# Comparative performance of KiwiCross™, Holstein and Jersey dairy cattle on pasture herds in KwaZulu-Natal

by

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Dissertation submitted to the Department of Animal Science, Faculty of Natural and Agricultural Sciences,

University of Pretoria

In accordance with the requirements for the degree

MScAgric Livestock Production

Pretoria

2022

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# Declaration

I declare that this thesis, which I hereby submit for the degree MSc (Agric) Animal Production at the University of Pretoria, is my own work and has not previously been submitted by me for degree purposes at this or any other tertiary institution.

26 April 2022

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# Abstract

Crossbreeding is found in almost all sectors of agriculture, including maize cultivars, poultry, pigs, small and large livestock breeds. Dairy has traditionally been one of the last strong holds of pure breeding strategies for Holstein, Jersey and Ayrshire. New Zealand was one of the first countries to adopt crossbreeding on a commercial scale by supplying semen from crossbred bulls for artificial insemination. Interest in crossbreeding is often due to concern with the depreciation of secondary, or management traits and is a relatively simple method to reduce inbreeding depression, introduce favourable traits from complementary breeds and take advantage of heterotic effect in several traits. Many South African dairy farmers have adopted the pasture-based and seasonal farming system, practicing criss-cross breeding between Holstein-Friesian and Jersey sires. Crossbred KiwiCross™ semen from New Zealand became available to these farmers, however, a Biological Impact Assessment study was requested by Government as a prerequisite to importing KiwiCross™ semen into South Africa. Individual cow performance data were recorded from six dairy farms in KwaZulu-Natal that were using KiwiCross™ sires alongside Holstein-Friesian and Jersey sires from LIC New Zealand. There were official milk (INTERGIS) records on 148 Holstein-Friesian, 80 Jersey, 476 KiwiCross™ and 287 non-descript sired heifers, and all were born in 2014. Records comprised of milk production, somatic cell count, inseminations, calving and visual inspection data. Mean lactation milk yield was not significantly different ($P>0.05$) between KiwiCross™, Holstein and non-descript breeds. The three sire breed groups, however, produced significantly higher ($P<0.05$) milk yield than the Jersey. There were no significant differences ($P>0.05$) in somatic cell score among the four sire breed groups. Lactation yields of milk, fat and lactose were significantly lower ($P<0.05$) for the Jersey compared to Holstein, KiwiCross™ and non-descript breeds. For protein yield, a significant difference ($P<0.05$) was only observed between the KiwiCross™ and non-descript, with the KiwiCross™ having the highest and non-descript the lowest lactation yield. Age at First Calving was significantly higher ($P<0.05$) for the KiwiCross™ compared to Jersey, Holstein and non-descript breeds. Services per conception were significantly higher ($P<0.05$) for the non-descript than the KiwiCross™, Holstein and Jersey. Analysis of the production and fertility data, along with linear visual inspection yielded results similar to what is seen in other international studies, i.e. crossbred animals raised in pastural systems produce production figures comparable with Holstein-Friesian and significantly higher ($P<0.05$) than Jersey pure breeds while showing slightly higher values in reproduction, health and welfare traits.

# Acknowledgements

The origin of this study started in 2013 with a request from the South African dairy industry wanting access to KiwiCross™ germplasm as produced by LIC New Zealand. My first thank you is going to this very industry and the truly incredible KiwiCross™ trial farmers that volunteered their farms, animals, and time to the introduction of the KiwiCross™ sire line into South Africa.

This request and subsequent research could only be made possible by the support and approval of Mr Joel Mamabolo, Department of Agriculture, Directorate: Animal Production. Thank you for your belief in Genimex that we could get this done to your high standards and to the benefit of the South African dairy industry.

David Sellars and the David Sellars International Herd Improvement Scholarship. Thank you for the support and advice you have given to this endeavour. I am proud to have been part of this Scholarship program. Thank you to Livestock Improvement Corporation Limited, New Zealand (LIC), with a special mention to Trina Dunning, Dr Joyce Voogt and Ken Bartlett (Farmwise consultant). Thank you LIC for leading the way in dairy crossbreeding. The advice I have received over the years has been incredibly valuable and I look forward to future collaborations.

My Professors, Prof Esté van Marle-Köster and Prof Cuthbert Banga. Thank you for always believing in me and guiding me through this process. I look forward to future collaborations in the professional world of Animal Science.

Chris Cloete and Genimex. I am privileged to be mentored by Chris since the beginning of my career. I believe the best way to thank you for all the opportunities you have given me is to pass on the knowledge you have shared with me over all these years. My plan is to help maintain the high standard and animal improvement that Genimex contributes to the dairy industry for years to come.

Friends and family, they have all been there from the very beginning and never stopped pushing me. Few accomplishments in life can be achieved without love and support from home, so thank you all so very much.

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| | |
|---|---|
| AFC | – Age at First Calving |
| ANOVA | – Analysis of Variance |
| ARC | – Agricultural Research Council |
| BIS | – Biological Impact Study |
| BMR | – Bull Marketing Report |
| CAI | – Calf to AI |
| CR42 | – Calving rate within 42 days of the planned start of calving |
| DAFF | – Registrar of Animal Improvement, Department: Agriculture, Forestry and Fisheries |
| DALRRD | – Department of Agriculture, Land Reform and Rural Development |
| DFM | – Days to First Mating |
| DIM | – Days in Milk |
| ICAR | – International Committee for Animal Recording |
| INTERGIS | – Integrated Registration and Genetic Information System |
| LIC | – Livestock Improvement Corporation |
| MPO | – Milk Producers Organisation |
| PM21 | – Percentage mated in 21 days from the planned start of mating |
| SAS | – Statistical Analysis System |
| SCC | – Somatic Cell Count |
| SCS | – Somatic Cell Score |
| TMR | – Total Mixed Ration |

# Chapter 1: Introduction

## 1.1 Introduction

The South African dairy industry is of major importance with regard to its contribution to the national economy and nutritional demands of the growing population. The industry produced 3 427 000 t of milk in 2020, with a turnover of approximately R17 billion, which makes up about 0,4% of global milk production (Lacto Data, 2021). Most of the milk (62%) is used as fresh milk or in liquid form, and the remaining (38%) is processed into cheese and other dairy products (Lacto Data, 2021).

At the end of 2020, the South African dairy population was made up of 1 053 dairy producers with an average of 510 cows per herd, totalling roughly 537 030 cows (Lacto Data, 2021). Holstein and Jersey are the major dairy cattle breeds in South Africa, with smaller numbers of the Ayrshire and Guernsey breeds. Pasture and zero grazing (Total Mixed Ration, TMR) are the primary production systems, with the pasture-based system becoming increasingly predominant (ICAR, 2018; Lacto Data, 2021). According to Lacto Data (2021), approximately 27% of dairy cattle are found in KwaZulu-Natal, 31% in the Southern and Western Cape and 26,2% in the Eastern Cape. The remaining 15,8% are found in the Free State (5,9%), Gauteng (4,1%), Mpumalanga (3,2%) North West (2,1%) and Limpopo provinces (0,4%). The Total Mixed Ration production system is found mainly in the South and Western Cape areas, while KwaZulu-Natal and the Eastern Cape have more pasture than TMR herds.

In line with global trends, South African dairy producers were solely focussed on improving milk yield for many decades (Oltenacu & Broom, 2010; Banga *et al*., 2014; Miglior *et al*., 2017). However, over the past two decades functional traits such as fertility, welfare and health have been added to the breeding objectives of dairy producers world-wide (Zavadilová et al., 2021). The importance of fertility and the associated traits (claw traits, mastitis) has dominated international research in dairy cattle in recent years, with emphasis on recording suitable phenotypes to improve these traits (Egger-Danner et al., 2015; Miglior et al., 2017; Heringstad et al., 2018).

South African breeders are under pressure to increase production efficiency with regard to land and water use. The SA dairy industry has experienced a trend towards fewer producers and larger farms over the past decade. Since January 2015, the number of dairy farmers decreased from 1 824 to 1053 in January 2021, with many large farms currently milking well over a thousand cows and the average herd size being 510 cows per herd (Lacto Data 2021). The dairy industry is faced with various challenges that include the need to improve cow health and welfare and pressures to reduce the carbon footprint (Oltenacu & Broom, 2010, Zavadilová et al., 2021). The Scandinavian countries took the lead in the 1980's by registering several health traits, such as clinical mastitis, and commenced with selection of cattle for improved health and functionality (Zavadilová et al., 2021, Nordic Cattle Genetic Evaluation, 2021, https://nordicebv.info).

There is limited information available on SA dairy breeds with regards to selection for health and welfare. Banga et al. (2014) reported that Holstein cattle were bred in accordance to the breeding value index (BVI) which had been developed through general consensus. This BVI lacked scientific and economic basis with a focus on type traits and production.

The increasing trend towards pasture-based farming in South Africa, coupled with unregulated milk pricing structures, demands animals that not only produce large volumes of milk but are also highly resilient. Such animals contribute towards the mitigation of rearing costs, due to better longevity which results in lower replacement costs (Lopez-Villalobos et al., 2000).

Historically, crossbreeding has been widely used in a number of farm species (Clasen et al., 2017), however, it is generally not accepted in dairy populations due the high milk producing ability of the Holstein breed and influence of purebred breeders (VanRaden & Sanders, 2003, Maltecca et al., 2006, Weigel, 2007, Shonka-Martin et al., 2019). In recent years, the recognition of the importance of functional traits such as fertility, longevity and health traits, coupled with growing value of milk solids (Weigel & Barlass, 2003) has seen a rise in interest in crossbreeding of dairy cattle (Clasen et al., 2017, Shonka-Martin et al., 2019). Furthermore, animal welfare and other economically important traits have been seen to benefit due to heterosis through crossbreeding (Oltenacu & Broom, 2010; Clasen et al., 2017).

In a survey of 50 US farms conducted by Weigel and Barlass (2003), commercial farmers indicated that their reasons for crossbreeding was to increase fertility, longevity, calving ease, health and survivability compared to pure Holsteins, and also to reduce inbreeding depression. Other considerations include breeding smaller animals, increased adaptability and raising milk solids when using non-Holstein breeds.

The uptake of crossbred animals has been seen not only in New Zealand but also the American population. Herds registered with Dairy Herd improvement Association (DHIA) has seen an increase from 2 971 crossbred animals registered in 1990, to 207 368 crossbred animals registered in 2018, showing growth that surpasses all other breeds (Guinan et al., 2019).

The KiwiCross™ has been registered in South Africa as a sire line breed since 2019. It is a cross between the Holstein and Jersey breeds, and was developed in New Zealand where the breed composition is based out of 16, or breed 16ths (please see Addendum A, three generation pedigrees). Therefore, a purebred Jersey would be J16 and a purebred Holstein-Friesian F16. KiwiCross™ sires are crossbred sires and are considered as no more than 13/16$^{th}$'s of one breed e.g. F3J13 would be a KiwiCross™ sire with 3/16$^{th}$'s Holstein-Friesian and 13/16$^{th}$'s Jersey. Access to all three breeds allows the breeder to breed the animal best suited for his/her production system. A scenario to consider: Mating Jersey sire to a Holstein-Friesian cow will give you a crossbred F8J8 heifer. If this is what a farmer feels fits his system, he could then select a KiwiCross™ sire with F8J8 make up. The offspring of the F8J8 sire would therefore stay F8J8. However, if access is only with pure sires, the offspring from an F8J8 cow would then give a F12J4 progeny with a Holstein-Friesian sire and F4J12 progeny with a Jersey sire. Table 1.1 shows a more extensive break down of possible sire effects on pure and crossbred cows / heifers.

Table 1.1 Breed composition of offspring when cows / heifers are mated to different sire lines

| | | DAM | | | | |
|---|---|---|---|---|---|---|
| | | F16J0 | F12J4 | F8J8 | F4J12 | F0J16 |
| SIRE | F0J16 | F8J8 | F6J10 | F4J12 | F2J14 | F0J16 |
| | F4J12 | F10J6 | F8J8 | F6J10 | F4J12 | F2J14 |
| | F8J8 | F12J4 | F10J6 | F8J8 | F6J10 | F4J12 |
| | F12J4 | F14J2 | F12J4 | F10J6 | F8J8 | F6J10 |
| | F16J0 | F16J0 | F14J2 | F12J4 | F10J6 | F8J8 |

The crossbred animal has gained popularity among pasture based dairy farmers. This has created the need to evaluate its performance under South African conditions.

## 1.2 Problem statement

Productive performance of dairy cattle breeds in South Africa is well documented for the pure breeds. Due to limited use of crossbreeding and unavailability of data, the performance of crossbred dairy animals has, however, not been characterised.

A Biological Impact Study (BIS) trial was conducted under permission from the Registrar of Animal Improvement, Department: Agriculture, Forestry and Fisheries (DAFF) in 2013 which resulted in the KiwiCross™ to be registered in South Africa as a KiwiCross™ sire line breed. In this study, the data from the BIS trial was made available for a statistical analysis to compare the performance of KiwiCross™ sired commercial cows against the most commonly used purebred Holstein and Jersey sires on commercial cows under the South African pasture based production system.

## 1.3 Aim

The aim of this study was to compare the performance of the crossbred KiwiCross™ dairy cattle breed against purebred Holstein and Jersey breeds, in a pasture-based production system in KwaZulu-Natal.

Objectives:

1. Compare reproductive performance, measured by conception rate and Age at First Calving, of KiwiCross™, Holstein and Jersey sired commercial cows.
2. Compare 305-day lactation production of milk and milk solids (protein, butterfat and lactose) of KiwiCross™, Holstein and Jersey sired commercial cows.
3. Compare somatic cell score, as an indicator of udder health, between KiwiCross™, Holstein and Jersey sired commercial cows.
4. Evaluate and compare visual and linear appraisal scores of KiwiCross™, Holstein and Jersey sired commercial cows.

# Chapter 2: Literature review

## 2.1 Introduction

In the past, selection of dairy cattle globally was mainly focused on milk production traits (Oltenacu & Broom, 2010). It was, however, noted that genetic improvement in milk production resulted in an undesirable correlated deterioration in functional traits such as health and reproduction (Miglior et al., 2017). This necessitated dairy producers to reconsider their breeding objectives, resulting in a shift in selection emphasis towards traits related to fitness, in the past two decades. Functional traits such as longevity, fertility, calving performance, udder and claw health and locomotion form part of most dairy cattle selection objectives worldwide (Buckley et al., 2014; Shonka-Martin, 2019).

Several researchers (Weigel & Barlass, 2003; VanRaden & Sanders, 2003; Brotherstone & Goddard, 2005; Maltecca et al., 2006; Heins et al., 2008; and Guinan et al., 2019) have highlighted the benefits of heterosis and complementarity derived from crossbreeding in dairy cattle. Hence, crossbreeding has been introduced in dairy cattle to improve fitness traits in countries such as Denmark and New Zealand (Buckley et al., 2014).

This review presents a brief overview of the SA dairy industry, with a focus on the pasture-based production system, followed by a discussion on traits of economic importance in dairy cattle. Special reference is made to the use of crossbreeding to improve production efficiency.

## 2.2 Overview of the SA dairy industry

The South African dairy industry is currently made up of approximately 1 053 milk producers, owning herds with an average size of 510 cows. These farmers produce about 3,4 million tons of milk per year, which represents 0,4% of the total world production. While small on a global scale, milk production is vital to food security in South Africa. The two main production systems are Total Mixed Ration (TMR) and pasture, with a growing trend towards the pasture-based system. Six dairy cattle breeds are found in South Africa, namely Holstein, Jersey, Ayrshire, Guernsey, Brown Swiss and Dairy Shorthorn. Holstein, Jersey and Ayrshire are the most commonly used of these breeds.

The South African dairy industry is considered as a major sector in South African agriculture by contributing R17,8 billion rand to Gross Domestic Product (GDP) and providing over 100 000 jobs both directly and indirectly (DALRRD, 2019).

Precision farm management systems, such as Afikim and Delpro from DeLaval enable South African dairy farmers to manage the ever increasing about of data to ensure effective management of their respective herds. These systems are good sources of information for advising Veterinarians and Animal Scientists (Norton & Berckmans, 2017, Crowe et al., 2018).

Most of the milk production in South Africa is in areas that predominantly use the pasture based system, especially the Eastern Cape and KwaZulu-Natal regions (Lacto Data, 2021). In Figure 2.1 the cow density per district (cows/km$^2$) is shown according to the October 2016 statutory survey.

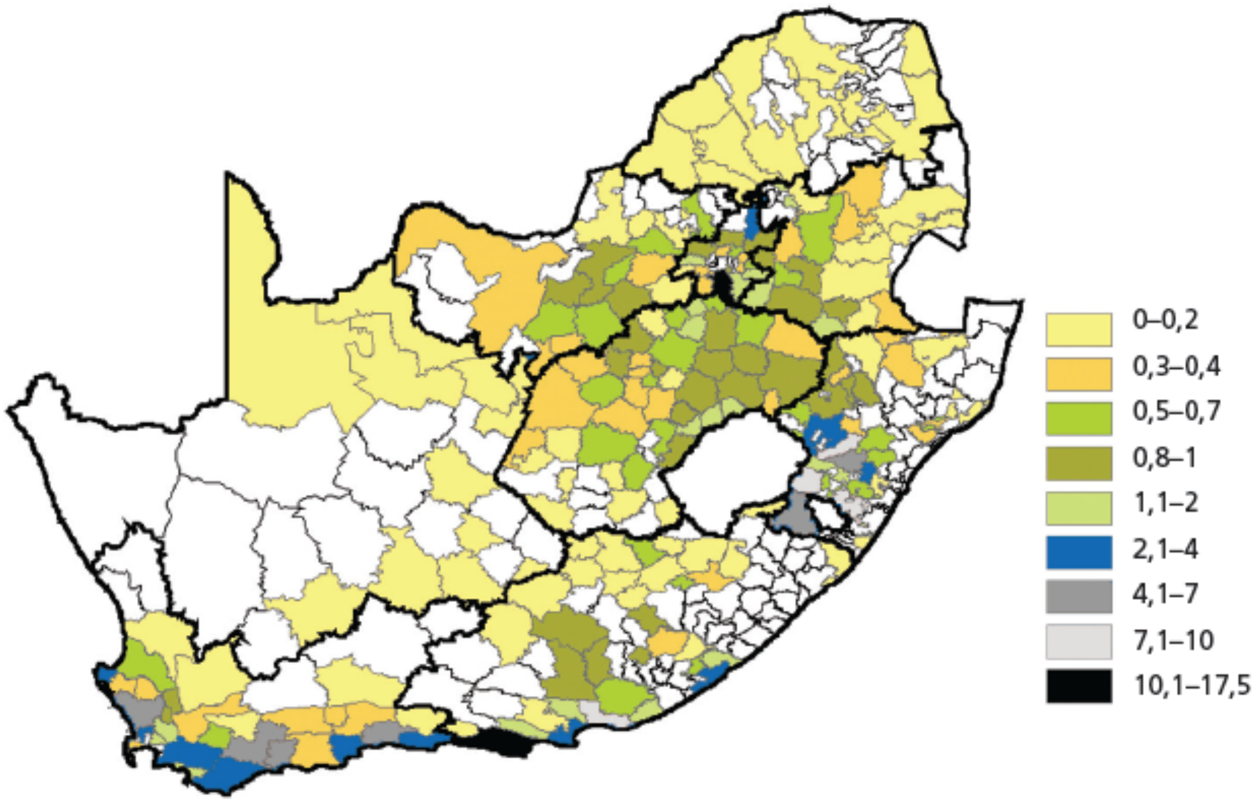


Figure 2.1 Cow density per district (cows/km$^2$), based on MPO estimates from October 2016 statutory survey.

In May 2021, there were 67 Producer-Distributers (farmers who package and sell their own milk) and 132 milk buyers in South Africa (Lacto Data, 2021). Figure 2.2 shows the percentage of milk production per province, with the Western Cape having the highest production (31%) and Limpopo province the lowest (0,4%). Northern Cape shows 0,0%, however, there are four producers according to Lacto Data (2021).


Figure 2.2. Percentage of milk produced in the different provinces of South Africa in 2020 (Lacto Data, 2021).

The main dairy production areas (Western Cape, Eastern Cape and KwaZulu-Natal) account for 84,2 % of total production. Herds in the Western Cape are mainly on TMR, while those in the Eastern Cape and KwaZulu-Natal are mostly on the pasture-based production system.

A TMR system can be defined as a high input and high output system, and a pasture-based system as low input and low output (Abin et al., 2018, Delaby et al., 2020). Cows in a TMR system are fed high energy concentrate diets and are, at times, housed in barns or other roofed systems. The high energy leads to the production of large milk volumes, as seen in Table 2.1. In contrast, cows kept on pasture systems rely mainly on grazing pastures, with supplements being offered when pasture quality is low (Wilkinson et al., 2019). Grazing cows normally walk long distances between the pastures and the milking parlours, expending energy in the process. As seen in Table 2.1, cows on the pasture-based production system produce lower yields of milk than those on TMR.

**Table 2.1 300 day production figures for South African Holstein and Jerseys participating in the Dairy Cattle Improvement Scheme in 2007 (Theron & Mostert, 2009)**

| Breed | System | Milk Production (kg) | Fat % | Protein % |
|---|---|---|---|---|
| Holstein | Total Mixed Ration | 9 967 | 3.81 | 3.20 |
| Holstein | Pasture | 7 143 | 3.78 | 3.21 |
| Jersey | Total Mixed Ration | 6 385 | 4.77 | 3.74 |
| Jersey | Pasture | 4 754 | 4.67 | 3.71 |

The high input system is susceptible to changes in input costs such as the maize price, which affects margins. The low input system, where pasture is the main feed source, tends to be more resilient to fluctuations in input costs (Hernandez-Mendo et al., 2007). Farmers on the pasture-based production system usually practice seasonal calving, in order to get the benefit of seasonal pasture availability (McClearn et al., 2020). This can be seen in Figure 2.3, below, showing milk purchase volumes peaking in Spring and decreasing in Autumn.

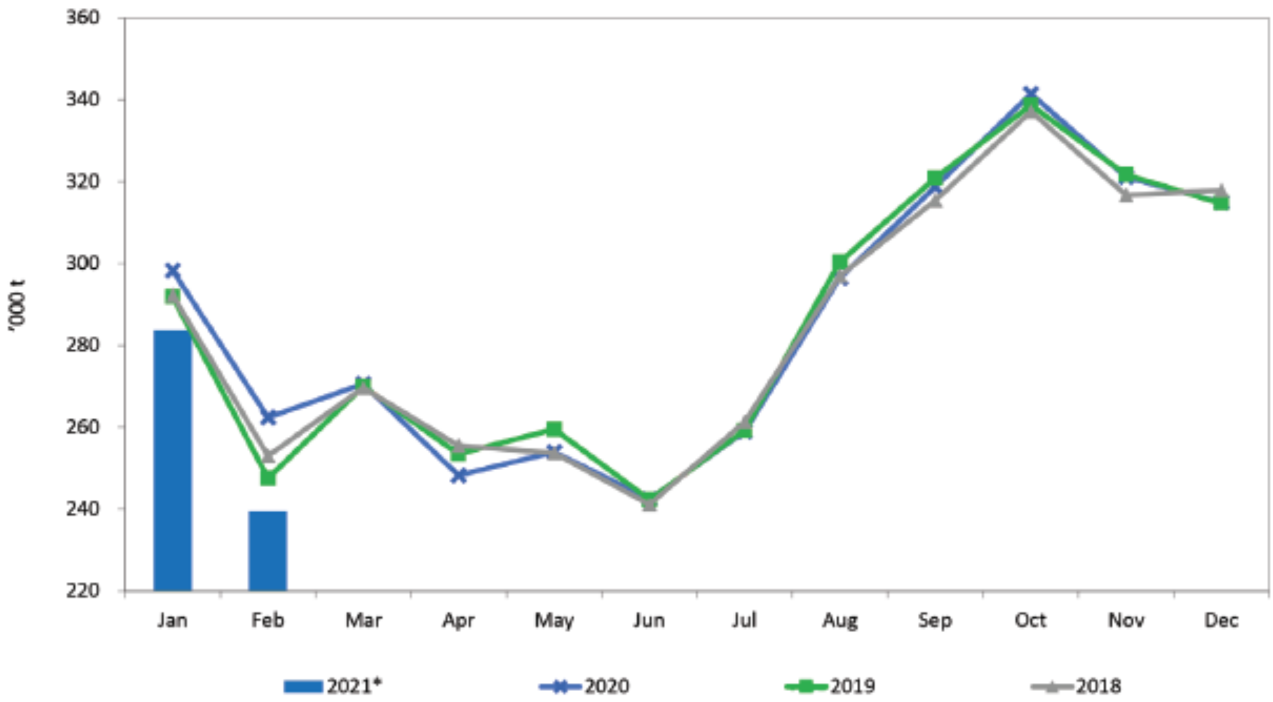


Figure 2.3 South African monthly unprocessed milk purchases 2018-2021 (Milk SA)

As already mentioned, the South African dairy industry is considered a major sector within SA agriculture by contributing to GDP, job security and food security. Farmers have access to modern technology in the form of rotary milking platforms and computerised recording devices as seen on the trial farms.

No recent scientific publications are available distinguishing between productions on pasture and TMR systems. In Table 2.2, a summary is provided on the two main dairy breeds from ARC's and SA Stud book's milk recording schemes (ICAR 2021).

**Table 2.2 305 day production figures for South African Holstein and Jerseys participating in the ARC's (2021) and SA Stud book's (2018) Dairy Cattle Improvement Scheme (ICAR 2021)**

| Breed | Lactations | Milk Production (kg) | Fat % | Protein % |
|---|---|---|---|---|
| Holstein (ARC) | 18 222 | 9 262 | 3,92 | 3,31 |
| Holstein (SA Stud book) | 11 802 | 9 664 | 3,81 | 3,18 |
| Jersey (ARC) | 26 789 | 5 898 | 4,89 | 3,79 |
| Jersey (SA Stud book) | 23 589 | 6 045 | 4,75 | 3,71 |

## 2.3 Traits of economic importance in dairy cattle

A general change of focus in selection objectives has been observed in dairy breeding programmes worldwide (Miglior et al., 2017). Recent research has highlighted the importance of having balanced breeding objectives, which has resulted in many non-production traits being incorporated into most national selection objectives (Fleming et al., 2018; Ismael et al., 2021). Functional traits such as longevity, health, fertility and workability are included in the majority of national dairy cattle breeding objectives worldwide, with a trend towards selection for an optimum in the yield traits (Oltenacu & Broom, 2010, Buckley et al., 2014, Clasen et al., 2017, Miglior et al., 2017, Johnson et al., 2018, Shonka-Martin et al., 2019).

Functional traits generally have low heritability, with environment playing a significant role in their expression (Cammack et al., 2009; Zavadilová et al., 2021) which results in low accuracy of selection. In dairy production, automated milking systems and recording has the potential for generating accurate data for application in genetic evaluations. Producers therefore have the option to select appropriate sires to meet their breeding objectives. Table 2.3 presents a summary of heritability estimates for yield, fertility, health and welfare traits. Yield traits are shown to have higher heritability's when compared to fertility, health and welfare traits.

**Table 2.3 Heritability estimates for milk yield, fertility, health and welfare traits**

| Category | Trait | Heritability | Reference |
|---|---|---|---|
| Yield | Milk Yield | 0.30 | Pritchard et al., (2012) |
| | Milk Yield | 0.40 | Tsuruta et al., (2005) |
| | Fat Yield | 0.26 | Pritchard et al., (2012) |
| | Fat Yield | 0.33 | Tsuruta et al., (2005) |
| | Protein Yield | 0.27 | Pritchard et al., (2012) |
| | Protein Yield | 0.35 | Tsuruta et al., (2005) |
| Fertility | PM21* | 0.0335 | Bowley et al., (2015) |
| | CR42** | 0.0087 | Bowley et al., (2015) |
| | Age at First Calving (AFC) | 0.24 | Makgahlela et al., (2007) |
| | Calving Interval | 0.04 | Pritchard et al., (2012) |
| | Calving Interval | 0.03 | Makgahlela et al., (2007) |
| | Days to First Service | 0.04 | Pritchard et al., (2012) |
| | Number of Inseminations | 0.02 | Pritchard et al., (2012) |
| | Days open | 0.07 | Tsuruta et al., (2005) |
| | Interval to first luteal activity | 0.16 | Cassell, B., (2001) |

| | | | |
|---|---|---|---|
| Health & Welfare | Somatic Cell Score | 0.14 | Pritchard et al., (2012) |
| | Somatic Cell Score | 0.14 | Tsuruta et al., (2005) |
| | Mastitis | 0.04 | Pritchard et al., (2012) |
| | Lifespan score | 0.05 | Pritchard et al., (2012) |
| | Productive life | 0.10 | Tsuruta et al., (2005) |

*Percentage mated in 21 days from the planned start of mating

**Calving rate within 42 days of the planned start of calving

South African dairy breeders have had access to National Milking Recording since 1917 (Bergh, 2010). According to ICAR's statistics of cow milk recording, as supplied by South Africa's Agricultural Research Council in 2020, only 36 214 lactations were recorded in official milk recording out of a population of 537 030 dairy cows. This is made up of Jersey (17 682), Holstein (16 792), Ayrshire (1 425) and Guernsey (315). This equates to just under 7% of the population being recorded. This low incidence of participation in the official milk recording scheme does complicate the recording and possible trials involving traits of economic importance within the South African dairy population.

**2.4 Crossbreeding in livestock species**

Crossbreeding is the breeding of two or more different breeds, and is mainly practised to exploit breed complementarity and heterosis (Lembeye, et al., 2015, Fleming, et al., 2018, Clasen et al., 2019). It has been applied in livestock worldwide, including the development of composite beef cattle breeds such as the Bonsmara in South Africa. Composite breeds are a step up from crossbreeding in that it has become a refined breed or population unto itself due to defined strategies, protocols and percentages allowed between breeds (Gosey, J. 1991). A summary of composite cattle, sheep and pig breeds developed through cross breeding and established in South Africa is provided in Table 2.4.

Table 2.4 A summary of composite livestock breeds in SA

| Breed | Base Breeds | Reference | Year |
|---|---|---|---|
| Beef | | | |
| PinZ2yl | Pinzgauer & Nguni | https://www.pinz2yl-sa.co.za | 2009 |
| Beefmaster | 50% Brahman X 25% Hereford X 25% Shorthorn | http://www.beefmastersa.co.za | 1987 |
| Simbra | Simmental & Brahman | https://simbra.org/why-simbra-2/ | 1987 |
| Bonsmara | 5/8 Afrikaner, 3/16 Hereford and 3/16 Shorthorn | https://bonsmara.co.za/more-about-us/ | 1964 |
| **Sheep** | | | |
| Afrino | 25% Merino, 25% Ronderib Afrikaner and 50% SA Mutton Merino | http://www.afrino.org.za | 1980 |
| Dormer | Dorset Horn & German Merino (SA Mutton Merino) | http://www.dormersa.com/p11/dormer-breed/ | 1937 |
| Dorper | Dorset Horn & Blackhead Persian | http://dorpersa.co.za/breed-history/ | 1950 |
| Meatmaster | Indigenous fat tailed & European muscled breeds | https://www.meatmastersa.co.za/Breed-Genesis.htm | 2007 |
| Van Rooy | Blinkhaar Afrikaner & Rambouillet | http://www.vanrooysa.co.za/p25/van-rooy-sheep-breed/ | 1906 |
| **Pig** | | | |
| Landrace | | http://www.pigsa.co.za/p11/pig-breeds/landrace-pig-breed.html | 1950's |
| PIC | Commercial strain | https://www.picrsa.co.za/products/#Boar | |
| TOPIGS | Commercial strain | https://topigsnorsvin.co.za | |

## 2.5 Crossbreeding in dairy cattle

While crossbreeding in the dairy industry is considered quite new, it has been around for many years, with a major acceptance in New Zealand (Heins et al., 2008, Buckley et al., 2014 and Berry & Buckley, 2016). Its adoption has taken long due to the historical influence of breed societies of pure breeds (Clasen, et al., 2019). Table 2.5 shows some types of crossbreeding systems practiced by dairy producers. Table 2.6 shows that uptake of crossbreeding in dairy cattle is on the rise, with most artificial breeding companies having some kind of crossbreeding program. The change in the composition of the US and several other national dairy populations shows that there is a growing move towards crossbreeding (Guinan et al., 2019). Interest in crossbreeding has grown due to the benefits seen in crosses in traits such as solid production, health and fertility (Anderson et al., 2007, Washburn & Mullen, 2014 and Shonka-Martin et al., 2019). Semen of crossbred dairy cattle sires, developed through various crossbreeding systems, is distributed globally as shown in Table 2.6.

Table 2.5 Types of crossbreeding found in dairy operations as defined by Bourdon (2000) and Herring (2014)

| Type of breeding | Definition |
|---|---|
| Crossbreeding (generalised) | The mating of animals from two, or more, established breeds that maintains a level of heterosis or breed complementarity. |
| Terminal crossing | Type of crossbreeding. Crossing to maximise heterosis but no replacements are produced from the cross. Can be done using two or more pure breeds. |
| Rotational crossing | Type of crossbreeding. Two or more pure breeds are used where the next bull to be used is the one with the least amount of influence in the genes of the animal. |
| Crisscrossing | Type of rotational crossbreeding. Alternate breeding between two breeds. |

Table 2.6 Examples of national crossbreeding systems producing and distributing dairy bull semen (2021)

| **Company** | **Home country/s** | **Terminology** | **Breeds** | **System** | **Reference** |
|---|---|---|---|---|---|
| LIC | New Zealand | KiwiCross™ | Holstein-Friesian<br>Jersey<br>Ayrshire | Rotational system &<br>Cross bred bull semen | www.licnz.com |
| CRV | New Zealand | Cross bred | Holstein-Friesian<br>Jersey<br>Ayrshire | Rotational system &<br>Cross bred bull semen | www.crv4all.co.nz |
| Genex | USA | Mixed Breed | Holstein<br>Jersey | Rotational system &<br>Cross bred bull semen | www.genex.coop |
| | | Dairy on beef | Dairy<br>Beef | Beef semen on dairy cows | |
| WWS | USA | Dairy Cross Breeds | Holstein<br>Jersey | Rotational system &<br>Cross bred bull semen | www.wwsires.com |
| VikingGenetics | Scandinavia | ProCross | VikingHolstein<br>VikingRed<br>Coopex Montbéliarde | Rotational system | www.vikinggentics.com |
| | | VikingGoldenCross | VikingHolstein<br>VikingRed<br>VikingJersey | Rotational system | |
| ABS | USA | HYVIG crossbreeding | Holstein<br>Jersey<br>Norwegian Red | Rotational system | www.absglobal.com |
| | | Dairy on beef | Dairy and beef | Beef semen on dairy cows | |
| Semex | Canada | Dairy on beef | Dairy and beef | Beef semen on dairy cows | www.semex.com |
| STgenetics | USA | Dairy on beef | Dairy and beef | Beef semen on dairy cows | www.stgen.com |
| Alta Genetics | USA | Dairy on beef | Dairy<br>Beef | Beef semen on dairy cows | www.altagenetics.com |

In Table 2.7 the expected heterosis for yield, health and welfare traits are shown. These effects show the added benefit when two complementary breeds are crossed over the expected parent average. All traits show a positive effect except for mastitis and a number of other diseases.

Table 2.7 Expected heterosis for yield, fertility, health and welfare traits

| **Category** | **Trait** | **Heterosis effect** | **Reference** |
|---|---|---|---|
| Yield | Milk Yield (Kg) | 4.92% | Lembeye et al., (2015) |
| | Fat Yield (Kg) | 7.39% | Lembeye et al., 2015) |
| | Protein Yield (Kg) | 6.21% | Lembeye et al., (2015) |
| | Production traits | ~3.00%* | Sørensen et al., (2008) |
| | Yields | 5.0 – 6.6% | McAllister, A. J., (2002) |
| Fertility | Fertility | ~10.00%* | Sørensen M.K. et al., (2008) |
| | DFM | 3.80% | Harris & Montgomerie (2001) |
| | CAI | 3.50% | Harris & Montgomerie (2001) |
| | Reproduction | 0.8 – 5.0% | McAllister, A. J., (2002) |
| Health & Welfare | Somatic Cell Score | -0.72% | Lembeye et al., , (2015) |
| | Metabolic Diseases | -3.80* | Sørensen et al., (2008) |
| | Leg & Claw Diseases | -6.10* | Sørensen et al., (2008) |
| | Reproduction Diseases | -0.10* | Sørensen et al., (2008) |
| | Mastitis** | 20.60* | Sørensen et al., (2008) |
| | Other Diseases** | 0.70* | Sørensen et al., (2008) |
| | Longevity | 10 - 15%* | Sørensen et al., (2008) |
| | Livability | 3.7 – 4.6% | McAllister, A. J., (2002) |
| | Growth | 3.2 – 5.7% | McAllister, A. J., (2002) |

*per 100 lactations

**positive figure is unfavourable

Interest and use of crossbreeding in the United States dairy industry prompted a 10 year study on the ProCross type cattle by Hazel et al. (2017). The ProCross is a three way crossbred dairy cow resulting from a crossbreeding mating system using sires from the VikingRed, Montbeliarde and Holstein breeds (http://www.procross.info/questions-and-answers). Comparison of the F1 cows i.e. Holstein x Viking Red and Holstein x Montbeliarde *versus* pure Holstein showed that the crossbred cattle, while having similar production levels, outperformed the pure Holstein in fertility and health traits. These findings partly concur with those of Saha et al. (2018) which showed improved body condition for three generation crosses than their purebred counterparts. Clasen et al. (2019) studied data on 103 307 pure

Holsteins and 14 832 F1 crosses between Holstein dams and Nordic Red sires and observed that the F1 crosses outperformed the purebred Holsteins on fertility, udder health, still birth and survival traits. An earlier study in Denmark, by Kargo and Fogh (2016), similarly indicated that crosses had comparable milk production but better fertility and health than purebreds (Sørensen et al., 2008).

In the US, the number one reason for culling dairy cattle is infertility. It is therefore a large component in the overall longevity of the herd. In a study by Hazel et al. (2017), conception rates in crosses were higher compared to pure lines, except the Jersey, while calving difficulty was also much lower in crosses and Jerseys. Calf mortality was also reported to be the lowest in Jersey X Holstein crosses (Weigel & Barlass, 2003). An ongoing study on a three-way cross between Montbelierde, Holstein and VikingReds has also shown the benefits of crossbreeding over the use of purebreds (Hazel et al., 2017). While production volumes were similar, the percentage in solids was better in the crosses (Hazel et al., 2017 and McClearn et al., 2020).

**2.6 The KiwiCross™ Breed**

In 1996, the New Zealand Animal Evaluation (AE) unit enabled bull evaluations across breed (https://www.lic.co.nz/about/animal-evaluation/ & https://www.lic.co.nz/about/our-history/) which led to the potential for evaluating crossbred sires. In 2000, KiwiCross™ (crossbred) semen was made available in New Zealand to enter LIC's Daughter Proving Scheme. In 2005 the first KiwiCross™ sires were made available on a commercial level, which led to a significant move to more crossbred cows being milked and tested (Table 2.8). Over a ten-year period (2008 – 2018) the National dairy cattle population in New Zealand has increased by 24,42% or almost a million dairy cows (ICAR website). Holstein-Friesian numbers decreased by 5,08%, while the Jersey herd decreased by 27,59%. The only increase was seen in the Holstein-Friesian / Jersey crosses which increased by 69,51%.

Table 2.8 Dairy cattle population statistics for New Zealand in 2008 and 2018 results from ICAR's Biennial Statistics of cow milk recording.

| | 2008 | 2018 | Change |
|---|---|---|---|
| **Population size** | 4 012 867 | 4 992 914 | 24,42% |
| **Number of lactations** | | | |
| Holstein-Friesian | 954 031 | 905 550 | -5,08% |
| Jersey | 357 491 | 258 852 | -27,59% |
| Holstein-Friesian / Jersey crossbred* | 871 930 | 1 478 001 | 69,51% |

*A crossbred animal is defined as one that has no more than, 14/16's of one breed (Buckley et al., 2014).

Average lactation production for the pure and crossbred populations in the ten year period is illustrated in Table 2.9. Milk volume for crossbreds in 2018 was about 9% lower than for the Holstein-Friesians, however solid percentages were higher. Crossbred solids are 0,49% higher in fat and 0,18% higher in protein percentage compared to Holstein-Friesians. When compared to Jerseys, crossbreds show about 22% higher milk volume with lower percentages in solids, being 0,59% lower in fat and 0,23% lower in protein percentage.

Table 2.9 Milk production figures for New Zealand dairy cattle in 2008 and 2018. Results from ICAR's Biennial Statistics of cow milk recording.

| | Milk (litres) | Milkfat (%) | Protein (%) |
|---|---|---|---|
| **2008 herd test season** | | | |
| Holstein-Friesian | 4 302 | 4,18 | 3,46 |
| Jersey | 3 070 | 5,51 | 3,98 |
| Holstein-Friesian / Jersey crossbred* | 3 893 | 4,74 | 3,70 |
| **2018 herd test season** | | | |
| Holstein-Frisian | 4 470 | 4,48 | 3,73 |
| Jersey | 3 208 | 5,65 | 4,14 |
| Holstein-Friesian / Jersey crossbred* | 4 102 | 4,97 | 3,91 |

*A crossbred animal is defined as one that has no more than, 14/16's of one breed (Buckley et al., 2014).

The use of rotational crossbreeding in South Africa has been apparent for many years, while the addition of crossbred semen the KiwiCross™ has only been an option since 2013. Crossbreeding in dairy cattle holds the potential to improve some of the difficult to measure low heritability traits while maintaining good yields. Buckley et al. (2014) indicated that crossbreeding has the potential to improve the economic situation of a dairy herd through the introduction of favourable genes, reduce inbreeding depression and taking advantage of heterosis. The long terms benefits are still to be defined (McClean, et al., 2020).

### 2.7 Conclusion

The correlated deterioration in functional traits, due to exclusive selection for milk production in the past, is well documented in the literature. Consequently, breeding objectives for dairy cattle have been broadened to a more balanced approach including functional traits such as fertility, welfare and health. Crossbreeding has the potential to contribute towards addressing this problem, in addition to exploiting breed complementarity for production traits. Thus, there is an increase in the adoption of crossbreeding in dairy cattle populations.

# Chapter 3: Materials and Methods

## 3.1 Introduction

Data from the Biological Impact Assessment Trial for the recognition of the KiwiCross™ Breed (refer to addendum A for genetic composition) in the Republic of South Africa, in accordance with the Livestock Improvement Act 1998 (Act no 62 of 1998), was made available for the current study. Ethical Clearance was granted by the ethics committee (NAS097/2020).

## 3.2 Materials

### 3.2.1 Study site and population

Performance data for this project was recorded on six farms in the KwaZulu-Natal Midlands area surrounding Nottingham Road, Rosetta, Balgowan and Greytown. (Figure 3.1).

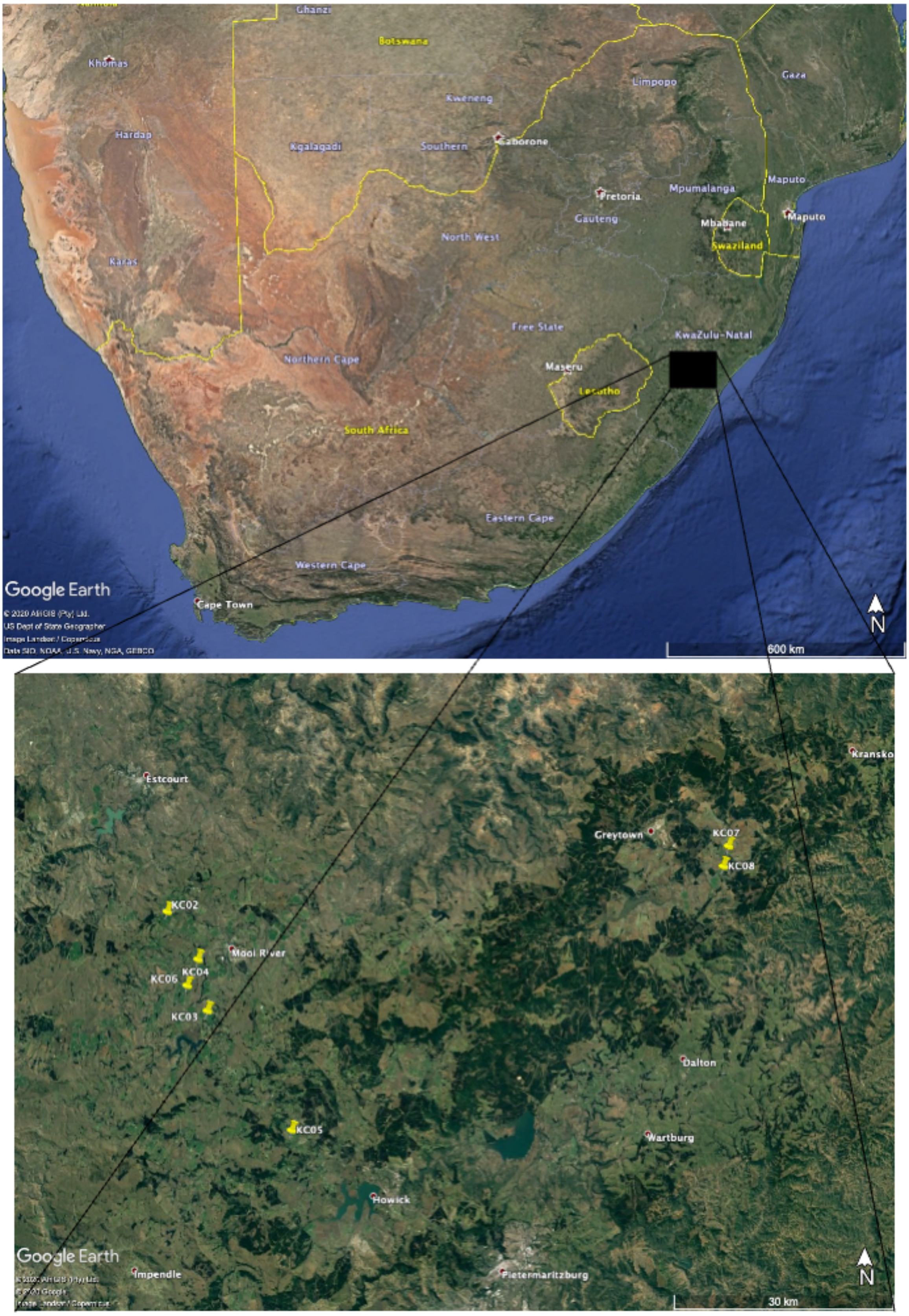


**Figure 3.1:** Google Earth image showing position of trial farms within KwaZulu-Natal

**3.2.2 Study animals management**

The six farms used for this study were commercial dairy farms with similar management practices. Farms were assigned identification numbers with the prefix KC (KiwiCross™ trial farm) numbers on the national livestock database (INTERGIS). Although farms were owned and managed by several producers, all data was loaded onto the INTERGIS under one name. KC02, KC03, and KC04 have the same owner but are run by three separate managers. KC05, KC06 and KC08 are owned by three different individuals with assistance from managers. A note on KC08. This was originally two farms sharing a boundary fence and were designated KC07 and KC08 even though owned by one person. Animals were identified by ear-tags labelled with numbers or names. The total number of animals in the trial was 991 animals across the six farms.

Farms were selected based on their proximity to each other, the seasonal nature of their mating plans, i.e. Spring mating (September, October and November) and Autumn mating (April, May and June) and for their being predominantly on a pasture based production system. All farms had been using a crossbreeding mating plan between Holstein and Jersey sires i.e. crisscross mating. This mating plan has a history of using semen from New Zealand, with influence of the New Zealand pasture based farming systems. Cows were milked twice a day, with all heifers being milked in one parlour. Four of the herds (KC02, KC03, KC04 and KC08) had herringbone milking parlours, and the other two (KC05 and KC06) had rotary parlours.

Semen for the trial was for Holstein, Jersey and KiwiCross™ sires and was supplied by Livestock Improvement Corporation (LIC). KiwiCross™ is a trademarked term for crossbred bulls which have been marketed since 2005 by Livestock Improvement Corporation (LIC) New Zealand (www.licnc.com). The KiwiCross™ sires were selected by LIC and the South African team responsible for running the BIS trial. In Addendum B, bull marketing reports can be found on the selected bulls showing performance data in country of origin. Sires are ranked between number three and number twelve at time of selection. As these are commercial farms, some matings were grouped as “non-descript”. This semen was supplied by companies other than LIC, farm bred bulls or natural mating from farm bred bulls. Farmers were free to use the semen as they would normally, with the only condition being that the use of

KiwiCross™ semen was in conjunction with Holstein or Jersey semen supplied by LIC. The condensed mating season ensured calving within in a two month period to allow for contemporary comparison. Table 3.1 shows the distribution and make up of animals across the six trial farms.

**Table 3.1** Number of heifers per farm sired by Holstein, Jersey, KiwiCross™ and Non-descript sires.

| **Farm** | **N of Holstein heifers** | **N of Sires** | **N of Jersey heifers** | **N of Sires** | **N of KiwiCross™ heifers** | **N of Sires** | **N of Non-descript heifers** | **N of Sires** |
|---|---|---|---|---|---|---|---|---|
| KC02 | 31 | 1 | 39 | 2 | 112 | 5 | 49 | Unknown |
| KC03 | 16 | 1 | 6 | 2 | 104 | 5 | 102 | Unknown |
| KC04 | 6 | 1 | 1 | 1 | 71 | 5 | 68 | Unknown |
| KC05 | 23 | 1 | 34 | 1 | 97 | 5 | 10 | Unknown |
| KC06 | 55 | 1 | 0 | 0 | 65 | 4 | 51 | Unknown |
| KC08 | 17 | 2 | 0 | 0 | 27 | 5 | 7 | Unknown |
| All | 148 | 2 | 80 | 3 | 476 | 5 | 287 | Unknown |

All production data collected for this trial were recorded between September 2013 and July 2017. The timeline was as follows:

- September 2013 – KiwiCross™ semen arrives in SA and is distributed amongst trial farmers
- Spring mating 2013 – September, October and November 2013
- Spring calving 2014 – June, July and August 2014
- Spring mating 2015 – September, October and November the 2014 trial heifers are mated
- Spring calving 2016 – Trial heifers calve down and National Milk Recording commences on heifers in line with ICAR standards
- Spring mating 2016 – September, October and November the 2014 trial heifers are mated for a second season
- June and July 2017 – Once first lactations were finished the trial was completed.

Fertility data were collected from the Spring 2013 mating season after pregnancy diagnosis in early 2014. Data on the resultant calvings were recorded on farm in 2014, and included calving ease, heifer & bull calf split (not all collected sex splits) and heifer mortality. Data was not readily available for the study. All heifer offspring were registered on the South African National Dairy Recording scheme, the INTERGIS. This process was repeated for the Autumn and Spring 2014 seasons, Autumn and Spring 2015 seasons and Autumn 2016 season. The Spring 2016 season only had conception rate records with their 2017 births being after the trial completion date.

#### 3.2.3.1 Data Recording and Management

Individual cow performance data from the trial was recorded and stored on the South African National Dairy Recording Scheme's database, the INTERGIS. The cow fertility data (inseminations per conception) was extracted from the Biological Impact Assessment (BIS) trial for the introduction of the KiwiCross™ breed into South Africa. Due to KiwiCross™ semen only being permitted into South Africa for this trial, production data was only available from first lactation heifers.

International Committee for Animal Recording (ICAR) standards were followed to ensure the accurate and credible lactation figures for comparative analysis. Five milk recording tests were administered during the lactation. During each test, milk yield (Kg) was recorded and a milk sample taken from each cow and sent to Milkolab, an accredited laboratory for testing. All test-day data were uploaded onto the INTERGIS following the procedures of the National Milk Recording Scheme, which is operated by the Agricultural Research Council.

The following traits were selected for analysis:

- Production (INTERGIS)
    - 305 day lactation Milk Yield (Kg)
    - 305 day lactation Protein Yield (Kg)
    - 305 day lactation Fat Yield (Kg)
    - 305 day lactation Solids (Protein + Fat) Yield (Kg)
    - 305 day lactation Lactose Yield (Kg)
- Udder Health (INTERGIS)

Somatic Cell Count (SCC) was converted to Somatic Cell Score (SCS) by logarithmic transformation, i.e. $SCS = Log_{10}(SCC)$ in order to ensure Normal Distribution of the data (Ali, A. K. A., and Shook, G. E., 1980)

- Reproduction
  - Age at first calving (INTERGIS)
  - Number of inseminations per conception (BIS Trial data)

**3.2.3.2 Linear Classification**

Linear classification of the trial animals was conducted by a qualified Senior Interbreeding Judge and Secretary of the Interbreeding Judges Association. The goal was to assess the relevant conformation traits of crossbred KiwiCross™ dairy cattle under commercial production systems. A total of 936 animals, across the six farms, were visually assessed and given a score for each conformation trait while grazing on pasture.

Scoring was focused on udder suitability, feet & legs and overall body conformation for a pasture-based animal on a scale of 1 to 10. Standard dairy protocol has linear scores out of 9 but this visual appraisal was not based on a standardised system but rather a general and subjective scoring system. Only factors affecting functional efficiency of these crossbred cattle under commercial production systems were considered. All cattle were considered as crossbred. Sire names were not available except on one farm (the ear tag showed the name). No Dam information was available nor requested during classification. Colour is not considered an important criterion, but animals showed varied colour patterns, from obvious Holstein and Jersey backgrounds, to animals of various degrees of black. Cows were scored while they were grazing in their respective paddocks, eating from provided feed or lying and chewing their cud, and were easily made to stand up for scoring. Scoring was conducted before milking.

Scores in no way resemble classic dairy type classifications and no discrimination was made for management related issues such as blind quarters. The animals were all of similar age and stage of lactation, so there was no need to adjust scores for age and stage of lactation effects. Below are the criteria on which all the animals were assessed:

**Feet and Legs:**

Feet and leg scores were based on ease of locomotion, taking into account the fact that these heifers were on a pasture based production system which required them to walk long distances. The specific aspects that were scored for were: set to leg (posty or sickle hocked), depth of heel and shape (hoof angle).

**Body:**

Functional aspects such as muzzle width, width through the chest, chest depth, body depth, spring of ribs, rump angle and width of pins were evaluated. The overall balance as a functional animal was a factor in the scoring process.

**Udder:**

Udders were assessed for fore udder attachment, udder depth, fore teat width (placement), teat shape and length, cover, levelness of udder floor, rear udder capacity, rear ligament and height and width of attachment.

## 3.3 Methods: Data Preparation and Analysis

### 3.3.1 Data preparation

All production data from the BIS trial was extracted from the INTERGIS and comprised of individual animal performance data for the traits contained in Table 3.2, except services per conception.

Distribution of data for each trait was analysed by the PROC UNIVARIATE procedure of the Statistical Analysis System (SAS, 2011) to ascertain if it was normally distributed as well as to identify possible outliers. No outliers were identified resulting in a total of records of 991 animals being available for analysis. Table 3.2 is a summary of the total records available for this study.

**Table 3.2** Traits included in the analysis to compare the performance of KiwiCross™, Jersey and Holstein sired cows.

| Trait | N of Farms | N of Animals | N Of Test-Day Observations |
|---|---|---|---|
| 305 Day Milk Yield (kg) | 6 | 991 | 4464 |
| 305 Day Protein Yield (kg) | 6 | 991 | 4461 |
| 305 Day Fat Yield (kg) | 6 | 991 | 4461 |
| 305 Day Fat & Protein Yield (kg) | 6 | 991 | 4461 |
| 305 Day Lactose Yield (kg) | 6 | 991 | 4461 |
| Somatic Cell Score (24 Hour) | 6 | 991 | 4460 |
| Age at First Calving (Months) | 6 | 991 | 4464 |
| Services per conception (2015)* | 2 | 279 | |
| Services per conception (2016) | 6 | 831 | |

*Data for analysis only available from two farms

### 3.3.3 Statistical Analysis

An Analysis of Variance (ANOVA) was conducted to test for the effects of herd, age at calving and breed on the traits studied, using the GLM procedure of the Statistical Analysis System (SAS 9.3, 2011). The following statistical model (model 1) was used for the analysis:

$$y_{ijk} = \mu + Herd_i + Breed_j + b_1Age + e_{ijk} \qquad (1)$$

Where

| | |
|---|---|
| $y_{ijk}$ | = an observation or performance record on an animal |
| $\mu$ | = an underlying constant (mean) |
| $Herd_i$ | = the fixed effect of the $i^{th}$ herd |
| $Breed_j$ | = the fixed effect of the $j^{th}$ breed |
| $b_1$ | = a linear regression coefficient on age at calving |
| Age | = the age at calving |
| $e_{ijk}$ | = the random residual error |

Residual errors were assumed to be independent and identically normally distributed with a mean of 0 and a variance of $\sigma^2_e$. Therefore, $e^{iid}{\sim}N(0, \sigma^2_e)$

### 3.3.4 Lactation curves

Lactation curves for milk, fat and protein yield were constructed for each breed by plotting least squares means for stage of lactation, obtained from a PROC GLM analysis of test day production using model 1 and including stage of lactation as a fixed effect. The 305-day lactation was divided into 30 stages of 10 day intervals and a final stage of 5 days.

### 3.3.5 Linear Classification

An Analysis of Variance (ANOVA) was performed on the linear assessment data to assess the effects of herd, breed and age at calving on each of the type traits. The analysis was carried out by the PROC GLM procedure of the Statistical Analysis System (SAS 9.3, 2011) and fitting the following linear mixed model (model 2).

$$y_{ijk} = \mu + Herd_i + Breed_j + b_1Age + e_{ijk} \quad (2)$$

Where

| | |
|---|---|
| $y_{ijktl}$ | = a linear score of trait t on the $l^{th}$ animal |
| $\mu$ | = an underlying constant (mean) |
| $Herd_i$ | = the fixed effect of the $i^{th}$ herd |
| $Breed_j$ | = the fixed effect of the $j^{th}$ breed |
| $b_1$ | = a linear regression coefficient on age at calving |
| Age | = the age at calving |
| $e_{ijk}$ | = the random residual error |

Residual errors were assumed to be independent and identically normally distributed with a mean of 0 and a variance of $\sigma^2_e$. Therefore, $e \overset{iid}{\sim} N(0, \sigma^2_e)$

# Chapter 4: Results

## 4.1 Reproduction traits

Least Square Means for reproduction traits (age at first calving and services per conception), for the four sire groups studied, are compared in Table 4.1. There was no significant difference (P>0.05) in age at first calving between the Holstein, Jersey and non-descript; however, the KiwiCross™ had a significantly higher (P<0.05) age at first calving than these other sire groups. For services at conception, a significant difference (P<0.05) was only observed between the non-descript sires and the three main sire groups in the study i.e. KiwiCross™, Holstein and Jersey in 2015. No significant difference (P>0.05) was seen in 2016.

**Table 4.1** Comparison of Least Square Means ± Standard Errors for reproduction traits for Holstein, Jersey, KiwiCross™ and non-descript sired heifers.

| Breed | Age at First Calving (months) | Services per Conception (2015) | Services per Conception (2016) |
|---|---|---|---|
| KiwiCross™ | 24,07 ± 0,06[a] | -0,002 ± 0,003[a] | 0,162 ± 0,010 |
| Jersey | 24,00 ± 0,16[ab] | 0,002 ± 0,008[a] | 0,187 ± 0,025 |
| Holstein | 23,74 ± 0,11[b] | 0,004 ± 0,005[a] | 0,170 ± 0,016 |
| Non-descript | 23,77 ± 0,09[b] | 0,028 ± 0,005[b] | 0,176 ± 0,013 |

Means with different superscripts differ significantly (P < 0,05)

## 4.2 Production traits

Table 4.2 and 4.3 presents a comparison of Least Square Means for production traits among the four breed groups studied. Mean lactation milk yield was not significantly different (P>0.05) between KiwiCross™, Holstein and non-descript breed groups. These three breed groups, however, produced significantly higher (P<0.05) milk yield than the Jersey. On the other hand, protein yield was significantly different (P<0.05) only between KiwiCross™ and non-descript breed groups, with the KiwiCross™ having the highest mean. The Jerseys had significantly higher (P<0.05) yields of fat and lactose compared to the Holstein, KiwiCross™ and non-descript breed groups. There were, however, no significant differences (P>0.05) among the breed group means for solids (protein + fat) and somatic cell score.

**Table 4.2** Comparison of Least Square Means ± Standard Errors for milk, protein, fat and combined protein and fat for Holstein, Jersey, KiwiCross™ and non-descript sired heifers.

| Breed | Milk Yield (kg)* | Protein (kg)* | Butterfat (kg)* | PR & BF (kg)* |
|---|---|---|---|---|
| KiwiCross™ | 4583,69 ± 14,60[a] | 167,38 ± 0,49[a] | 210,72 ± 0,56[a] | 378,10 ± 1,01 |
| Jersey | 4446,68 ± 36,48[b] | 165,68 ± 1,21[ab] | 213,97 ± 1,40[b] | 379,65 ± 2,52 |
| Holstein | 4631,80 ± 25,53[a] | 166,00 ± 0,85[ab] | 209,81 ± 0,98[a] | 375,80 ± 1,76 |
| Non-descript | 4604,59 ± 19,35[a] | 165,79 ± 0,64[b] | 210,02 ± 0,74[a] | 375,81 ± 1,33 |

*305 Day

Means with different superscripts differ significantly (P < 0,05)

**Table 4.3** Comparison of Least Square Means ± Standard Errors for lactose yield, and SCS for Holstein, Jersey, KiwiCross™ and non-descript sired heifers.

| Breed | Lactose (kg)* | Somatic Cell Score** |
|---|---|---|
| KiwiCross™ | 222,77 ± 0,74[a] | 2,11 ± 0,01 |
| Jersey | 217,23 ± 1,86[b] | 2,13 ± 0,02 |
| Holstein | 223,52 ± 1,30[a] | 2,14 ± 0,02 |
| Non-descript | 222,62 ± 0,98[a] | 2,10 ± 0,01 |

*305 Day **24 Hour

Means with different superscripts differ significantly (P < 0,05)

Figure 4.1 depicts the lactation curves for milk yield for Holstein, Jersey, KiwiCross™ and Non-descript heifers. All curves followed the typical shape for heifers, with a shallow peak in the first six to eight weeks and a gradual decline through to the end. There was a pronounced dip for all breeds except KiwiCross™at 70-80 days in lactation. The curve for Jersey heifers was consistently the lowest, and that for the KiwiCross™ was mainly intermediate between the Holstein and non-descript.

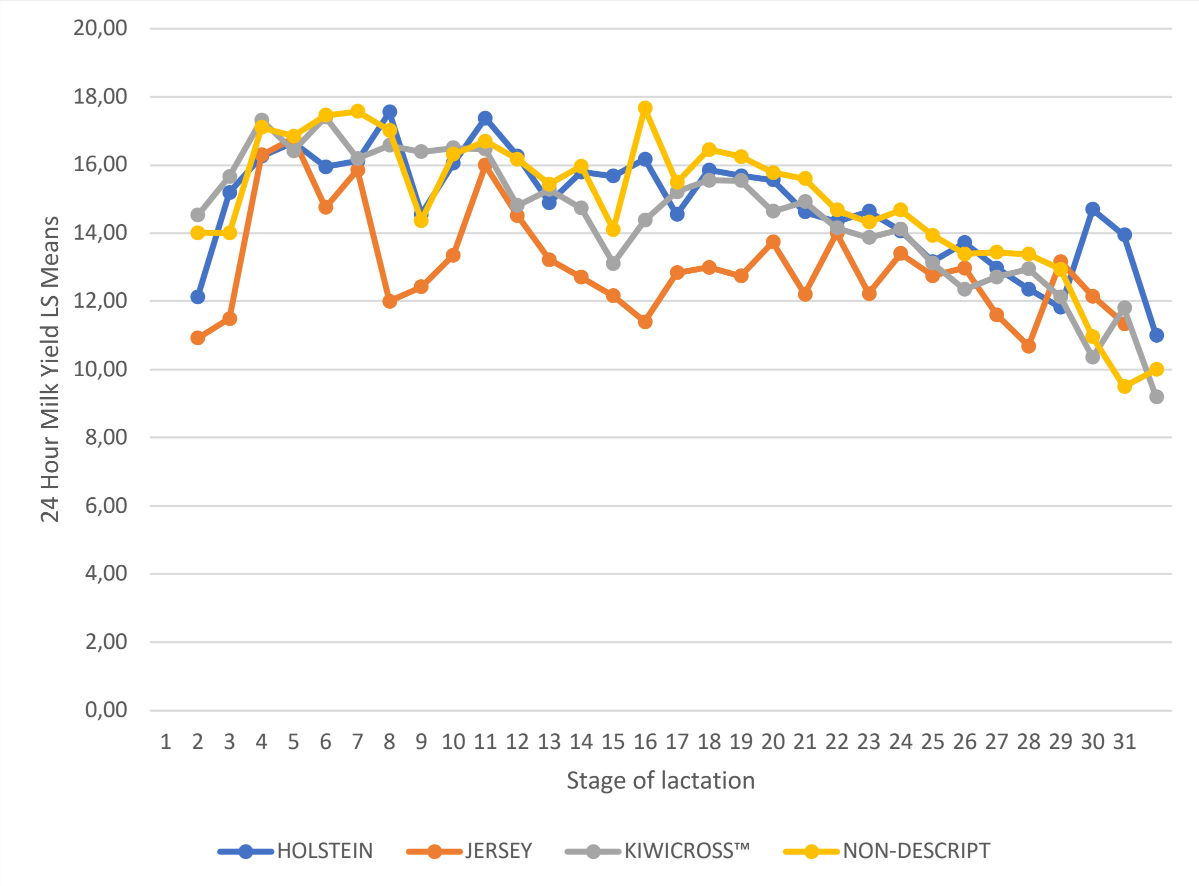


**Figure 4.1** Milk Yield Lactation Curves of Holstein, Jersey, KiwiCross™ and Non-descript sired heifers. Data points from Least Square Means calculations using GLM Procedure on the SAS System.

The lactation curves for protein yield for Holstein, Jersey, KiwiCross™ and Non-descript heifers are shown in Figure 4.2. The curves appeared flatter compared to those for milk yield; however, the trend was similar. The relative levels for the curves were also similar to those for milk yield.

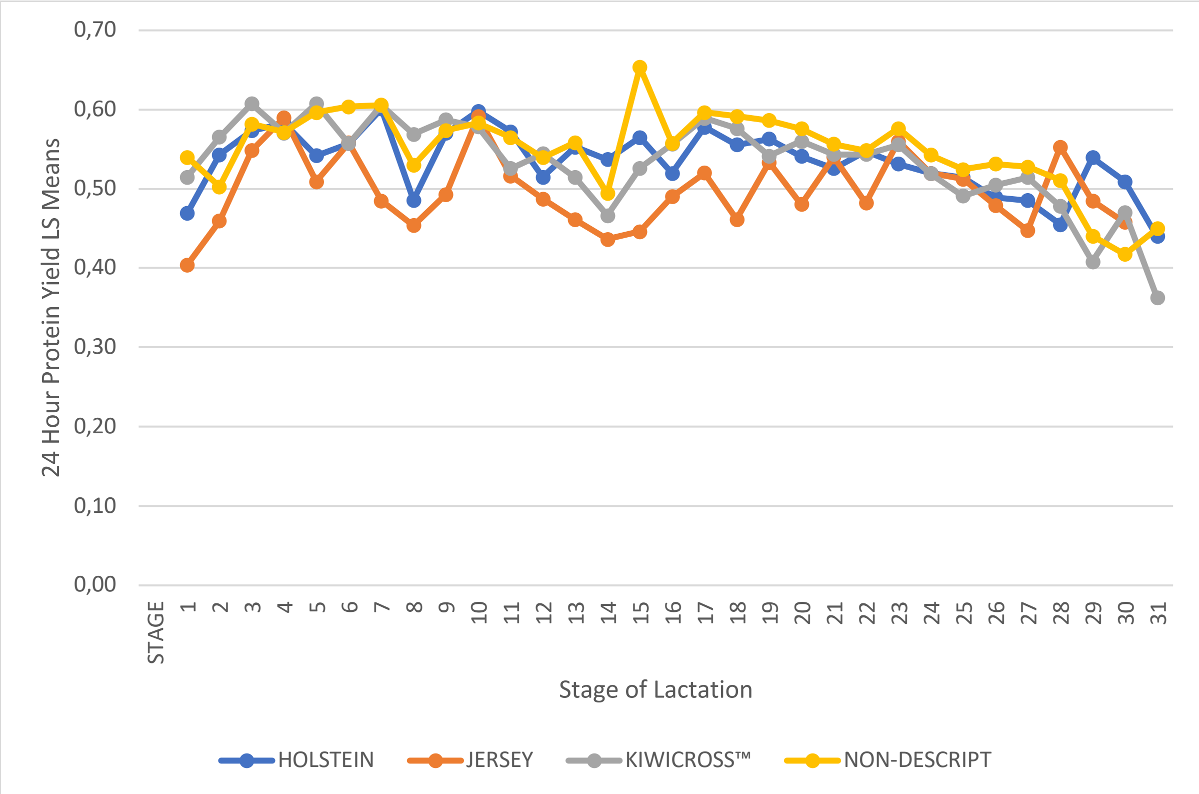


**Figure 4.2** Protein Yield Lactation Curves of Holstein, Jersey, KiwiCross™ and Non-descript sired heifers. Data points from Least Square Means calculations using GLM Procedure on the SAS System.

Figure 4.3 shows the lactation curves for fat yield for each of the four breeds studied. The curves followed similar trends as those for milk yield and protein. The dip at 70-80 days was highly pronounced for the Jersey.

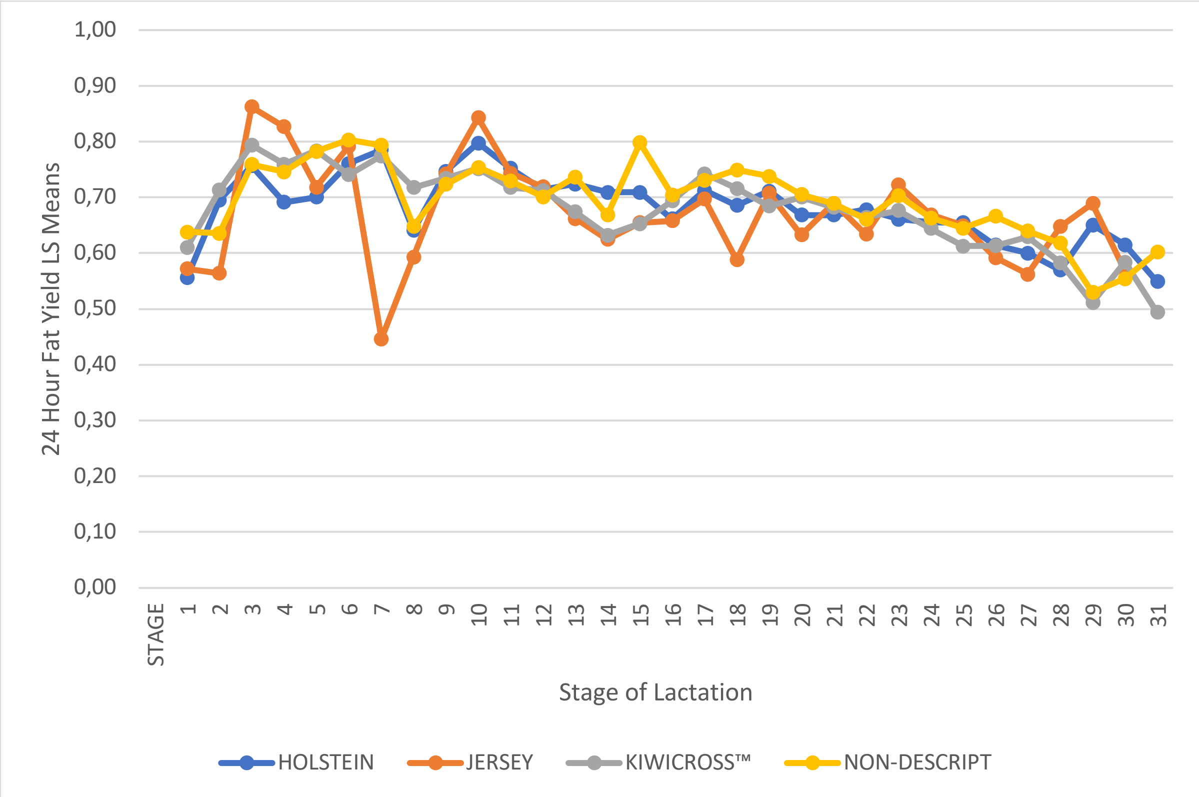


**Figure 4.3** Fat Yield Lactation Curves of Holstein, Jersey, KiwiCross™ and Non-descript sired heifers. Data points from Least Square Means calculations using GLM Procedure on the SAS System.

### 4.3 Linear type assessment

Table 4.4 shows the average linear type scores for each breed. Averages scores for body traits were identical for all the breeds and within 0,1 of each other for udder and feet and leg traits. There were no significant differences (P>0.05) among the breed group means for linear classification scores.

**Table 4.4** Mean linear classification scores for Holstein, Jersey, KiwiCross™ and non-descript sires.

| Herd # | Name | Sire | F&L | Body | Udder | Animals classified | Herds |
|---|---|---|---|---|---|---|---|
| All | All | KiwiCross™ | 6,6 | 7,2 | 6,8 | 409 | 6 |
| All | All | Holstein | 6,6 | 7,2 | 7,0 | 130 | 6 |
| All | All | Jersey | 6,6 | 7,2 | 7,0 | 64 | 4 |
| All | All | Non-descript | 6,7 | 7,2 | 6,9 | 240 | 6 |

Means with different superscripts significantly different (P < 0,05)

# Chapter 5: Discussion

## 5.1 Introduction

This study was motivated by the need to assess the impact of importation of KiwiCross™ germplasm from New Zealand into South Africa, on the South African dairy cattle gene pool, in accordance with the South African Livestock Improvement Act 1998 (Act no 62 of 1998). Such importations had been initiated in 2013 by a local semen importer, Genimex, following requests from South African pasture based dairy farmers (www.genimex.co.za, www.kiwicross.co.za).

The aim of the study was to compare the performance of the KiwiCross™ sired commercial cows against those sired by the dominant dairy cattle breeds in South Africa, namely Holstein and Jersey. The first step was to test for environmental effects influencing the production, udder health and reproduction traits studied, using an analysis of variance. Means for the linear scores from the visual appraisal were summarised in a table for simple comparative analysis.

Lactation milk yield for the Jersey (4446kg) was the lowest, and significantly so, compared to the other breeds. This was 4% and 3% lower than for the Holstein and KiwiCross™, respectively. These results concur with those from other studies by Heins et al., (2008) and Maltecca et al., (2006) who reported that the Jersey produced the least amount of milk, the Holsteins produced the highest, and crossbreds were in between the two pure breeds.

Mean lactation protein yield was highest for the KiwiCross™ (167,38kg), however, there were no significant differences among all the breeds. On the other hand, fat yield was significantly higher for the Jersey, compared to the other breeds. Mean fat yield was 2% and 1.5% higher for the Jersey, relative to the Holstein and KiwiCross™, respectively. These results differ from those from a North American study which analysed data from TMR herds and found both protein and fat production to be significantly higher in Holsteins (Heins et al., 2008). A study by Shonka-Martin et al., (2019) showed similar results to this study when crossbreds were compared to pure Holsteins, where there was no significant differences in fat and protein production.

However, that study also stated that although the pure Holsteins produced more volume, due to the crossbreds smaller size but better body condition score, they may prove to be more economical when feed conversion is considered.

Lactation curves for milk, fat and protein yield followed the same typical trend (Lopez et al, 2019) for all three breeds. The components, however, peaked at slightly different stages of lactation. The variation in peak yields between breeds was also seen in a European study of Holsteins versus a three breed rotational cross of Montbeliarde, VikingRed and Holstein (Shonka-Martin et al., 2019), i.e. total solid production was similar but peaked at different times of lactation.

Age at first calving and services per conception are important reproductive traits in seasonal-calving herds, due to the need to maximise fodder flow from planted pastures. Ideally, the calving block should not exceed twelve weeks (Harris & Montgomerie, 2001; Bowley et al., 2015). KiwiCross™ heifers calved significantly older than those of the other breeds. On enquiry, it was established that the trial farms used the following mating strategy regarding semen usage and breed of sire. KiwiCross™ semen was used first due to higher cost per dose. Mating of heifers started two weeks before the rest of the herd to give them a better chance to conceive, and therefore calve before the rest of the herd therefore giving them a slight advantage of extra feed and cycling potential before becoming part of the milking herd. Research by DairyNZ (https://www.dairynz.co.nz/animal/heifers/heifer-mating/) supports this notion and has become common practice on commercial herds. Heifers were also mated to Jersey semen to ensure small calves and therefore reduce the risk of dystocia. Holstein semen was only put into the insemination lists once mating of the main herd began. Services per conception showed minimal variation for both the heifers first mating in 2015 and their following mating in 2016.

The linear classification scores provide an indication of the functional efficiency of an individual cow. Scores for feet and legs generally showed sound locomotion capacity for all the breeds. Higher feet and leg scores, and lower incidence of lameness were found in pasture herds when compared to TMR systems in studies by Haskell et al., (2006) and Hernandez-Mendo et al., (2007) which found an increase in gait performance of 0,22/5 per week when cattle were moved to pasture from a zero-grazing TMR system. Visual based scoring for the linear traits was based out of 10 for body, udder and feet and legs, with averages not differing by more than 0,1 points for body and feet and legs. Udder score showed a difference of 0,2 with KiwiCross™ scoring 6,8 (409 scored), Holstein 7,0 (130 scored) and Jersey 7,0 (64 scored). Similar research in New Zealand found significant difference ($p < 0,05$) in udder overall between Jerseys and the pure Holstein-Friesian and Holstein x Jersey crossbreds. Scoring was based on New Zealand's Traits Other than Production (TOP) system (Rocha et al., 2017).

No animals with jaw defects were observed. Occasional animals lacking depth, spring of rib, narrow pins or functional shortcomings were marked down on score. The KiwiCross™ animals were of a medium size, slightly larger in general than the Jersey crosses in the population, but smaller in stature compared to the predominantly Holstein animals in the group, which was similar to the findings by Holmes et al., (2007). The latest dairy statistics (2020) from Dairy New Zealand followed the same trend with average weights of 497kg for Holstein-Friesian (20 472 records), 409kg for Jersey (8 200kg records) and 458kg for the cross bred animals (40 495 records).

Average scores for udders showed that udders were generally well attached for all the breeds, with most animals showing good rear udder capacity. Similar research in New Zealand found a significant difference ($p < 0,05$) in udder overall between Jerseys and the pure Holstein-Friesian and Holstein x Jersey crossbreds. Teat length tended to vary from long to short, which was observed in the Jersey and Holstein crosses (based on colour identification).

Very few genetic defects were observed. A few cases of skew tails and Curly toe syndrome were observed and although it could be genetic (Selk, G., 2016), this could also be due to moist pasture conditions. There is a lack of literature on this point as was mentioned by Shearer et al., (2015).

### 5.2 Relevance of the study

The change in the composition of the US and several other national dairy populations indicates that there is a growing move towards cross breeding (Guinan et al., 2019). New Zealand, the home of KiwiCross™, has a dairy population of almost five million cows and the national herd is now made up of 42,6% crossbred cows (www.dairynz.co.nz/dairystatistics). The variation between these three breeds in regards to production, fertility and linear scores has shown limited differences.

A current, ongoing, study into the comparisons of a three-way cross between Montbelierde, Holstein and VikingReds has reported the benefits of crossbreeding over the use of purebreds (Hazel et al., 2017). While production volumes are similar, the percentage in solids is showing better performance in the crosses (VanRaden et al., 2003). Shonka-Martin et al., (2019) has shown that the interest in crossbreeding has grown due to the benefit seen in crosses such as, health and fertility traits. Calving difficulty was also much lower in crosses and Jerseys. Calf mortality was lowest in Jersey X Holstein (Weigel & Barlass, 2003). Kargo & Fogh (2016) have reported that Scandinavian results coming out of Denmark have shown that crosses have led to similar productions while giving better fertility and better health. Similar results have been published in New Zealand, (Buckley et al., 2014).

# Chapter 6: Conclusion

This study originated from a request by South African dairy producers wanting access to the KiwiCross™ germplasm for use on commercial pasture based dairy operations. The overall aim was to compare the KiwiCross™ offspring's performance against the offspring from the two main registered breeds in South Africa, Holsteins and Jerseys. The study was done under farming conditions and therefore limits were experienced in regards to records and timeline. The results of the study confirmed that under commercial productions conditions, the performance of the KiwiCross™ offspring were comparable to that of the Holstein and Jersey offspring. While crossbreeding is still new within the dairy industry, further study and long term trials will bring to light further long term benefits to the modern dairy producer.

Literature illustrates the benefits of crossbreeding more poignantly in long term trials and on traits of a low heritability, or difficulty in scoring. Maltecca et al., (2006) concluded that several considerations must be taken before embarking on a crossbreeding strategy. Heins et al., (2008) also iterated the point that top quality genetics is vital to any breeding strategy. This trial data came from first lactation heifers and therefore not enough time was given to show long term effects (Clasen et al., 2021).

South African dairy operations, like many other farming operations, are not unique in that they are being challenged, and in order to survive they will need to adapt (Zavadilová et al., 2021). This adaptation can take form in many places, i.e. nutritional, medical, production systems and breeding to name a few. Dairy operations take two forms. Option one, the system is adapted to the animal, option two, the animal is adapted to the system (Washburn & Mullen, 2014). In ideal circumstances, adapting a system to suit the animal is possible, a farmer could buy in feed or build housing which can be effective although costly. Lacto Data (2018) shows that between January 2009 and January 2018, South African dairy producers dropped from 3 551 to 1 364 producers which is a reduction of 62%. Production, however has increased by 26% over the same period. This shift in the industry can only be due to change in circumstance and change in reality. The animal, and by default, the breeder, needs to breed an animal that is more suitable for sustainable dairy production. New Zealand's KiwiCross™, ProCross and Beef on Dairy, along with other crossbreeding type systems, are realities in the industry which are being actively marketed and adopted around the world. The increasing nature of pasture-based farming in South Africa (Lacto Data 2021) coupled with unregulated milk buying pricing structures demands for a highly resilient animal, not just in various traits, but in suitability to make a profit.

Currently, some dairy farmers in South Africa are crossbreeding Holstein-Friesian and Jersey. Introduction of the KiwiCross™ into South Africa gives breeders access to genetics that comes from a well-established system geared for pasture based farming (Buckley et al., 2014). Access to all three breeds allows the breeder to breed the right animals to match the production system. The availability of crossbred sires presents an opportunity for farmers to practice systematic crossbreeding. It offers the farmer a customisation of the dairy cow that complements the desirable characteristics of the Holstein-Friesian and Jersey (Holmes et al., 2007).

**Limitations of current study**

A limiting factor of this trial is that only first lactation heifers were analysed. In order to fully study the long term impact of KiwiCross™ within these herds would be to continue the study for several generations. A longer time frame would enable better analysis of health, fertility and longevity traits and therefore truly express the potential benefits of crossbreeding and the use of crossbred sires. Extending the study over several generations would also enable the study to generate pedigree data and possibly look at variations within crossbreds i.e. knowing breed 16$^{th}$'s would indicate benefits of more Holstein or more Jersey type offspring in varying production systems. Environmental factors could also be expanded by increasing study farms to include those in other parts of South Africa where other, possibly more intensive, farming systems are used. This trial was limited to KwaZulu-Natal and should be expanded to other pasture based areas in South Africa.

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## Addendum A – Three generation pedigrees of KiwiCross™ sires

P001.50 Official Publication of Livestock Improvement Corporation Limited Internal Animal Key = 25050969

# Three Generation Pedigree

LIC MINDA

Livestock Improvement Corporation
New Zealand

Herd Averages as at
Ancestry : BW : PW :

PTPT / HERDCODE :
LOCATION :
DATE : 26/04/2013

## MATAKURI ATLANTIS

G3,G1 S✓ D✓

| | |
|---|---|
| Birth Ident: | KFYY-08-101 (509004) |
| Sex : | MALE |
| Breed : | JF J8F7 |
| Date of Birth : | 1/08/2008 |
| Genomic Indicator: | |
| BW ($): | 222/81 |
| Protein BV (kg): | 21/85 |
| Fat BV (kg): | 24/85 |
| Milk BV (ltr): | 256/87 |
| Liveweight BV (kg): | -25/90 |
| Fertility BV (%): | -3.3/67 |
| Total Longevity BV (days): | 145/68 |
| Somatic Cell BV: | -0.24/78 |
| Overall Opinion BV: | 0.21/86 |
| Udder Overall BV: | 0.18/84 |
| Dairy Conformation BV: | -0.08/88 |
| Fat %: | 5 |
| Protein %: | 4 |

## SCOTTS NORTHSEA

Birth Ident: HGMC-00-27 (501038)

Breed : FJ F9J6 G3,G1 S✓ D✓

| | |
|---|---|
| Genomic Indicator: | |
| BW ($): | 200/99 |
| Protein BV (kg): | 13/99 |
| Fat BV (kg): | 22/99 |
| Milk BV (ltr): | 0/99 |
| Liveweight BV (kg): | -25/99 |
| Fertility BV (%): | 0.3/99 |
| Total Longevity BV (days): | 218/99 |
| Somatic Cell BV: | -0.09/99 |
| Fat %: | 5.3 |
| Protein %: | 4 |

## ALCAMENO MHTTN DEMI

Birth Ident: KFYY-06-11

Breed: JF J10F6 G3 S✓

| | | | |
|---|---|---|---|
| Genomic Indicator: | | PW ($): | 465/87 |
| BW ($): | 218/61 | Lwt BV (kg): | -21/57 |
| Protein BV (kg): | 24/64 | Fertility BV (%): | -3.8/51 |
| Fat BV (kg): | 29/65 | TotL BV (days): | 106/52 |
| Milk BV (ltr): | 344/67 | SCC BV: | 0.28/60 |

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 6 yr 1 m | 3839 | 4.33 | 166 | 5.59 | 215 | 183 | 595 |
| 5 yr 0 m | 3619 | 4.29 | 155 | 5.31 | 192 | 191 | 381 |
| 4 yr 0 m | 4841 | 4.35 | 211 | 5.26 | 255 | 243 | 460 |
| 3 yr 1 m | 4550 | 3.97 | 181 | 5.00 | 228 | 229 | 499 |
| 2 yr 0 m | 4786 | 3.94 | 189 | 5.04 | 241 | 283 T | 506 |
| Avg | 4327 | 4.17 | 180 | 5.22 | 226 | 226 | 5 Lacts. |

Traits other than production results : (2008)

| AM | ST | MS | OO | S | W | C | RA | RW | L | US | FU | RU | FT | RT | UO | DC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 8 | 9 | 9 | 6 | 5 | 7 | 6 | 8 | 7 | 6 | 6 | 6 | 5 | 5 | 6 | 7 |

## SRB COLLINS ROYAL HUGO

Birth Ident: BHDF-95-25 (96329)

Breed: SF F16 G3,G1

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | 125/99 | Lwt BV (kg): | 40/99 |
| Protein BV (kg): | 22/99 | Fertility BV (%): | 0.8/99 |
| Fat BV (kg): | 25/99 | TotL BV (days): | 165/99 |
| Milk BV (ltr): | 523/99 | SCC BV: | 0.13/99 |

**DAM:**

Birth Ident: FMGX-95-5

Breed: JA J12A2 G1 S✓

Genomic Indicator (g):

BW ($): 165/62 PW ($): 270/83

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 8 yr 11 m | 2818 | 4.21 | 119 | 5.14 | 145 | 200 T | 131 |
| 7 yr 11 m | 3901 | 4.77 | 186 | 6.19 | 241 | 250 | 161 |
| 6 yr 11 m | 2992 | 4.72 | 141 | 6.42 | 192 | 216 | 120 |
| 5 yr 11 m | 1086 | 4.65 | 50 | 5.48 | 59 | 65 | 242 |
| 5 yr 0 m | 4418 | 4.73 | 209 | 6.03 | 266 | 261 | 331 |
| Plus 4 unprinted lactations | | | | | | | |
| Avg | 3167 | 4.56 | 145 | 5.96 | 189 | 234 | 7 Lacts. |

## OKURA MANHATTEN ET SJ3

Birth Ident: CFWR-99-47 (300534)

Breed: SJ J16 G3,G1

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | 174/99 | Lwt BV (kg): | -39/99 |
| Protein BV (kg): | 12/99 | Fertility BV (%): | -0.5/99 |
| Fat BV (kg): | 15/99 | TotL BV (days): | 55/99 |
| Milk BV (ltr): | -54/99 | SCC BV: | 0.08/99 |

## ALCAMENO PIERE DUMPA S0F

Birth Ident: KFYY-04-14

Breed: SF F12J4 S✓

Genomic Indicator:

BW ($): 201/57 PW ($): 425/82

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 8 yr 1 m | 4580 | 4.03 | 184 | 4.30 | 197 | 200 | 517 |
| 6 yr 11 m | 5029 | 4.25 | 214 | 4.86 | 244 | 230 | 535 |
| 6 yr 1 m | 5139 | 4.27 | 219 | 4.36 | 224 | 229 | 468 |
| 5 yr 1 m | 5730 | 3.92 | 225 | 4.43 | 254 | 228 | 505 |
| 4 yr 0 m | 6816 | 3.87 | 264 | 3.80 | 259 | 274 | 488 |
| Plus 2 unprinted lactations | | | | | | | |
| Avg | 4784 | 4.01 | 192 | 4.29 | 205 | 210 | 7 Lacts. |

### BARTONS BICKFORD

Birth Ident: VGR-89-67 (90266)
Breed: F F15J1
Genomic Indicator: BW ($): 17/99

### COLLINS STORM HEATHER

Birth Ident: BHDF-92-12
Breed : F F16
Genomic Indicator:
BW ($): 74/56 PW ($): 122/74

| 3 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 4089 | 3.80 | 156 | 4.43 | 181 | 210 |

### JUDDS ADMIRAL

Birth Ident: FTH-88-39 (89429)
Breed : PJ J16
Genomic Indicator: BW ($): 109/99

**DAM:**
Birth Ident: FMGX-92-17
Breed : JA J8A4
Genomic Indicator:
BW ($) : 127/53 PW ($): 191/84

| 10 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3614 | 4.14 | 150 | 6.35 | 229 | 249 |

### FYN LEMVIG

Oseas HB No: 000000300003/DNK (664109)
Breed: PJ J16
Genomic Indicator: BW ($): 65/98

### KAIPARA MOONSHINE SJ2

Birth Ident: FXQG-94-26
Breed: SJ J16 VHC S✓
Genomic Indicator:
BW ($): 198/81 PW ($): 209/88

| 6 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3675 | 4.24 | 156 | 5.64 | 207 | 257 |

### TOP DECK KO PIERRE

Birth Ident: JKJD-98-5 (672213)
Breed: PF F16
Genomic Indicator: BW ($): 119/99

### LIC-FJORD

Birth Ident: GHJG-99-3
Breed: JF J9F7
Genomic Indicator:
BW ($): 152/54 PW ($): 199/66

| 5 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3995 | 4.27 | 171 | 5.67 | 227 | 222 |



N = Induced T = At least 1 Abnormal Test in this Lactation
D = Lactation values include at least 1 derived test

= GeneMark DNA Profiled # = Parentage Uncertain D / S ✓ = Parentage Confirmed by DNA
g Indices evaluated by LIC using genomic information

P001.50

P001.50 Official Publication of Livestock Improvement Corporation Limited

Internal Animal Key = 23019770

# Three Generation Pedigree

LIC

MINDA

Livestock Improvement Corporation
New Zealand

Herd Averages as at
Ancestry : BW : PW :

PTPT / HERDCODE :
LOCATION :
DATE : 26/04/2013

G3,G1 S✓ D✓

## LYNSKEYS LANCASTER

**Birth Ident:** BNTT-06-60 (507036)

| | |
|---|---|
| Sex : | MALE |
| Breed : | JF J9F7 |
| Date of Birth : | 11/08/2006 |
| Genomic Indicator: | |
| BW ($): | 218/86 |
| Protein BV (kg): | 17/88 |
| Fat BV (kg): | 24/89 |
| Milk BV (ltr): | 70/90 |
| Liveweight BV (kg): | -6/90 |
| Fertility BV (%): | 2.3/77 |
| Total Longevity BV (days): | 320/76 |
| Somatic Cell BV: | -0.13/87 |
| Overall Opinion BV: | -0.04/86 |
| Udder Overall BV: | 0.22/83 |
| Dairy Conformation BV: | 0.20/87 |
| Fat %: | 5.2 |
| Protein %: | 4 |

## MITCHELLS LIKABULL SJ3

**Birth Ident:** DTWX-98-26 (99416)

Breed : SJ J16 G3,G1 S✓ D✓

| | |
|---|---|
| Genomic Indicator: | |
| BW ($): | 158/99 |
| Protein BV (kg): | 0/99 |
| Fat BV (kg): | 3/99 |
| Milk BV (ltr): | -522/99 |
| Liveweight BV (kg): | -52/99 |
| Fertility BV (%): | 1.5/99 |
| Total Longevity BV (days): | 173/99 |
| Somatic Cell BV: | -0.05/99 |
| Fat %: | 5.5 |
| Protein %: | 4.2 |

## DAM:

**Birth Ident:** BNTT-02-26

Breed: F F14J2 G1 S✓

| | | | |
|---|---|---|---|
| Genomic Indicator: | | PW ($): | 406/83 |
| BW ($): | 219/58 | Lwt BV (kg): | 24/47 |
| Protein BV (kg): | 27/61 | Fertility BV (%): | 3.9/49 |
| Fat BV (kg): | 24/62 | TotL BV (days): | 402/51 |
| Milk BV (ltr): | 796/64 | SCC BV: | -0.32/58 |

| Age | | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|---|
| 6 yr 11 m | D | 6349 | 4.06 | 258 | 4.56 | 289 | 215 | 592 |
| 6 yr 1 m | D | 4692 | 3.82 | 179 | 4.59 | 215 | 171 | 391 |
| 5 yr 0 m | D | 5747 | 4.11 | 236 | 5.04 | 290 | 271 | 417 |
| 4 yr 0 m | | 5135 | 3.95 | 203 | 4.52 | 232 | 220 | 392 |
| 3 yr 0 m | | 4660 | 4.12 | 192 | 4.79 | 223 | 238 | 324 |
| 2 yr 0 m | | 4080 | 3.81 | 156 | 4.65 | 190 | 220 | 392 |
| Avg | D | 5110 | 3.99 | 204 | 4.69 | 240 | 223 | 6 Lacts. |

## SILVER FALLS QUICK FAME

**Birth Ident:** FHK-91-12 (92472)

Breed: PJ J16 G3

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | 120/99 | Lwt BV (kg): | -61/99 |
| Protein BV (kg): | -13/99 | Fertility BV (%): | 6.2/99 |
| Fat BV (kg): | -2/99 | TotL BV (days): | 253/99 |
| Milk BV (ltr): | -705/99 | SCC BV: | -0.74/99 |

## MITCHELLS ADS COLLEEN SJ2

**Birth Ident:** DTWX-94-64

Breed: SJ J16 G1 HC S✓

Genomic Indicator (g):

BW ($): 180/67 PW ($): 362/87

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 14 yr 11 m | 972 | 3.75 | 36 | 6.04 | 59 | 67 T | 348 |
| 12 yr 11 m | 2958 | 4.44 | 131 | 4.92 | 145 | 183 | 310 |
| 11 yr 11 m | 3468 | 4.22 | 146 | 5.48 | 190 | 209 | 281 |
| 9 yr 11 m | 3945 | 3.84 | 151 | 5.03 | 198 | 255 T | 161 |
| 8 yr 11 m | 3351 | 3.88 | 130 | 5.11 | 171 | 169 | 246 |
| Plus 6 unprinted lactations | | | | | | | |
| Avg | 3703 | 4.12 | 152 | 5.24 | 194 | 228 | 10 Lacts. |

## ATHOL ENIGMA

**Birth Ident:** DYBP-95-138 (96242)

Breed: PF F16 G3,G1

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | 80/99 | Lwt BV (kg): | 24/99 |
| Protein BV (kg): | 15/99 | Fertility BV (%): | 1.5/99 |
| Fat BV (kg): | 2/99 | TotL BV (days): | 232/99 |
| Milk BV (ltr): | 472/99 | SCC BV: | 0.21/99 |

## DAM:

**Birth Ident:** BNTT-94-22

Breed: FJ F12J4

Genomic Indicator:

BW ($): 179/56 PW ($): 251/87

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 9 yr 11 m | 5673 | 4.00 | 227 | 4.37 | 248 | 243 | 373 |
| 9 yr 0 m | 5681 | 3.86 | 219 | 4.80 | 273 | 214 | 372 |
| 8 yr 0 m | 5926 | 4.03 | 239 | 5.27 | 312 | 238 | 396 |
| 7 yr 0 m | 5879 | 3.80 | 224 | 4.59 | 270 | 229 | 399 |
| 6 yr 0 m | 4762 | 3.99 | 190 | 5.01 | 239 | 230 | 215 |
| Plus 4 unprinted lactations | | | | | | | |
| Avg | 5221 | 3.91 | 204 | 4.91 | 256 | 233 | 9 Lacts. |

### J S QUICKSILVER ROYAL

**Oseas HB No:** 000000634142/USA (65129)

Breed: PJ J16

Genomic Indicator: BW ($): -59/98

### SILVER FALLS ELTON FAIRY

**Birth Ident:** FHK-88-24

Breed : PJ J16 EX4

Genomic Indicator:

BW ($): 37/65 PW ($): 41/91

| 11 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3759 | 4.29 | 161 | 6.06 | 228 | 267 |

### JUDDS ADMIRAL

**Birth Ident:** FTH-88-39 (89429)

Breed : PJ J16

Genomic Indicator: BW ($): 109/99

### MITCHELLS VANS SUE SJ1

**Birth Ident:** DTWX-88-5

Breed : SJ J16

Genomic Indicator:

BW ($) : 165/61 PW ($): 203/86

| 11 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3460 | 4.34 | 150 | 5.19 | 179 | 238 |

### ATHOL BARON

**Birth Ident:** BLP-90-188 (91208)

Breed: PF F16

Genomic Indicator: BW ($): 38/99

### ATHOL CLASP-OC

**Birth Ident:** DYBP-91-117

Breed: PF F16 81 GP

Genomic Indicator:

BW ($): 73/64 PW ($): 262/91

| 10 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 4777 | 3.52 | 168 | 3.97 | 190 | 208 |

### BALSOMS TAYLOR

**Birth Ident:** BJGL-86-110 (87208)

Breed: F F16

Genomic Indicator: BW ($): 49/99

### DAM:

**Birth Ident:** BNTT-91-35

Breed: FJ F8J8

Genomic Indicator:

BW ($): 135/54 PW ($): 10/87

| 6 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3666 | 3.86 | 141 | 4.68 | 171 | 220 |



N = Induced T = At least 1 Abnormal Test in this Lactation
D = Lactation details include at least one derived test

= GeneMark DNA Profiled # = Parentage Uncertain D / S ✓ = Parentage Confirmed by DNA
g Indices evaluated by LIC using genomic information

P001.50

P001.50 Official Publication of Livestock Improvement Corporation Limited

Internal Animal Key = 22425868

# Three Generation Pedigree

LIC

MINDA

**Livestock Improvement Corporation**
New Zealand

**Herd Averages as at**
**Ancestry : BW : PW :**

**PTPT / HERDCODE :**
**LOCATION :**
**DATE :** 15/04/2013

## CUTFORTHS LORD BRIAN

G3,G1 S✓ D✓

**Birth Ident: HXVV-05-83 (506063)**

| | |
|---|---|
| Sex : | **MALE** |
| Breed : | **JF J7F5** |
| Date of Birth : | **31/07/2005** |
| Genomic Indicator: | |
| BW ($): | **245/85** |
| Protein BV (kg): | **21/88** |
| Fat BV (kg): | **25/88** |
| Milk BV (ltr): | **124/90** |
| Liveweight BV (kg): | **9/90** |
| Fertility BV (%): | **1.8/77** |
| Total Longevity BV (days): | **377/78** |
| Somatic Cell BV: | **-0.43/86** |
| Overall Opinion BV: | **0.01/84** |
| Udder Overall BV: | **0.40/83** |
| Dairy Conformation BV: | **0.32/87** |
| Fat %: | **5.2** |
| Protein %: | **4.1** |

## NUMANS LORD NELSON

**Birth Ident: CQVB-00-80 (501042)**

**Breed : FJ F11J5** G3,G1 S✓ D✓

| | |
|---|---|
| Genomic Indicator: | |
| BW ($): | **152/99** |
| Protein BV (kg): | **9/99** |
| Fat BV (kg): | **22/99** |
| Milk BV (ltr): | **-200/99** |
| Liveweight BV (kg): | **6/99** |
| Fertility BV (%): | **4.2/99** |
| Total Longevity BV (days): | **237/99** |
| Somatic Cell BV: | **0.08/99** |
| Fat %: | **5.5** |
| Protein %: | **4.1** |

## WOODNOOK LAURIE BIRD JC8

**Birth Ident: HXVV-01-78**

**Breed: CJ A8J8** G1 S✓

| | | | |
|---|---|---|---|
| Genomic Indicator: | | PW ($): | **498/85** |
| BW ($): | **154/65** | Lwt BV (kg): | **-23/59** |
| Protein BV (kg): | **9/67** | Fertility BV (%): | **-1.3/58** |
| Fat BV (kg): | **10/67** | TotL BV (days): | **269/59** |
| Milk BV (ltr): | **27/69** | SCC BV: | **-0.33/64** |

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 11 yr 0 m | 2640 | 3.68 | 97 | 5.30 | 140 | 120 T | 376 |
| 9 yr 0 m | 4686 | 4.03 | 189 | 5.87 | 275 | 259 | 376 |
| 7 yr 11 m | 3862 | 4.10 | 158 | 5.77 | 223 | 191 | 496 |
| 7 yr 0 m | 4209 | 4.35 | 183 | 5.67 | 239 | 235 T | 422 |
| 5 yr 11 m | 4295 | 3.96 | 170 | 5.25 | 226 | 228 | 480 |
| 4 yr 11 m | 4836 | 4.08 | 197 | 5.75 | 278 | 228 | 525 |
| 3 yr 11 m | 4588 | 4.11 | 189 | 5.42 | 249 | 234 | 489 |
| 2 yr 11 m | 4265 | 4.08 | 174 | 5.17 | 221 | 233 | 482 |
| 1 yr 11 m | 3331 | 3.93 | 131 | 5.33 | 178 | 254 | 363 |
| Avg | 4079 | 4.05 | 165 | 5.52 | 225 | 220 | 9 Lacts. |

## SRB COLLINS ROYAL HUGO

**Birth Ident: BHDF-95-25 (96329)**

**Breed: SF F16** G3,G1

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | **125/99** | Lwt BV (kg): | **40/99** |
| Protein BV (kg): | **22/99** | Fertility BV (%): | **0.8/99** |
| Fat BV (kg): | **25/99** | TotL BV (days): | **165/99** |
| Milk BV (ltr): | **523/99** | SCC BV: | **0.13/99** |

## AM

**Birth Ident: CQVB-97-3**

**Breed: JF J10F6** G2,G1 S✓

Genomic Indicator (g):
BW ($): **137/61** PW ($): **431/84**

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 12 yr 0 m | 4111 | 4.01 | 165 | 5.16 | 212 | 245 | 506 |
| 11 yr 1 m | 4168 | 3.90 | 162 | 5.18 | 216 | 232 | 251 |
| 10 yr 0 m | 4629 | 3.97 | 184 | 5.33 | 247 | 263 | 366 |
| 9 yr 0 m | 4478 | 4.06 | 182 | 5.22 | 234 | 263 | 357 |
| 8 yr 0 m | 4320 | 4.02 | 174 | 4.63 | 200 | 239 | 205 |
| Plus 6 unprinted lactations | | | | | | | |
| Avg | 4406 | 4.11 | 181 | 5.37 | 237 | 249 | 11 Lacts. |

## GLENMARIE IMPRESS LAURIE

**Birth Ident: DGHT-95-14 (61636)**

**Breed: PA A16** G3,G1

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | **38/99** | Lwt BV (kg): | **-15/98** |
| Protein BV (kg): | **1/99** | Fertility BV (%): | **-4.1/99** |
| Fat BV (kg): | **-8/99** | TotL BV (days): | **202/99** |
| Milk BV (ltr): | **164/99** | SCC BV: | **-0.49/99** |

## OKURA JUDDS BELLBIRD

**Birth Ident: CFWR-95-364** VHC

**Breed: PJ J16**

Genomic Indicator:
BW ($): **158/60** PW ($): **377/86**

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 11 yr 2 m | 2997 | 3.80 | 114 | 5.59 | 168 | 163 | 328 |
| 10 yr 1 m | 3500 | 3.82 | 134 | 5.67 | 199 | 202 | 286 |
| 9 yr 1 m | 3865 | 4.05 | 156 | 5.51 | 213 | 213 | 337 |
| 8 yr 0 m | 3192 | 4.21 | 134 | 6.19 | 197 | 235 | 271 |
| 7 yr 0 m | 3594 | 4.39 | 158 | 6.30 | 226 | 226 | 264 |
| Plus 5 unprinted lactations | | | | | | | |
| Avg | 3525 | 4.09 | 144 | 5.88 | 207 | 218 | 10 Lacts. |

### BARTONS BICKFORD

**Birth Ident: VGR-89-67 (90266)**
Breed: **F F15J1**
Genomic Indicator: BW ($): **17/99**

### COLLINS STORM HEATHER

**Birth Ident: BHDF-92-12**
Breed : **F F16**
Genomic Indicator:
BW ($): **74/56** PW ($): **122/74**

| 3 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 4089 | 3.80 | 156 | 4.43 | 181 | 210 |

### WILLIAMS LORD NORMAN

**Birth Ident: CLRL-91-7 (92412)**
Breed : **PJ J16**
Genomic Indicator: BW ($): **60/99**

### DTR OF NO 18

**Birth Ident: CQVB-95-7**
Breed : **FJ F12J4**
Genomic Indicator:
BW ($) : **66/54** PW ($): **139/76**

| 3 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 4062 | 3.72 | 151 | 5.08 | 206 | 262 |

### NGARANGI IMPRESSARIO

**HB No: A/34439/M (61368)**
Breed: **PA A16**
Genomic Indicator: BW ($): **38/99**

### GLENMARIE MILKY LAUREL

**Birth Ident: DGHT-92-55**
Breed: **PA A16 VHC S✓**
Genomic Indicator:
BW ($): **132/77** PW ($): **220/89**

| 12 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 4819 | 3.55 | 171 | 4.38 | 211 | 248 |

### JUDDS ADMIRAL

**Birth Ident: FTH-88-39 (89429)**
Breed: **PJ J16**
Genomic Indicator: BW ($): **109/99**

### OKURA TAURUS BILLY

**Birth Ident: CFWR-93-198**
Breed: **PJ J16 A**
Genomic Indicator:
BW ($): **40/55** PW ($): **-22/69**

| 2 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 2682 | 3.82 | 102 | 5.77 | 155 | 218 |



N = Induced T = At least 1 Abnormal Test in this Lactation
D = Lactation values include at least 1 derived test
= GeneMark DNA Profiled # = Parentage Uncertain D / S ✓ = Parentage Confirmed by DNA
g Indices evaluated by LIC using genomic information

P001.50

P001.50 Official Publication of Livestock Improvement Corporation Limited

Internal Animal Key = 25602353

# Three Generation Pedigree

LIC — Livestock Improvement Corporation, New Zealand

MINDA

Herd Averages as at
Ancestry : BW : PW :

PTPT / HERDCODE :
LOCATION :
DATE : 26/04/2013

## BROOKLANDS RAMPANT

G3 S✓ D✓

**Birth Ident:** NDDX-08-170 (509046)

| | |
|---|---|
| Sex : | MALE |
| Breed : | FJ F12J4 |
| Date of Birth : | 17/08/2008 |
| Genomic Indicator: | |
| BW ($): | 218/79 |
| Protein BV (kg): | 23/82 |
| Fat BV (kg): | 26/83 |
| Milk BV (ltr): | 310/86 |
| Liveweight BV (kg): | 4/89 |
| Fertility BV (%): | -1.3/64 |
| Total Longevity BV (days): | 334/66 |
| Somatic Cell BV: | 0.03/75 |
| Overall Opinion BV: | 0.42/85 |
| Udder Overall BV: | 0.20/82 |
| Dairy Conformation BV: | 0.28/87 |
| Fat %: | 5 |
| Protein %: | 4 |

## VALDEN HI APPLAUSE-ET S2F

**Birth Ident:** JVLH-02-13 (103180)

Breed : SF F16 G3,G1 S✓ D✓

| | |
|---|---|
| Genomic Indicator: | |
| BW ($): | 195/99 |
| Protein BV (kg): | 30/99 |
| Fat BV (kg): | 36/99 |
| Milk BV (ltr): | 576/99 |
| Liveweight BV (kg): | 34/99 |
| Fertility BV (%): | -3.5/99 |
| Total Longevity BV (days): | 305/99 |
| Somatic Cell BV: | 0.43/99 |
| Fat %: | 4.9 |
| Protein %: | 3.9 |

## DAM:

**Birth Ident:** BDTQ-05-56

Breed: JF J9F7 G2 S✓

Genomic Indicator: PW ($): 315/82

| | | | |
|---|---|---|---|
| BW ($): | 180/56 | Lwt BV (kg): | -15/44 |
| Protein BV (kg): | 14/60 | Fertility BV (%): | 1.5/48 |
| Fat BV (kg): | 16/61 | TotL BV (days): | 264/49 |
| Milk BV (ltr): | 164/63 | SCC BV: | -0.08/56 |

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 6 yr 11 m | 4851 | 3.87 | 188 | 5.01 | 243 | 176 T | 271 |
| 6 yr 1 m | 6032 | 3.69 | 223 | 5.19 | 313 | 208 | 396 |
| 5 yr 1 m | 5048 | 3.65 | 184 | 4.80 | 242 | 200 T | 279 |
| 4 yr 0 m | 6324 | 3.95 | 250 | 4.95 | 313 | 248 | 381 |
| 3 yr 0 m | 6419 | 3.84 | 246 | 4.26 | 273 | 259 | 267 |
| 2 yr 1 m | 3872 | 4.08 | 158 | 4.85 | 188 | 218 T | 315 |
| Avg | 5424 | 3.84 | 208 | 4.83 | 262 | 218 | 6 Lacts. |

## SRB HANSENS INGMAR

**Birth Ident:** CJKB-96-150 (97380)

Breed: SF F16 G3,G1 S✓ D✓

Genomic Indicator:

| | | | |
|---|---|---|---|
| BW ($): | 178/93 | Lwt BV (kg): | 33/94 |
| Protein BV (kg): | 22/94 | Fertility BV (%): | 0.7/90 |
| Fat BV (kg): | 27/94 | TotL BV (days): | 323/91 |
| Milk BV (ltr): | 438/95 | SCC BV: | -0.29/93 |

## VALDEN POSH AMBERLY-ET

**Birth Ident:** PMX-00-145

89 VG

Breed: PF F16 G2,G1 S✓ D✓

Genomic Indicator (g):

BW ($): 81/74 PW ($): 224/90

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 9 yr 1 m | 5640 | 3.56 | 201 | 4.27 | 241 | 222 | 254 |
| 6 yr 10 m | 8695 | 3.56 | 310 | 4.69 | 408 | 300 | 377 |
| 5 yr 10 m | 8233 | 3.59 | 295 | 4.65 | 383 | 305 T | 220 |
| 4 yr 10 m | 8809 | 3.66 | 323 | 4.41 | 389 | 305 | 270 |
| 3 yr 11 m | 6978 | 3.60 | 251 | 4.10 | 286 | 283 | 190 |
| Plus 2 unprinted lactations | | | | | | | |
| Avg | 7241 | 3.60 | 261 | 4.40 | 318 | 283 | 7 Lacts. |

## MITCHELLS LIKABULL SJ3

**Birth Ident:** DTWX-98-26 (99416)

Breed: SJ J16 G3,G1 S✓ D✓

Genomic Indicator:

| | | | |
|---|---|---|---|
| BW ($): | 158/99 | Lwt BV (kg): | -52/99 |
| Protein BV (kg): | 0/99 | Fertility BV (%): | 1.5/99 |
| Fat BV (kg): | 3/99 | TotL BV (days): | 173/99 |
| Milk BV (ltr): | -522/99 | SCC BV: | -0.05/99 |

## DAM:

**Birth Ident:** BDTQ-03-79

Breed: F F14J2

Genomic Indicator:

BW ($): 148/55 PW ($): 200/79

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| 7 yr 1 m | 4480 | 3.52 | 158 | 3.94 | 176 | 194 | -12 |
| 6 yr 0 m | 5530 | 3.72 | 206 | 4.50 | 249 | 206 | 181 |
| 3 yr 11 m | 5220 | 3.84 | 200 | 4.07 | 212 | 254 | 196 |
| 2 yr 11 m | 6753 | 3.81 | 257 | 3.96 | 267 | 275 | 243 |
| 1 yr 11 m | 6142 | 3.75 | 230 | 4.33 | 266 | 268 | 330 |
| Avg | 5625 | 3.74 | 210 | 4.16 | 234 | 239 | 5 Lacts. |

### WELBURN A V HERMES

**Birth Ident:** BRHW-90-14 (91201)

Breed: PF F16

Genomic Indicator: BW ($): 14/99

### SRA INKSTERS CHARLIE

**Birth Ident:** CJKB-93-5

Breed : SF F16 83 GP

Genomic Indicator:

BW ($): 117/58 PW ($): 252/78

| 5 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 4700 | 3.51 | 165 | 4.71 | 222 | 243 |

### KAPAWAI JIMTOWN POSH-ET

**Birth Ident:** BBQR-95-3 (96388)

Breed : PF F16

Genomic Indicator: BW ($): -52/99

### ROJAN EMIN JEBEL-ET

**Birth Ident:** HYWT-98-89

Breed : PF F16 88 VG S✓D✓

Genomic Indicator:

BW ($) : 56/79 PW ($): -4/76

| 5 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 6028 | 3.39 | 204 | 3.83 | 231 | 258 |

### SILVER FALLS QUICK FAME

**Birth Ident:** FHK-91-12 (92472)

Breed: PJ J16

Genomic Indicator: BW ($): 120/99

### MITCHELLS ADS COLLEEN SJ2

**Birth Ident:** DTWX-94-64

Breed: SJ J16 HC S✓

Genomic Indicator:

BW ($): 180/67 PW ($): 362/87

| 10 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 3703 | 4.12 | 152 | 5.24 | 194 | 228 |

### SRD BENTONS HOT KAT

**Birth Ident:** GVHK-97-150 (98326)

Breed: SF F16 S✓D✓

Genomic Indicator: BW ($): 96/99

### DAM:

**Birth Ident:** BDTQ-00-43

Breed: FJ F12J4

Genomic Indicator:

BW ($): 159/57 PW ($): 252/82

| 7 Lacts. Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| 5948 | 4.04 | 240 | 4.65 | 277 | 253 |



N = Induced T = At least 1 Abnormal Test in this Lactation
D = Lactation values include at least 1 derived test
= GeneMark DNA Profiled # = Parentage Uncertain D / S ✓ = Parentage Confirmed by DNA
g Indices evaluated by LIC using genomic information

P001.50

P001.50 Official Publication of Livestock Improvement Corporation Limited

Internal Animal Key = 23951759

# Three Generation Pedigree

LIC

Livestock Improvement Corporation
New Zealand

Herd Averages as at
Ancestry : BW : PW :

MINDA

PTPT / HERDCODE :
LOCATION :
DATE : 15/04/2013

## PRIESTS SOLARIS-ET

G3,G1 S✓ D✓

**Birth Ident: JVLH-07-183 (508154)**

| | |
|---|---|
| Sex : | **MALE** |
| Breed : | **JF J10F6** |
| Date of Birth : | **3/08/2007** |
| Genomic Indicator: | |
| BW ($): | **217/98** |
| Protein BV (kg): | **18/99** |
| Fat BV (kg): | **24/99** |
| Milk BV (ltr): | **272/99** |
| Liveweight BV (kg): | **-3/95** |
| Fertility BV (%): | **2.4/98** |
| Total Longevity BV (days): | **231/98** |
| Somatic Cell BV: | **-0.96/99** |
| Overall Opinion BV: | **0.42/90** |
| Udder Overall BV: | **0.44/88** |
| Dairy Conformation BV: | **1.03/92** |
| Fat %: | **5** |
| Protein %: | **3.9** |

## INGRAMS RAMROD

**Birth Ident: BNQL-02-34 (503041)**

Breed : **JF J10F6** G3,G1 S✓ D✓

| | |
|---|---|
| Genomic Indicator: | |
| BW ($): | **244/94** |
| Protein BV (kg): | **18/96** |
| Fat BV (kg): | **35/96** |
| Milk BV (ltr): | **148/97** |
| Liveweight BV (kg): | **-10/92** |
| Fertility BV (%): | **6.1/90** |
| Total Longevity BV (days): | **308/91** |
| Somatic Cell BV: | **-0.09/95** |
| Fat %: | **5.4** |
| Protein %: | **4** |

**DAM:**

**Birth Ident: JQXQ-02-11**

Breed: **JF J9F7** G3,G1 S✓

| | | | |
|---|---|---|---|
| Genomic Indicator: | | PW ($): | **400/83** |
| BW ($): | **169/72** | Lwt BV (kg): | **-9/63** |
| Protein BV (kg): | **14/74** | Fertility BV (%): | **-1.6/66** |
| Fat BV (kg): | **22/74** | TotL BV (days): | **212/67** |
| Milk BV (ltr): | **331/76** | SCC BV: | **-0.85/72** |

| Age | | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|---|
| **10 yr 2 m** | D | **3515** | **3.64** | **128** | **6.44** | **226** | **167** | **366** |
| **7 yr 1 m** | D | **2407** | **3.76** | **91** | **4.87** | **117** | **130** | **395** |
| **6 yr 1 m** | D | **3128** | **3.79** | **119** | **4.84** | **151** | **189** | **187** |
| **5 yr 3 m** | D | **2283** | **3.18** | **73** | **4.84** | **110** | **87** | **413** |
| **4 yr 0 m** | | **6130** | **3.91** | **240** | **4.61** | **283** | **252** | **430** |
| **3 yr 0 m** | | **4832** | **3.88** | **188** | **4.82** | **233** | **266** | **350** |
| **2 yr 0 m** | | **3920** | **3.75** | **147** | **4.59** | **180** | **231** | **376** |
| **Avg** | D | **3988** | **3.81** | **152** | **4.97** | **198** | **206** | **6 Lacts.** |

## WILLAND ADS SAMUAL

**Birth Ident: FHKD-96-3 (97472)**

Breed: **PJ J16** G3,G1 S✓ D✓

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | **147/99** | Lwt BV (kg): | **-53/99** |
| Protein BV (kg): | **0/99** | Fertility BV (%): | **1.5/99** |
| Fat BV (kg): | **17/99** | TotL BV (days): | **156/99** |
| Milk BV (ltr): | **-502/99** | SCC BV: | **0.52/99** |

**DAM:**

**Birth Ident: BLYK-97-37**

Breed: **FJ F11J4** G3,G1 S✓

Genomic Indicator (g):

BW ($): **158/73** PW ($): **464/85**

| Age | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|
| **12 yr 10 m** | **5571** | **4.02** | **224** | **5.23** | **291** | **237** | **376** |
| **11 yr 10 m** | **6031** | **4.08** | **246** | **5.10** | **307** | **271** | **535** |
| **10 yr 9 m** | **6902** | **4.12** | **284** | **4.84** | **334** | **291** | **528** |
| **9 yr 10 m** | **5441** | **4.12** | **224** | **4.95** | **269** | **216** | **631** |
| **8 yr 11 m** | **6119** | **4.04** | **247** | **5.06** | **309** | **268** | **483** |
| **Plus 7 unprinted lactations** | | | | | | | |
| **Avg** | **5683** | **4.18** | **237** | **5.22** | **296** | **252** | **12 Lacts.** |

## AMADEUS JC12

**Birth Ident: DWPY-94-50 (667072)**

Breed: **CJ J12F4** G3,G1 S✓ D✓

| | | | |
|---|---|---|---|
| Genomic Indicator: | | | |
| BW ($): | **132/99** | Lwt BV (kg): | **-34/99** |
| Protein BV (kg): | **0/99** | Fertility BV (%): | **2.6/99** |
| Fat BV (kg): | **4/99** | TotL BV (days): | **208/99** |
| Milk BV (ltr): | **-137/99** | SCC BV: | **-0.98/99** |

**DAM:**

**Birth Ident: JQXQ-00-1**

Breed: **FJ F11J5**

Genomic Indicator:

BW ($): **162/56** PW ($): **311/84**

| Age | | Milk (ltr) | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days | LW |
|---|---|---|---|---|---|---|---|---|
| **9 yr 1 m** | D | **2342** | **3.66** | **86** | **4.79** | **112** | **130** | **266** |
| **8 yr 1 m** | D | **3234** | **3.96** | **128** | **4.90** | **158** | **189** | **226** |
| **7 yr 1 m** | D | **2970** | **3.75** | **111** | **4.48** | **133** | **144** | **293** |
| **6 yr 1 m** | | **4575** | **3.77** | **172** | **4.10** | **188** | **230** | **317** |
| **5 yr 0 m** | | **5198** | **3.72** | **194** | **4.74** | **247** | **250** | **366** |
| **Plus 3 unprinted lactations** | | | | | | | | |
| **Avg** | D | **4113** | **3.75** | **154** | **4.56** | **188** | **207** | **8 Lacts.** |

### JUDDS ADMIRAL

**Birth Ident: FTH-88-39 (89429)**
Breed: **PJ J16**
Genomic Indicator: BW ($): **109/99**

### WILLAND SAMS MELI GR

**Birth Ident: FHKD-93-11**
Breed : **PJ J16** **VHC** **S✓**
Genomic Indicator:
BW ($): **171/79** PW ($): **438/86**

| **9 Lacts.** Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| **4112** | **4.10** | **168** | **6.21** | **255** | **255** |

### O'BYRNES EAMONN

**Birth Ident: BNBM-92-7 (93278)**
Breed : **PF F16**
Genomic Indicator: BW ($): **34/99**

**DAM:**
**Birth Ident: BLYK-94-15**
Breed : **JF J8F6**
Genomic Indicator:
BW ($) : **132/55** PW ($): **268/84**

| **9 Lacts.** Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| **5029** | **3.82** | **192** | **4.98** | **250** | **233** |

### CRESCENT SENATOR SAM

**Birth Ident: GFW-86-61 (65113)**
Breed: **PJ J16**
Genomic Indicator: BW ($): **92/99**

### BELGARD COLOGNE JC8

**Birth Ident: DWPY-86-25**
Breed: **CJ F8J8** **S✓**
Genomic Indicator:
BW ($): **133/78** PW ($): **472/76**

| **11 Lacts.** Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| **7240** | **3.94** | **285** | **4.93** | **357** | **242** |

### SRC HIBI SECRET SKELTON

**Birth Ident: FKNW-89-3 (662033)**
Breed: **SF F16**
Genomic Indicator: BW ($): **115/99**

**DAM:**
**Birth Ident: MMR-97-18**
Breed: **JF J10F6**
Genomic Indicator:
BW ($): **75/55** PW ($): **113/84**

| **8 Lacts.** Milk | Protein (%) | Protein (kg) | Milkfat (%) | Milkfat (kg) | Days |
|---|---|---|---|---|---|
| **3956** | **4.17** | **165** | **5.23** | **207** | **251** |



N = Induced T = At least 1 Abnormal Test in this Lactation
D = Lactation details include at least one derived test

= GeneMark DNA Profiled # = Parentage Uncertain D / S ✓ = Parentage Confirmed by DNA
**g Indices evaluated by LIC using genomic information**

P001.50

## Addendum B – Bull Marketing Reports (BMR) of KiwiCross™, Holstein-Friesian and Jersey sires

LIC **Bull Marketing Report** **AE Run Date: 11/05/2013** 28/05/2013

| 509004 MATAKURI ATLANTIS | KiwiCross 1/08/2008 | Current LIC Rank 5 | Newstead Centre Bulls UNREGISTERED |
|---|---|---|---|

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 233/ 81 | | 5544/69 | 1958/84 | | | | 25/08/2010 | 2009 |

Traits other than production BVs

| Management | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | 0.03 / 86 | slowly | quickly |
| Shed Temperament | 0.01 / 86 | nervous | placid |
| Milking speed | 0.00 / 81 | slow | fast |
| Overall opinion | 0.14 / 86 | undesirable | desirable |
| **Conformation** | 78 dtrs | | |
| Stature | -0.52 / 90 | small | tall |
| Capacity | -0.01 / 87 | frail | capacious |
| Rump angle | -0.01 / 86 | high pins | sloping |
| Rump width | 0.10 / 86 | narrow | wide |
| Legs | 0.30 / 72 | straight | curved |
| Udder support | 0.07 / 91 | weak | strong |
| Front udder | 0.03 / 89 | loose | strong |
| Rear udder | 0.06 / 89 | low | high |
| Front teat placement | 0.32 / 89 | wide | close |
| Rear teat placement | 0.47 / 89 | wide | close |
| Udder overall | 0.13 / 84 | undesirable | desirable |
| Dairy conformation | -0.04 / 88 | undesirable | desirable |

Production BVs

| Fat | Protein | Milk Vol | Livewt | Fertility | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 24 / 86 | 21 / 85 | 247 / 87 | -25 / 90 | -1.5 / 67 | -5 / 68 | 193 / 68 | -0.26 / 83 |
| 5.0% | 4.0% | | | | | | |

Pedigree

| | | |
|---|---|---|
| Sire | 501038 | SCOTTS NORTHSEA |
| Dam | KFYY-06-11 | ALCAMENO MHTTN DEMI |
| MG Sire | 300534 | OKURA MANHATTEN ET SJ3 |
| MG Dam | KFYY-04-14 | ALCAMENO PIERE DUMPA S0F |
| MGG Sire | 672213 | TOP DECK KO PIERRE |
| MGG Dam | GHJG-99-3 | LIC-FJORD |

Other Values

| | |
|---|---|
| NZ HF % | 29 |
| NZ Jsy % | 29 |
| NZ Ayr % | 2 |
| NZ Total % | 59 |
| % White | 1 |
| Inbreed | 2.3 |
| Breed 16ths | F7J8A1 |

Other BVs

| | |
|---|---|
| Calving Diff | -2.7 / 64 / 181 |
| SGL | -4.9 |
| Body Cond | -0.14 |

Single Genes

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | A2A2 |
| Alpha SI Casein | |
| Beta Casein | |
| Beta Lactoglobulin | |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | |
| Optimum | |
| Quantum | |
| Red Factor | |

BW and BV History

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 233 | 247 | -5 | 92 |
| 13/04/2013 | 222 | 256 | -3 | 92 |
| 09/03/2013 | 232 | 333 | -20 | 92 |
| 16/02/2013 | 219 | 297 | -1 | 92 |
| 12/01/2013 | 218 | 257 | -38 | 92 |
| 08/12/2012 | 208 | 237 | -30 | 92 |
| 10/11/2012 | 204 | 172 | -32 | 88 |
| 27/10/2012 | 216 | 182 | -43 | 85 |
| 13/10/2012 | 183 | 97 | 0 | 81 |
| 11/05/2013& | 185 | 34 | 7 | 0 |

& Latest ancestry proof

TOP History

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.14 | 0.13 | -0.04 | 78 |
| 16/02/2013 | 0.21 | 0.18 | -0.08 | 78 |
| 08/12/2012 | 0.25 | 0.09 | -0.09 | 64 |
| 06/10/2012 | 0.44 | 0.00 | -0.07 | 32 |
| 12/05/2012 | 0.42 | 0.09 | -0.09 | 0 |
| 11/02/2012 | 0.42 | 0.09 | -0.10 | 0 |
| 10/12/2011 | 0.40 | 0.10 | -0.06 | 0 |
| 08/10/2011 | 0.45 | 0.11 | -0.05 | 0 |
| 16/07/2011 | 0.48 | 0.18 | 0.00 | 0 |
| 14/05/2011 | 0.48 | 0.18 | 0.00 | 0 |

Tot Long / Fert History

| Extract date | Total Long | Fertility |
|---|---|---|
| 26/04/2013 | 193 | -1.5 |
| 01/02/2013 | 145 | -3.3 |
| 27/04/2012 | 150 | -0.7 |
| 27/01/2012 | 143 | -0.7 |
| 01/07/2011 | 131 | -1.1 |

LIC **Bull Marketing Report** **AE Run Date: 11/05/2013** 28/05/2013

| 509046 BROOKLANDS RAMPANT | KiwiCross 17/08/2008 | Current LIC Rank 12 | Newstead Centre Bulls UNREGISTERED |
|---|---|---|---|

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 214/ 79 | | 5144/67 | 1740/82 | | | 39/53 | 25/08/2010 | 2009 |

Traits other than production BVs

| Management | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | 0.21 / 85 | slowly | quickly |
| Shed Temperament | 0.20 / 85 | nervous | placid |
| Milking speed | 0.05 / 80 | slow | fast |
| Overall opinion | 0.37 / 85 | undesirable | desirable |
| **Conformation** | 68 dtrs | | |
| Stature | 0.11 / 89 | small | tall |
| Capacity | 0.04 / 86 | frail | capacious |
| Rump angle | -0.12 / 84 | high pins | sloping |
| Rump width | -0.22 / 84 | narrow | wide |
| Legs | 0.00 / 69 | straight | curved |
| Udder support | 0.21 / 89 | weak | strong |
| Front udder | -0.12 / 88 | loose | strong |
| Rear udder | 0.09 / 87 | low | high |
| Front teat placement | 0.14 / 88 | wide | close |
| Rear teat placement | 0.49 / 88 | wide | close |
| Udder overall | 0.11 / 82 | undesirable | desirable |
| Dairy conformation | 0.19 / 87 | undesirable | desirable |

Production BVs

| Fat | Protein | Milk Vol | Livewt | Fertility | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 26 / 83 | 23 / 82 | 318 / 86 | 4 / 89 | -2.7 / 64 | 181 / 66 | 329 / 66 | 0.08 / 80 |
| 5.0% | 4.0% | | | | | | |

Pedigree

| | | |
|---|---|---|
| Sire | 103180 | VALDEN HI APPLAUSE-ET S2F |
| Dam | BDTQ-05-56 | |
| MG Sire | 99416 | MITCHELLS LIKABULL SJ3 |
| MG Dam | BDTQ-03-79 | |
| MGG Sire | 98326 | SRD BENTONS HOT KAT |
| MGG Dam | BDTQ-00-43 | |

Other Values

| | |
|---|---|
| NZ HF % | 40 |
| NZ Jsy % | 19 |
| NZ Ayr % | 0 |
| NZ Total % | 59 |
| % White | 25 |
| Inbreed | 1.3 |
| Breed 16ths | F12J4 |

Other BVs

| | |
|---|---|
| Calving Diff | 0.7 / 59 / 157 |
| SGL | -7.5 |
| Body Cond | -0.01 |

Single Genes

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | A2A2 |
| Alpha SI Casein | |
| Beta Casein | |
| Beta Lactoglobulin | |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | |
| Optimum | |
| Quantum | |
| Red Factor | |

BW and BV History

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 214 | 318 | 181 | 77 |
| 13/04/2013 | 218 | 310 | 146 | 77 |
| 09/03/2013 | 216 | 278 | 149 | 77 |
| 16/02/2013 | 204 | 242 | 157 | 77 |
| 12/01/2013 | 194 | 258 | 51 | 77 |
| 08/12/2012 | 204 | 279 | 45 | 77 |
| 10/11/2012 | 208 | 350 | 25 | 75 |
| 27/10/2012 | 208 | 357 | 23 | 72 |
| 13/10/2012 | 209 | 355 | 22 | 66 |
| 11/05/2013& | 227 | 498 | -9 | 0 |

& Latest ancestry proof

TOP History

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.37 | 0.11 | 0.19 | 68 |
| 16/02/2013 | 0.42 | 0.20 | 0.28 | 68 |
| 08/12/2012 | 0.39 | 0.09 | 0.18 | 61 |
| 06/10/2012 | 0.33 | -0.03 | 0.09 | 31 |
| 12/05/2012 | 0.25 | 0.09 | 0.24 | 0 |
| 11/02/2012 | 0.26 | 0.10 | 0.24 | 0 |
| 10/12/2011 | 0.26 | 0.12 | 0.25 | 0 |
| 08/10/2011 | 0.29 | 0.11 | 0.24 | 0 |
| 16/07/2011 | 0.28 | 0.09 | 0.27 | 0 |
| 14/05/2011 | 0.28 | 0.09 | 0.27 | 0 |

Tot Long / Fert History

| Extract date | Total Long | Fertility |
|---|---|---|
| 26/04/2013 | 329 | -2.7 |
| 01/02/2013 | 334 | -1.3 |
| 27/04/2012 | 317 | 2.4 |
| 27/01/2012 | 320 | 2.5 |
| 01/07/2011 | 279 | 2.1 |

**LIC** **Bull Marketing Report** **AE Run Date: 11/05/2013** 28/05/2013

| **506063** | **CUTFORTHS LORD BRIAN** | **KiwiCross 31/07/2005** | **Current LIC Rank 3** | **Newstead Centre Bulls** UNREGISTERED |
|---|---|---|---|---|

| **BW** | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 244 / 86 | | 5736/74 | 2064/87 | | 128/22 | 176/69 | 25/08/2010 | 2006 |

| Traits other than production BVs | | -1 | 1 |
|---|---|---|---|
| **Management** | | | |
| Adaptability to milking | 0.11 / 84 | slowly | quickly |
| Shed Temperament | 0.05 / 84 | nervous | placid |
| Milking speed | -0.20 / 79 | slow | fast |
| Overall opinion | 0.00 / 84 | undesirable | desirable |
| **Conformation** | 69 dtrs | | |
| Stature | 0.02 / 89 | small | tall |
| Capacity | 0.29 / 86 | frail | capacious |
| Rump angle | -0.09 / 85 | high pins | sloping |
| Rump width | 0.00 / 85 | narrow | wide |
| Legs | -0.05 / 70 | straight | curved |
| Udder support | 0.34 / 90 | weak | strong |
| Front udder | 0.26 / 88 | loose | strong |
| Rear udder | 0.53 / 88 | low | high |
| Front teat placement | -0.10 / 88 | wide | close |
| Rear teat placement | -0.07 / 88 | wide | close |
| Udder overall | 0.40 / 83 | undesirable | desirable |
| Dairy conformation | 0.32 / 87 | undesirable | desirable |

Production BVs

| Fat | Protein | Milk Vol | Livewt | Fertility | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 25 / 88 | 21 / 88 | 123 / 90 | 9 / 90 | 1.8 / 77 | 80 / 78 | 376 / 78 | -0.43 / 86 |
| 5.2% | 4.1% | | | | | | |

| Pedigree | | |
|---|---|---|
| Sire | 501042 | NUMANS LORD NELSON |
| Dam | HXVV-01-78 | WOODNOOK LAURIE BIRD JC8 |
| MG Sire | 61636 | GLENMARIE IMPRESS LAURIE |
| MG Dam | CFWR-95-364 | OKURA JUDDS BELLBIRD |
| MGG Sire | 89429 | JUDDS ADMIRAL |
| MGG Dam | CFWR-93-198 | OKURA TAURUS BILLY |

| Other Values | |
|---|---|
| NZ HF % | 19 |
| NZ Jsy % | 37 |
| NZ Ayr % | 21 |
| NZ Total % | 77 |
| % White | 20 |
| Inbreed | 0.5 |
| Breed 16ths | F5J7A4 |

| Other BVs | |
|---|---|
| Calving Diff | -2.2 / 99 / 49,078 |
| SGL | -0.4 |
| Body Cond | 0.19 |

| Single Genes | |
|---|---|
| Cattle Locus Descr | Phenotype Descr |
| A2 | |
| Alpha SI Casein | BB |
| Beta Casein | A1B |
| Beta Lactoglobulin | AB |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | AB |
| Optimum | TT |
| Quantum | FP |
| Red Factor | |

BW and BV History

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 244 | 123 | 80 | 81 |
| 13/04/2013 | 245 | 124 | 80 | 81 |
| 09/03/2013 | 223 | 125 | 92 | 81 |
| 16/02/2013 | 223 | 127 | 92 | 81 |
| 12/01/2013 | 209 | 128 | 84 | 80 |
| 08/12/2012 | 209 | 128 | 84 | 80 |
| 10/11/2012 | 192 | 129 | 114 | 80 |
| 27/10/2012 | 194 | 129 | 111 | 80 |
| 13/10/2012 | 194 | 130 | 111 | 80 |
| 11/05/2013& | 251 | 33 | 101 | 0 |

& Latest ancestry proof

TOP History

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.00 | 0.40 | 0.32 | 69 |
| 16/02/2013 | 0.01 | 0.40 | 0.32 | 69 |
| 08/12/2012 | 0.01 | 0.40 | 0.32 | 69 |
| 06/10/2012 | 0.02 | 0.40 | 0.34 | 69 |
| 12/05/2012 | 0.07 | 0.39 | 0.39 | 69 |
| 11/02/2012 | 0.08 | 0.39 | 0.39 | 69 |
| 10/12/2011 | 0.08 | 0.42 | 0.37 | 69 |
| 08/10/2011 | 0.12 | 0.43 | 0.38 | 69 |
| 16/07/2011 | 0.18 | 0.44 | 0.37 | 69 |
| 14/05/2011 | 0.18 | 0.44 | 0.38 | 69 |

Tot Long / Fert History

| Extract date | Total Long | Fertility |
|---|---|---|
| 26/04/2013 | 376 | 1.8 |
| 01/02/2013 | 377 | 1.8 |
| 27/04/2012 | 374 | 1.9 |
| 27/01/2012 | 382 | 1.9 |
| 01/07/2011 | 400 | -0.5 |

**LIC** **Bull Marketing Report** **AE Run Date: 11/05/2013** 28/05/2013

| **507036** | **LYNSKEYS LANCASTER** | **KiwiCross 11/08/2006** | **Current LIC Rank 11** | **Newstead Centre Bulls** UNREGISTERED |
|---|---|---|---|---|

| **BW** | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 217 / 86 | | 5726/74 | 1735/88 | | | | 25/08/2010 | 2007 |

| Traits other than production BVs | | -1 | 1 |
|---|---|---|---|
| **Management** | | | |
| Adaptability to milking | -0.02 / 86 | slowly | quickly |
| Shed Temperament | 0.00 / 85 | nervous | placid |
| Milking speed | -0.14 / 80 | slow | fast |
| Overall opinion | -0.05 / 86 | undesirable | desirable |
| **Conformation** | 74 dtrs | | |
| Stature | -0.05 / 90 | small | tall |
| Capacity | 0.19 / 86 | frail | capacious |
| Rump angle | 0.09 / 85 | high pins | sloping |
| Rump width | 0.06 / 85 | narrow | wide |
| Legs | 0.11 / 70 | straight | curved |
| Udder support | 0.17 / 90 | weak | strong |
| Front udder | 0.39 / 88 | loose | strong |
| Rear udder | 0.15 / 88 | low | high |
| Front teat placement | 0.17 / 89 | wide | close |
| Rear teat placement | 0.16 / 89 | wide | close |
| Udder overall | 0.23 / 83 | undesirable | desirable |
| Dairy conformation | 0.20 / 87 | undesirable | desirable |

Production BVs

| Fat | Protein | Milk Vol | Livewt | Fertility | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 24 / 89 | 17 / 88 | 68 / 90 | -6 / 90 | 2.4 / 77 | 43 / 76 | 321 / 76 | -0.13 / 87 |
| 5.2% | 4.0% | | | | | | |

| Pedigree | | |
|---|---|---|
| Sire | 99416 | MITCHELLS LIKABULL SJ3 |
| Dam | BNTT-02-26 | |
| MG Sire | 96242 | ATHOL ENIGMA |
| MG Dam | BNTT-94-22 | |
| MGG Sire | 87208 | BALSOMS TAYLOR |
| MGG Dam | BNTT-91-35 | |

| Other Values | |
|---|---|
| NZ HF % | 24 |
| NZ Jsy % | 38 |
| NZ Ayr % | 0 |
| NZ Total % | 61 |
| % White | 0 |
| Inbreed | 0.1 |
| Breed 16ths | F7J9 |

| Other BVs | |
|---|---|
| Calving Diff | -1.0 / 99 / 19,948 |
| SGL | -2.5 |
| Body Cond | -0.10 |

| Single Genes | |
|---|---|
| Cattle Locus Descr | Phenotype Descr |
| A2 | A2A2 |
| Alpha SI Casein | |
| Beta Casein | |
| Beta Lactoglobulin | |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | |
| Optimum | TT |
| Quantum | FF |
| Red Factor | |

BW and BV History

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 217 | 68 | 43 | 90 |
| 13/04/2013 | 218 | 70 | 44 | 90 |
| 09/03/2013 | 218 | 70 | 44 | 90 |
| 16/02/2013 | 218 | 70 | 44 | 90 |
| 12/01/2013 | 207 | 72 | 55 | 90 |
| 08/12/2012 | 208 | 73 | 55 | 90 |
| 10/11/2012 | 208 | 74 | 55 | 90 |
| 27/10/2012 | 207 | 74 | 58 | 90 |
| 13/10/2012 | 207 | 75 | 58 | 90 |
| 11/05/2013& | 126 | -177 | 3 | 0 |

& Latest ancestry proof

TOP History

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | -0.05 | 0.23 | 0.20 | 74 |
| 16/02/2013 | -0.04 | 0.22 | 0.20 | 74 |
| 08/12/2012 | -0.04 | 0.23 | 0.20 | 74 |
| 06/10/2012 | -0.03 | 0.23 | 0.21 | 74 |
| 12/05/2012 | -0.03 | 0.28 | 0.24 | 74 |
| 11/02/2012 | -0.03 | 0.27 | 0.23 | 74 |
| 10/12/2011 | -0.03 | 0.27 | 0.24 | 74 |
| 08/10/2011 | -0.02 | 0.28 | 0.24 | 74 |
| 16/07/2011 | -0.02 | 0.29 | 0.24 | 74 |
| 14/05/2011 | -0.02 | 0.29 | 0.23 | 73 |

Tot Long / Fert History

| Extract date | Total Long | Fertility |
|---|---|---|
| 26/04/2013 | 321 | 2.4 |
| 01/02/2013 | 320 | 2.3 |
| 27/04/2012 | 326 | 2.0 |
| 27/01/2012 | 301 | 1.7 |
| 01/07/2011 | 331 | 2.5 |

LIC **Bull Marketing Report** **AE Run Date: 11/05/2013** 28/05/2013

| **508154** | **PRIESTS SOLARIS-ET** | **KiwiCross 3/08/2007** | **Current LIC Rank 10** | **Newstead Centre Bulls** UNREGISTERED |
|---|---|---|---|---|

| **BW** | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 220/ 99 | | 5649/86 | 2001/98 | | 88/10 | 168/53 | 25/08/2010 | 2008 |

Traits other than production BVs

| **Management** | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | 0.45 / 90 | slowly | quickly |
| Shed Temperament | 0.42 / 89 | nervous | placid |
| Milking speed | -0.17 / 85 | slow | fast |
| Overall opinion | 0.41 / 90 | undesirable | desirable |
| **Conformation** | 118 dtrs | | |
| Stature | -0.43 / 93 | small | tall |
| Capacity | 1.04 / 91 | frail | capacious |
| Rump angle | -0.36 / 90 | high pins | sloping |
| Rump width | 0.05 / 90 | narrow | wide |
| Legs | -0.12 / 78 | straight | curved |
| Udder support | 0.36 / 93 | weak | strong |
| Front udder | 0.30 / 92 | loose | strong |
| Rear udder | 0.54 / 92 | low | high |
| Front teat placement | 0.20 / 92 | wide | close |
| Rear teat placement | 0.56 / 92 | wide | close |
| Udder overall | 0.45 / 88 | undesirable | desirable |
| Dairy conformation | 1.01 / 92 | undesirable | desirable |

Production BVs

| Fat | Protein | Milk Vol | Livewt | Fertility | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 23 / 99 | 18 / 99 | 269 / 99 | -3 / 95 | 2.5 / 98 | -84 / 98 | 247 / 98 | -0.99 / 99 |
| 5.0% | 3.9% | | | | | | |

Pedigree

| | | |
|---|---|---|
| Sire | 503041 | INGRAMS RAMROD |
| Dam | JQXQ-02-11 | |
| MG Sire | 667072 | AMADEUS JC12 |
| MG Dam | JQXQ-00-1 | |
| MGG Sire | 662033 | SRC HIBI SECRET SKELTON |
| MGG Dam | MMR-97-18 | |

Other Values

| | |
|---|---|
| NZ HF % | 25 |
| NZ Jsy % | 51 |
| NZ Ayr % | 0 |
| NZ Total % | 76 |
| % White | 50 |
| Inbreed | 3.1 |
| Breed 16ths | F6J10 |

Other BVs

| | | |
|---|---|---|
| Calving Diff | -2.5 / 99 | / 17,573 |
| SGL | -7.2 | |
| Body Cond | 0.25 | |

Single Genes

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | |
| Alpha SI Casein | CC |
| Beta Casein | A2A2 |
| Beta Lactoglobulin | AB |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | BB |
| Optimum | TT |
| Quantum | FP |
| Red Factor | |

BW and BV History

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 220 | 269 | -84 | 4,752 |
| 13/04/2013 | 217 | 272 | -96 | 4,711 |
| 09/03/2013 | 222 | 275 | -99 | 4,638 |
| 16/02/2013 | 221 | 274 | -98 | 4,541 |
| 12/01/2013 | 213 | 275 | -72 | 4,464 |
| 08/12/2012 | 215 | 278 | -74 | 4,340 |
| 10/11/2012 | 216 | 281 | -75 | 3,968 |
| 27/10/2012 | 219 | 281 | -81 | 3,484 |
| 13/10/2012 | 217 | 278 | -80 | 2,387 |
| 11/05/2013& | 251 | 244 | -96 | 0 |

& Latest ancestry proof

TOP History

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.41 | 0.45 | 1.01 | 118 |
| 16/02/2013 | 0.42 | 0.44 | 1.03 | 117 |
| 08/12/2012 | 0.25 | 0.53 | 1.06 | 97 |
| 06/10/2012 | 0.24 | 0.59 | 1.10 | 80 |
| 12/05/2012 | 0.22 | 0.57 | 1.09 | 76 |
| 11/02/2012 | 0.23 | 0.60 | 1.06 | 70 |
| 10/12/2011 | 0.18 | 0.58 | 0.98 | 52 |
| 08/10/2011 | 0.48 | 0.71 | 0.85 | 28 |
| 16/07/2011 | 0.51 | 0.43 | 0.56 | 0 |
| 14/05/2011 | 0.51 | 0.43 | 0.56 | 0 |

Tot Long / Fert History

| Extract date | Total Long | Fertility |
|---|---|---|
| 26/04/2013 | 247 | 2.5 |
| 01/02/2013 | 231 | 2.4 |
| 27/04/2012 | 219 | 1.2 |
| 27/01/2012 | 233 | 1.1 |
| 01/07/2011 | 347 | 5.8 |

## LIC Bull Marketing Report — AE Run Date: 11/05/2013 — 28/05/2013

| | | | | |
|---|---|---|---|---|
| **106170** | **SPELDHURST STATESMAN S2F** | **Friesian 16/08/2005** | **Current LIC Rank 4** | **Newstead Centre Bulls** |
| | | | | REGISTERED HOLSTEIN-FRIESIAN (SUPPLEMENTARY) |

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 248/ 86 | | 5355/74 | 2059/88 | | | | 25/08/2010 | 2006 |

**Traits other than production BVs**

| Management | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | -0.02 / 84 | slowly | quickly |
| Shed Temperament | -0.05 / 84 | nervous | placid |
| Milking speed | 0.37 / 79 | slow | fast |
| Overall opinion | 0.11 / 84 | undesirable | desirable |
| **Conformation** | 69 dtrs | | |
| Stature * | -1.06 / 89 | small | tall |
| Capacity | 0.34 / 86 | frail | capacious |
| Rump angle | -0.19 / 85 | high pins | sloping |
| Rump width | 0.35 / 85 | narrow | wide |
| Legs | 0.39 / 70 | straight | curved |
| Udder support | 0.06 / 90 | weak | strong |
| Front udder | 0.18 / 88 | loose | strong |
| Rear udder | 0.04 / 88 | low | high |
| Front teat placement | 0.16 / 88 | wide | close |
| Rear teat placement | 0.46 / 88 | wide | close |
| Udder overall | 0.29 / 82 | undesirable | desirable |
| Dairy conformation | 0.19 / 87 | undesirable | desirable |

* deviated within breed

**Production BVs**

| Fat | Protein | Milk Vol * | Livewt * | Fertility * | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 32 / 89 | 30 / 88 | 47 / 90 | -32 / 90 | 5.8 / 77 | 79 / 78 | 435 / 78 | -0.23 / 87 |
| 4.7% | 3.7% | | | | | | |

**Pedigree**

| | | |
|---|---|---|
| Sire | 101046 | GRAYS NAUTILUS S2F |
| Dam | CPMV-00-25 | |
| MG Sire | 93270 | LLOYDS EXCELLENCY |
| MG Dam | CPMV-96-88 | |
| MGG Sire | 90274 | SRD DAWSONS BELVEDERE |
| MGG Dam | CPMV-86-52 | |

**Other Values**

| | |
|---|---|
| NZ HF % | 41 |
| NZ Jsy % | 6 |
| NZ Ayr % | 0 |
| NZ Total % | 47 |
| % White | 2 |
| Inbreed | 0.3 |
| Breed 16ths | F15J1 |

**Other BVs**

| | |
|---|---|
| Calving Diff | -0.5 / 99 / 65,016 |
| SGL | 2.3 |
| Body Cond | 0.00 |

**Single Genes**

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | A1A2 |
| Alpha SI Casein | BB |
| Beta Casein | A2B |
| Beta Lactoglobulin | AB |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | AB |
| Optimum | AT |
| Quantum | FP |
| Red Factor | |

**BW and BV History**

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 248 | 792 | 79 | 86 |
| 13/04/2013 | 249 | 794 | 79 | 85 |
| 09/03/2013 | 249 | 795 | 78 | 85 |
| 16/02/2013 | 250 | 797 | 77 | 85 |
| 12/01/2013 | 234 | 799 | 69 | 85 |
| 08/12/2012 | 235 | 800 | 69 | 85 |
| 10/11/2012 | 234 | 802 | 68 | 85 |
| 27/10/2012 | 232 | 803 | 73 | 85 |
| 13/10/2012 | 234 | 803 | 73 | 85 |
| 11/05/2013& | 226 | 515 | 51 | 0 |

& Latest ancestry proof

**TOP History**

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.11 | 0.29 | 0.19 | 69 |
| 16/02/2013 | 0.11 | 0.31 | 0.20 | 69 |
| 08/12/2012 | 0.11 | 0.31 | 0.20 | 69 |
| 06/10/2012 | 0.12 | 0.32 | 0.25 | 69 |
| 12/05/2012 | 0.13 | 0.32 | 0.30 | 69 |
| 11/02/2012 | 0.13 | 0.32 | 0.29 | 69 |
| 10/12/2011 | 0.13 | 0.32 | 0.29 | 69 |
| 08/10/2011 | 0.14 | 0.33 | 0.29 | 69 |
| 16/07/2011 | 0.16 | 0.33 | 0.29 | 69 |
| 14/05/2011 | 0.16 | 0.33 | 0.29 | 69 |

**Tot Long / Fert History**

| Extract date | Total Long | Fertility * |
|---|---|---|
| 26/04/2013 | 435 | 5.8 |
| 01/02/2013 | 436 | 5.8 |
| 27/04/2012 | 435 | 6.0 |
| 27/01/2012 | 450 | 6.0 |
| 01/07/2011 | 475 | 2.8 |

## LIC Bull Marketing Report — AE Run Date: 11/05/2013 — 28/05/2013

| | | | | |
|---|---|---|---|---|
| **109004** | **VALDEN TF TREASURER-ET** | **Friesian 10/06/2008** | **Current LIC Rank** | **Abbattoir** |
| | | | | REGISTERED HOLSTEIN-FRIESIAN |

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 163/ 85 | | 1733/73 | 1574/88 | | | | 25/08/2010 | 2009 |

**Traits other than production BVs**

| Management | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | 0.53 / 89 | slowly | quickly |
| Shed Temperament | 0.55 / 89 | nervous | placid |
| Milking speed | 0.30 / 85 | slow | fast |
| Overall opinion | 0.73 / 89 | undesirable | desirable |
| **Conformation** | 101 dtrs | | |
| Stature * | 0.33 / 92 | small | tall |
| Capacity | 0.38 / 90 | frail | capacious |
| Rump angle | 0.12 / 89 | high pins | sloping |
| Rump width | 0.90 / 89 | narrow | wide |
| Legs | -0.09 / 76 | straight | curved |
| Udder support | 0.66 / 92 | weak | strong |
| Front udder | 0.71 / 91 | loose | strong |
| Rear udder | 0.33 / 91 | low | high |
| Front teat placement | 0.27 / 91 | wide | close |
| Rear teat placement | 0.52 / 91 | wide | close |
| Udder overall | 0.58 / 87 | undesirable | desirable |
| Dairy conformation | 0.80 / 90 | undesirable | desirable |

* deviated within breed

**Production BVs**

| Fat | Protein | Milk Vol * | Livewt * | Fertility * | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 17 / 89 | 39 / 89 | 281 / 91 | 22 / 92 | 3.1 / 73 | 188 / 74 | 337 / 74 | 0.64 / 87 |
| 4.2% | 3.7% | | | | | | |

**Pedigree**

| | | |
|---|---|---|
| Sire | 103505 | TELESIS EUON FIRENZE |
| Dam | PMX-06-187 | VALDEN E TREASURE-ET S3F |
| MG Sire | 101169 | WHINLEA PALADIUM ELSTO-ET |
| MG Dam | PMX-02-150 | VALDEN INGAR THEO-ET S2F |
| MGG Sire | 97380 | SRB HANSENS INGMAR |
| MGG Dam | PMX-00-145 | VALDEN POSH AMBERLY-ET |

**Other Values**

| | |
|---|---|
| NZ HF % | 34 |
| NZ Jsy % | 0 |
| NZ Ayr % | 0 |
| NZ Total % | 34 |
| % White | 20 |
| Inbreed | 2.5 |
| Breed 16ths | F16 |

**Other BVs**

| | |
|---|---|
| Calving Diff | 3.9 / 96 / 3,853 |
| SGL | -0.8 |
| Body Cond | 0.16 |

**Single Genes**

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | A1A2 |
| Alpha SI Casein | |
| Beta Casein | |
| Beta Lactoglobulin | |
| BLAD | BLAD FREE |
| Citrullinaemia | citrullinaemia free |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | |
| Optimum | |
| Quantum | |
| Red Factor | |

**BW and BV History**

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 163 | 1,026 | 188 | 137 |
| 13/04/2013 | 165 | 1,023 | 156 | 135 |
| 09/03/2013 | 163 | 1,020 | 158 | 135 |
| 16/02/2013 | 164 | 1,017 | 158 | 134 |
| 12/01/2013 | 155 | 1,018 | 176 | 130 |
| 08/12/2012 | 153 | 1,018 | 177 | 129 |
| 10/11/2012 | 162 | 1,018 | 175 | 116 |
| 27/10/2012 | 162 | 1,023 | 180 | 108 |
| 13/10/2012 | 164 | 1,025 | 179 | 101 |
| 11/05/2013& | 216 | 994 | 124 | 0 |

& Latest ancestry proof

**TOP History**

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.73 | 0.58 | 0.80 | 101 |
| 16/02/2013 | 0.73 | 0.51 | 0.77 | 99 |
| 08/12/2012 | 0.79 | 0.48 | 0.75 | 96 |
| 06/10/2012 | 0.56 | 0.87 | 0.64 | 27 |
| 12/05/2012 | 0.38 | 0.57 | 0.49 | 0 |
| 11/02/2012 | 0.38 | 0.58 | 0.49 | 0 |
| 10/12/2011 | 0.39 | 0.60 | 0.52 | 0 |
| 08/10/2011 | 0.37 | 0.58 | 0.52 | 0 |
| 16/07/2011 | 0.43 | 0.58 | 0.51 | 0 |
| 14/05/2011 | 0.43 | 0.58 | 0.51 | 0 |

**Tot Long / Fert History**

| Extract date | Total Long | Fertility * |
|---|---|---|
| 26/04/2013 | 337 | 3.1 |
| 01/02/2013 | 320 | 3.3 |
| 27/04/2012 | 347 | 3.6 |
| 27/01/2012 | 332 | 3.8 |
| 01/07/2011 | 323 | 5.1 |

## LIC Bull Marketing Report — AE Run Date: 11/05/2013 — 28/05/2013

| 306011 | OKURA OM LAVA | Jersey 23/07/2005 | Current LIC Rank | Abbattoir REGISTERED JERSEY |
|---|---|---|---|---|

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 138/ 88 | | 4374/76 | 1339/90 | 165/57 | 192/49 | 108/59 | 25/08/2010 | 2006 |

**Traits other than production BVs**

| Management | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | 0.08 / 86 | slowly | quickly |
| Shed Temperament | 0.11 / 86 | nervous | placid |
| Milking speed | 0.19 / 81 | slow | fast |
| Overall opinion | 0.19 / 86 | undesirable | desirable |
| **Conformation** | 74 dtrs | | |
| Stature * | 0.37 / 91 | small | tall |
| Capacity | 0.85 / 88 | frail | capacious |
| Rump angle | 0.13 / 87 | high pins | sloping |
| Rump width | 0.05 / 87 | narrow | wide |
| Legs | 0.24 / 75 | straight | curved |
| Udder support | 0.38 / 91 | weak | strong |
| Front udder | 0.68 / 90 | loose | strong |
| Rear udder | 0.51 / 89 | low | high |
| Front teat placement | 0.16 / 90 | wide | close |
| Rear teat placement | -0.12 / 90 | wide | close |
| Udder overall | 0.61 / 85 | undesirable | desirable |
| Dairy conformation | 0.58 / 89 | undesirable | desirable |

* deviated within breed

**Production BVs**

| Fat | Protein | Milk Vol * | Livewt * | Fertility * | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 14 / 91 | 6 / 91 | 310 / 91 | 33 / 91 | -4.9 / 80 | 69 / 81 | 128 / 81 | -0.21 / 88 |
| 5.5% | 4.2% | | | | | | |

**Pedigree**

| | | |
|---|---|---|
| Sire | 300534 | OKURA MANHATTEN ET SJ3 |
| Dam | CFWR-03-77 | OKURA HEARTS LAVENDER |
| MG Sire | 99485 | WILLIAMS ACE OF HEARTS |
| MG Dam | CFWR-99-60 | OKURA ADMIRALS LULU ET |
| MGG Sire | 89429 | JUDDS ADMIRAL |
| MGG Dam | DYHY-93-7 | LAWMUIR WAI LASSIE |

**Other Values**

| | |
|---|---|
| NZ HF % | 0 |
| NZ Jsy % | 56 |
| NZ Ayr % | 0 |
| NZ Total % | 56 |
| % White | 0 |
| Inbreed | 5.8 |
| Breed 16ths | J16 |

**Other BVs**

| | | |
|---|---|---|
| Calving Diff | -3.0 / 70 | / 182 |
| SGL | -1.0 | |
| Body Cond | 0.10 | |

**Single Genes**

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | |
| Alpha SI Casein | BB |
| Beta Casein | A1A2 |
| Beta Lactoglobulin | AB |
| BLAD | |
| Citrullinaemia | |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | BB |
| Optimum | TT |
| Quantum | FP |
| Red Factor | |

**BW and BV History**

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 138 | -318 | 69 | 90 |
| 13/04/2013 | 135 | -316 | 67 | 90 |
| 09/03/2013 | 134 | -332 | 69 | 90 |
| 16/02/2013 | 133 | -355 | 71 | 90 |
| 12/01/2013 | 147 | -364 | 32 | 91 |
| 08/12/2012 | 150 | -358 | 29 | 91 |
| 10/11/2012 | 144 | -357 | 45 | 91 |
| 27/10/2012 | 144 | -357 | 45 | 91 |
| 13/10/2012 | 144 | -356 | 45 | 91 |
| 11/05/2013& | 220 | -431 | -108 | 0 |

& Latest ancestry proof

**TOP History**

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.19 | 0.61 | 0.58 | 74 |
| 16/02/2013 | 0.17 | 0.61 | 0.58 | 74 |
| 08/12/2012 | 0.18 | 0.64 | 0.58 | 75 |
| 06/10/2012 | 0.17 | 0.65 | 0.58 | 75 |
| 12/05/2012 | 0.20 | 0.62 | 0.59 | 75 |
| 11/02/2012 | 0.20 | 0.62 | 0.59 | 75 |
| 10/12/2011 | 0.14 | 0.60 | 0.60 | 75 |
| 08/10/2011 | 0.13 | 0.59 | 0.59 | 75 |
| 16/07/2011 | 0.10 | 0.61 | 0.53 | 75 |
| 14/05/2011 | 0.10 | 0.61 | 0.53 | 75 |

**Tot Long / Fert History**

| Extract date | Total Long | Fertility * |
|---|---|---|
| 26/04/2013 | 128 | -4.9 |
| 01/02/2013 | 119 | -5.0 |
| 27/04/2012 | 151 | -2.6 |
| 27/01/2012 | 138 | -2.8 |
| 01/07/2011 | 138 | -1.1 |

## LIC Bull Marketing Report — AE Run Date: 11/05/2013 — 28/05/2013

| 308066 | PUKETAWA MINS SUPERNOVA | Jersey 7/08/2007 | Current LIC Rank | Abbattoir REGISTERED JERSEY |
|---|---|---|---|---|

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 167/ 98 | | 5775/86 | 1436/99 | | 259/37 | 153/56 | 25/08/2010 | 2008 |

**Traits other than production BVs**

| Management | | -1 | 1 |
|---|---|---|---|
| Adaptability to milking | 0.44 / 94 | slowly | quickly |
| Shed Temperament | 0.43 / 93 | nervous | placid |
| Milking speed | 0.28 / 91 | slow | fast |
| Overall opinion | 0.55 / 94 | undesirable | desirable |
| **Conformation** | 222 dtrs | | |
| Stature * | 0.13 / 96 | small | tall |
| Capacity | 0.43 / 95 | frail | capacious |
| Rump angle | -0.04 / 94 | high pins | sloping |
| Rump width | 0.07 / 94 | narrow | wide |
| Legs | -0.06 / 86 | straight | curved |
| Udder support | 0.38 / 96 | weak | strong |
| Front udder | 0.34 / 96 | loose | strong |
| Rear udder | 0.71 / 96 | low | high |
| Front teat placement | 0.06 / 96 | wide | close |
| Rear teat placement | -0.13 / 96 | wide | close |
| Udder overall | 0.60 / 93 | undesirable | desirable |
| Dairy conformation | 0.41 / 95 | undesirable | desirable |

* deviated within breed

**Production BVs**

| Fat | Protein | Milk Vol * | Livewt * | Fertility * | Res Surv | Tot Long | SCC |
|---|---|---|---|---|---|---|---|
| 26 / 99 | 3 / 99 | 377 / 99 | 17 / 96 | -2.0 / 96 | 66 / 96 | 256 / 96 | -0.14 / 99 |
| 5.7% | 4.0% | | | | | | |

**Pedigree**

| | | |
|---|---|---|
| Sire | 300011 | WILLIAMS MINSTREL |
| Dam | BHYD-05-61 | PUKETAWA OM SERENITY |
| MG Sire | 300534 | OKURA MANHATTEN ET SJ3 |
| MG Dam | BHYD-98-77 | PUKETAWA GLO SIOUX GR |
| MGG Sire | 94451 | GLOAMING SS FOREVER GR |
| MGG Dam | XKC-95-141 | FERNAIG ADMIRAL SUZI SJ3 |

**Other Values**

| | |
|---|---|
| NZ HF % | 0 |
| NZ Jsy % | 71 |
| NZ Ayr % | 0 |
| NZ Total % | 71 |
| % White | 0 |
| Inbreed | 4.9 |
| Breed 16ths | J16 |

**Other BVs**

| | | |
|---|---|---|
| Calving Diff | -2.9 / 98 | / 7,666 |
| SGL | -3.4 | |
| Body Cond | 0.14 | |

**Single Genes**

| Cattle Locus Descr | Phenotype Descr |
|---|---|
| A2 | |
| Alpha SI Casein | BC |
| Beta Casein | A1A2 |
| Beta Lactoglobulin | AA |
| BLAD | |
| Citrullinaemia | |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | BB |
| Optimum | TT |
| Quantum | FF |
| Red Factor | |

**BW and BV History**

| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 167 | -251 | 66 | 2,162 |
| 13/04/2013 | 169 | -247 | 53 | 2,150 |
| 09/03/2013 | 175 | -242 | 49 | 2,133 |
| 16/02/2013 | 181 | -229 | 43 | 2,095 |
| 12/01/2013 | 188 | -215 | -38 | 2,075 |
| 08/12/2012 | 188 | -207 | -38 | 2,014 |
| 10/11/2012 | 192 | -206 | -37 | 1,861 |
| 27/10/2012 | 194 | -203 | -44 | 1,673 |
| 13/10/2012 | 195 | -199 | -44 | 1,208 |
| 11/05/2013& | 221 | -228 | -1 | 0 |

& Latest ancestry proof

**TOP History**

| AE Run Date | OO | UO | DC | TOP Dtr Count |
|---|---|---|---|---|
| 11/05/2013 | 0.55 | 0.60 | 0.41 | 222 |
| 16/02/2013 | 0.55 | 0.60 | 0.42 | 223 |
| 08/12/2012 | 0.64 | 0.67 | 0.41 | 202 |
| 06/10/2012 | 0.47 | 0.67 | 0.43 | 105 |
| 12/05/2012 | 0.52 | 0.71 | 0.48 | 100 |
| 11/02/2012 | 0.53 | 0.68 | 0.48 | 98 |
| 10/12/2011 | 0.48 | 0.58 | 0.40 | 83 |
| 08/10/2011 | 0.29 | 0.77 | 0.55 | 36 |
| 16/07/2011 | 0.24 | 0.46 | 0.42 | 0 |
| 14/05/2011 | 0.24 | 0.46 | 0.42 | 0 |

**Tot Long / Fert History**

| Extract date | Total Long | Fertility * |
|---|---|---|
| 26/04/2013 | 256 | -2.0 |
| 01/02/2013 | 248 | -2.0 |
| 27/04/2012 | 227 | -0.1 |
| 27/01/2012 | 213 | -0.1 |
| 01/07/2011 | 299 | 2.1 |

LIC **Bull Marketing Report** **AE Run Date: 11/05/2013** 28/05/2013

| 309030 | TAWA GROVE KRC TANA | Jersey 12/08/2008 | Current LIC Rank 14 | Newstead Centre Bulls REGISTERED JERSEY |
|---|---|---|---|---|

| BW | aeBW / Rel | BW / Rel | | OAD / Rel | Hi / Rel | APR / Rel | EBI / Rel | PLI / Rel | Updated | SPS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 191 / 79 | | 6359/67 | 1636/83 | | | | 25/08/2010 | 2009 |

| Traits other than production BVs | | | |
|---|---|---|---|
| **Management** | | -1 | 1 |
| Adaptability to milking | 0.30 / 86 | slowly | quickly |
| Shed Temperament | 0.30 / 86 | nervous | placid |
| Milking speed | -0.01 / 81 | slow | fast |
| Overall opinion | 0.38 / 86 | undesirable | desirable |
| **Conformation** | 75 dtrs | | |
| Stature * | -0.11 / 90 | small | tall |
| Capacity | 0.73 / 87 | frail | capacious |
| Rump angle | -0.18 / 86 | high pins | sloping |
| Rump width | -0.23 / 85 | narrow | wide |
| Legs | 0.02 / 71 | straight | curved |
| Udder support | 0.44 / 90 | weak | strong |
| Front udder | 0.80 / 89 | loose | strong |
| Rear udder | 0.43 / 88 | low | high |
| Front teat placement | 0.05 / 89 | wide | close |
| Rear teat placement | -0.16 / 89 | wide | close |
| Udder overall | 0.81 / 83 | undesirable | desirable |
| Dairy conformation | 0.66 / 88 | undesirable | desirable |

* deviated within breed

| Production BVs | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fat | Protein | Milk Vol * | Livewt * | Fertility * | Res Surv | Tot Long | SCC |
| 11 / 83 | 3 / 83 | 41 / 86 | 6 / 90 | -1.6 / 64 | 83 / 66 | 214 / 66 | -0.08 / 80 |
| 5.8% | 4.4% | | | | | | |

| Pedigree | | |
|---|---|---|
| Sire | 303029 | KIRKS RI CHARISMA ET GR |
| Dam | CVVK-03-125 | TAWA GROVE ACES TAMMY |
| MG Sire | 99485 | WILLIAMS ACE OF HEARTS |
| MG Dam | CVVK-00-75 | TAWA GROVE QUEUES |
| MGG Sire | 95465 | COGDEN YABBA DABBA DO |
| MGG Dam | CVVK-98-75 | TAWA GROVE OCHID |

| Other Values | |
|---|---|
| NZ HF % | 0 |
| NZ Jsy % | 82 |
| NZ Ayr % | 0 |
| NZ Total % | 82 |
| % White | 0 |
| Inbreed | 4.6 |
| Breed 16ths | J16 |

| Other BVs | | |
|---|---|---|
| Calving Diff | -3.3 / 61 | / 165 |
| SGL | -5.1 | |
| Body Cond | 0.00 | |

| Single Genes | |
|---|---|
| Cattle Locus Descr | Phenotype Descr |
| A2 | A2A2 |
| Alpha SI Casein | |
| Beta Casein | |
| Beta Lactoglobulin | |
| BLAD | BLAD FREE |
| Citrullinaemia | |
| CVM | CVM FREE |
| Factor XI | |
| Kappa Casein | |
| Optimum | |
| Quantum | |
| Red Factor | |

| BW and BV History | | | | |
|---|---|---|---|---|
| AE Run Date | BW | Milk Volume | Res Surv | Vol Dtr Count |
| 11/05/2013 | 191 | -587 | 83 | 78 |
| 13/04/2013 | 192 | -572 | 103 | 77 |
| 09/03/2013 | 197 | -550 | 93 | 77 |
| 16/02/2013 | 209 | -450 | 71 | 73 |
| 12/01/2013 | 198 | -423 | -131 | 73 |
| 08/12/2012 | 198 | -386 | -135 | 73 |
| 10/11/2012 | 147 | -558 | -61 | 67 |
| 27/10/2012 | 148 | -560 | -65 | 62 |
| 13/10/2012 | 149 | -561 | -64 | 61 |
| 11/05/2013& | 148 | -762 | -38 | 0 |

& Latest ancestry proof

| TOP History | | | | |
|---|---|---|---|---|
| AE Run Date | OO | UO | DC | TOP Dtr Count |
| 11/05/2013 | 0.38 | 0.81 | 0.66 | 75 |
| 16/02/2013 | 0.36 | 0.83 | 0.63 | 71 |
| 08/12/2012 | 0.42 | 0.85 | 0.64 | 66 |
| 06/10/2012 | 0.30 | 0.84 | 0.48 | 27 |
| 12/05/2012 | 0.34 | 0.76 | 0.33 | 0 |
| 11/02/2012 | 0.34 | 0.76 | 0.33 | 0 |
| 10/12/2011 | 0.35 | 0.77 | 0.34 | 0 |
| 08/10/2011 | 0.33 | 0.78 | 0.37 | 0 |
| 16/07/2011 | 0.30 | 0.74 | 0.38 | 0 |
| 14/05/2011 | 0.30 | 0.74 | 0.38 | 0 |

| Tot Long / Fert History | | |
|---|---|---|
| Extract date | Total Long | Fertility * |
| 26/04/2013 | 214 | -1.6 |
| 01/02/2013 | 227 | -1.9 |
| 27/04/2012 | 132 | 2.2 |
| 27/01/2012 | 141 | 2.3 |
| 01/07/2011 | 132 | 1.6 |