycles only but actual number is for whole herd
3 Referenced 2019 DNZ Repro data
4 Referenced Poukawa Calf Rearing Survey
5 Calves fed 250kgDM as meal and pasture from 37--40kgLW to 100kgLW

The Cost of Natural Mating with Beef Bulls in a mixed-age Dairy Herd

Sep-21

Cost per pregnancy and a 4-day old calf	Cost	Comment
Bull Cost	$85.92	per cow in-calf
Tagging EID	$5.00	NAIT requirement
Cost per Cow In-Calf Bull	**$85.92**	
Cost per Calf at 4-days Bull	**100.74**	As per 'Success Factor to 4-days'

Calf Rearing Costs 37-40kgLW to 100kgLW		
Labour	$75.00	Normally $70 - $80 per calf
Calf pick up	$10.00	From Dairy Farmer
Milk Powder	$170.00	2 x 20kg Bag
Straw	$5.00	For rumen development
Meal	$100.00	4 x 20kg Bag
Pasture (170kgDM @ 20cpk)	$34.00	
Animal Health	$10.00	Vaccination and B12
Bedding/power etc	$10.00	
R&M on Calf Sheds	$10.00	
Deaths	$18.63	Based on Death Calculations
Commission on sale	$15.00	When Agent is invloved in sale
Total cost to rear	**$457.63**	
Cost to breed and rear via Bull to weaning	**$558.37**	

Cost Assumptions for Bull			
Bull Item	**Bull Detail**	**Bull Direct Costs**	**Per Bull**
Purchase Bull	$2,550	Days on-farm	106
Buy Liveweight (kg)	450	DM Intake (% of LW)	2.5%
Purchase Date	1-Oct-21	Cost per kgDM	$0.10
Sell Liveweight (kg)	500	Animal Health	$25.00
Sale Date	15-Jan-22	Death Rate	2%
Dressing	52%	Feed Cost	$125.88
Value per kgCW	$6.00	Other Costs	$76.00
Sale Price	$1,560	**Per Bull Costs**	**$990**

Success Factor for Calves to 4 days old		
Pick-up	**Survival**	
95%	95%	90.3%

Calf Death Calculations for Rearing		4%
4%	of purchase price	$4.03
4%	of labour	$3.00
4%	of pick-up	$0.40
4%	meal	$6.80
4%	Straw	$4.00
4%	Animal Health	$0.40
Total cost of deaths per weaned c		**$18.63**

Whole Herd Performance Dairy AI & Beef Bull			
AI Subm'n per Cycle		**AI Concep'n per Cycle**	
80%		54%	
Cycle	**Cows**	**In-calf**	**Percent**
1 Dairy	94	41	43%
2 Dairy	53	23	43%
Dairy AI in-calf		64	68%
Bull Subm'n per Cycle		**Bull Concep'n per Cycle**	
85%		60%	
Cycle	**Cows**	**In-calf**	**Percent**
3 Beef	30	15	51%
4 Beef	15	8	51%
Beef AI in-calf		23	76%
Overall Total in-calf		**87**	**92%**
Overall Empty		7	8%

Notes

1 Assumed 2-cycles Dairy AI followed by 2-cycles of Beef Bull
2 Natural Bull has higher conception rate than AI
3 Empty rate for cows relates to last 2-cycles but actual number is for whole herd
4 Referenced 2019 DNZ Repro data
5 Referenced Poukawa Calf Rearing Survey
5 Calves fed 250kgDM as meal and pasture from 37-40kgLW to 100kgLW

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