

The Use of Crossbred Sires (Holstein-Friesian/Jersey) in the New Zealand Dairy Industry

A Farmers Perspective

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1. Preface

This research is done by Lianne Zonneveld, a fourth year student Applied Animal Science at Van Hall Larenstein in Wageningen, as a final thesis.

I have always been interested in breeding of dairy cattle and I also wanted to go to a foreign country. Because of that I wrote a letter to CRV AmBreed and they came up with this research about the use of crossbred bulls in the New Zealand dairy sector. The research was exactly what I wanted, contact with farmers, going to an other country and studying a new subject.

I like to thank everyone involved in this project and everyone which has been a great help to me. Especially my supervisor from CRV AmBreed, Peter Berney, marketing manager, Phil Beatson, Genetic Development Strategist, and Philip Fourie, Sales manager. I also want to thank Lyn Goodall for sharing her office with me for 5 months.

And off course I do not want to forget the support from Holland from my supervisor from Van Hall Larenstein, Ina Meijer, and last but certainly not least my parents and family for supporting and encouraging me to make this great journey!

2. Abstract

In New Zealand most dairy cows are farmed outside on the pasture year round, which gives them low cost farming. Nearly all dairy farming is pasture based and calving is very seasonal. Farmers have to deal with environmental influences and variable terrain. Because of this the dairy cows need to be robust and strong, and have to be able to cope with variable conditions. Production of milk solids and fertility are the key drivers for farming profit.

Holstein-Friesians are larger and produce more than Jerseys, therefore they need more feed. Milk solid production per liter of milk is higher in Jerseys, but the Holstein-Friesian produces higher milk yield. Jerseys also have a higher fertility and greater calving ease than Holstein-Friesians and this, plus the advantage of hybrid vigor, started the move to crossbreeding in 1980.

Because of all those things farmers started crossbreeding in 1980. Holstein-Friesians and Jerseys were the most used for crossbreeding but also Ayreshires did play an important role in the crossbred population. But by getting better results with Jerseys and Holstein-Friesians Ayreshires are being less and less used in crossbreeding for milk production purposes.

Due to all the good results they had with the crossbreeding AI companies came with the first crossbred bulls in 2002. Since then, the use of crossbred bulls (Holstein-Friesian/Jersey) has increased significantly and in 2007/2008, 17.4% of all the semen sold in New Zealand was from crossbred bulls (NZ Dairy Statistics, 2007-08).

But why are farmers using crossbred bulls? And more important are they satisfied with the results? The research covered 302 dairy farmers in New Zealand. With interviews at Fieldays, a website survey and on farm visits.

Based on the results of the interviews done for this research, 55% of the farmers use crossbred bulls. Eighty-eight percent of the 55% were satisfied with these bulls. There were no real differences in decision making between farmers who were satisfied or unsatisfied with crossbred bulls, or between those using crossbred bulls and those not using them. The most important traits during selection were fertility, protein and udders. The order of importance varied, but only for those farmers un-happy with crossbred bulls ranked capacity higher than fertility.

Further, 17.3% of the herd Breeding Worth's (BW, *¹) given by the farmers was higher than the average BW in the national dairy herd of New Zealand. And this was the same for 24.7% of all the Production Worth's (PW, *²) given by them.

The most important reasons for using crossbred bulls are to improve:

- calving ease
- easy to use on crossbred cows (less difficult during bull selection)
- size of cow (smaller Holstein-Friesian, bigger Jersey)

These are seen as the key advantages of crossbred bulls over purebred bulls. Size seems to be the most important advantage, followed by easy calving, and simplicity of crossbreeding. Farmers see the use of crossbred bulls as simple because they think they have to pay less attention to selection than when they use purebred bulls.

Noticeable from the survey results is that most farmers do not (yet) see any disadvantages. Those that do, mention the variability they get in their herd and the loss of hybrid vigor.

The survey results made also clear that farmers who do not use crossbred bulls either have a purebred herd or they are crossing with purebred bulls.

Criss crossing is described as a good way to get good crosses, but, for many New Zealand farmers it is too complicated and too time consuming.

Farmers use crossbred bulls to get their ideal cow for their circumstances. The expectation is that the use of crossbred bulls will be increasing in the future. Large commercial farms seem to like using crossbred bulls because of ease of use and management (fertility and calving

ease) of the resulting progeny. To get big clients like this it is almost necessary to have a good team of crossbred bulls. Criss crossing does not seem to be a preferred option for large commercial farms as well as many smaller farmers, as if it is too complicated and too time consuming. To get the crossbred cow they like so much it is logical for them to use crossbred bulls.

*¹ BW ranks bulls and cows on their expected ability to breed replacements which will be efficient converters of feed into farmer profit (Animal Evaluation Unit, 2009). An extended explanation and an example of a calculation can be found on the following website <http://www.yourindex.co.nz/bullindexes.htm>.

*² Cows are given Production Values for the four individual traits of Milkfat, Protein, Volume, and Liveweight, and these are then combined into a PW using Economic Values (Animal Evaluation Unit, 2009). An extended explanation and an example of a calculation can be found on the following website <http://www.yourindex.co.nz/bullindexes.htm>.

3. Introduction

Since the season of 2000/2001 crossbred bull semen is used because of the good performance of the crossbred cows. Since that season the demand of crossbred semen in the market is growing. Last season (2007/2008) it was 17.4% of all the inseminations registered against 55% Holstein-Friesian and 23% Jersey semen. Because of the growing demand of crossbred semen the demand of Jersey and Holstein-Friesian semen is slowing down. The absolute number of AI in New Zealand dairy per year has grown from 2,727,065 in the season of 1999/2000 to 3,017,112 in the season of 2007/2008 (NZ Dairy Statistics, 2007-08).

Using Crossbred semen has been seen as a logical extension of crossbreeding - it is simpler and 50-60% of heterosis can be retained. Using crossbred semen from the first cross (F1) will not influence the hybrid vigor too much. But the problem will probably start by using crossbred semen from the 3rd cross. The hybrid vigor will get less and less especially when the semen is used on crossbred cows (Phil Beatson 'personal communication').

Now there is anecdotal evidence from the field of farmers that have gone away from using crossbred semen because of major problems with the increased variation. Instead of getting a consistent line of black medium sized cows with good fertility and production, they are getting big differences in their herds, big cows, small cows, indifferent calving etc.

Crossbred semen accounts for around 17.4% of the semen sold in New Zealand but would be around 7% of the whole AmBreed sales, the rest of the sales is been done at LIC (Livestock Improvement Corporation). LIC is giving what the market is asking for which means that the use of crossbred bulls by them is growing.

But at CRV AmBreed questions came up about the whole concept because of the effect it can have on a herd's genetic makeup.

This research is giving an answer to the following questions:

Main Question:

How is the performance of the crossbred bull progeny and why are crossbred bulls used?

Sub Questions:

- What is the reason for using cross bred bulls?
- What is the reason for stop using or not using cross bred bulls?
- What are the most common breeding goals of farmers using cross bred bulls?
- What are the most common breeding goals of farmers stop or not using cross bred bulls?
- What are the advantages of using cross bred bulls over using pure bred bulls?
- What are the disadvantages of using cross bred bulls over using pure bred bulls?

For CRV AmBreed it is important to get an answer to the question if the use of crossbred bulls will be an improvement of the dairy population or if it will cause problems on the longer term. To get an answer on this enough data from the field is needed to allow making an assessment of the crossbred bull progeny. To get this data and to get answers on the research questions a desk study will be done, farmers will be surveyed and experts will be interviewed. If the answer is positive, the breeding program will be adjusted, if negative it will be attacking the credibility of the crossbred bulls. The results of this project will have a significant impact on CRV AmBreeds strategy in the market.

4. Literature Review

4.1 Industry Background

In the season of 2007/2008 New Zealand had 11,436 dairy herds, the total number of cows in the country was 4,012,867 on 1,436,549 hectares. The average herd size was 351 cows on an average 126 hectares. This is on average 2.83 cows per hectare. The production of milk solids (fat and protein) for that season was per hectare 873 kg and per cow 307 kg. The average milk solids per herd were 111,033. From the time milk solids were measured in 1992/93 the production of milk solids per hectare is increased with 220 kg and per cow with 48 kg. The average liters milk for the 2007/2008 season per herd was 1,289,337, and per cow 3,567 liters (NZ Dairy Statistics, 2007-08).

More than 90% of the milk produced in New Zealand is processed in milk products for export to the global market. To survive in the industry low cost systems are needed for the production of milk because large distances from the major markets are making transport costs high (Montgomerie, 2002).

To get the storing, transporting and evaporating water in milk costs as low as possible farmers are rewarded for supplying milk with high concentrations of milk solids (a combination of fat and protein) and are paying a milk volume deduction per liter supplied. From the milk solids protein is the highest valued, fat is around half the worth of protein (Montgomerie 2002).

Body Maintenance is the main part where the total farm feed supply is going to. Because the amount of feed needed for body maintenance differs between cows of a larger and a smaller body size milk solids per kilogram of metabolic liveweight is used as a measure for cow efficiency. Net income per hectare of available grazing land is another measure which is taking this into account. Income per cow is not important for New Zealand farmers (Montgomerie, 2002). This is important to know to better understand why New Zealand dairy farmers make certain decisions.

To keep the production costs of milk as low as possible farming in New Zealand is pasture based. Cows have to be efficient converters of grass into milk, because most of them are on the pasture the whole year. Therefore there is the Breeding Worth (BW). The BW is ranking animals on their expected ability to breed profitable and efficient offspring regardless of breed. A BW of 150 indicates that the bull or cow is expected to generate an extra \$nz150 per year per unit of feed, per breeding replacement, compared to using a cow or bull with a BW of 0 (Animal Evaluation Unit, 2009). An extended explanation and an example of a calculation can be found on the following website <http://www.yourindex.co.nz/bullindexes.htm>. The average BW per herd in 2007/08 was 130 (Dairy NZ, 2008).

Because dairy farming in New Zealand is pasture based it is important to match the production peak with the peak of the grass growth. In this way the production can stay as high as possible by keeping the feeding costs as low as possible. That's why seasonal calving is maintained. Important in seasonal calving is to get your cows back in calf quick enough to maintain a calving interval of around 365 days without too much trouble. Every cow which is not in calf quick enough is costing money or means a loss.

Another way to stay low cost is to reduce the rates of involuntary culling. Reproduction, health and survival are important non-production traits which are important by reducing the costs. In this way farmers try to be as efficient as possible and they want to reduce replacement costs with adding total longevity or length of productive life (Pyman, 2006).

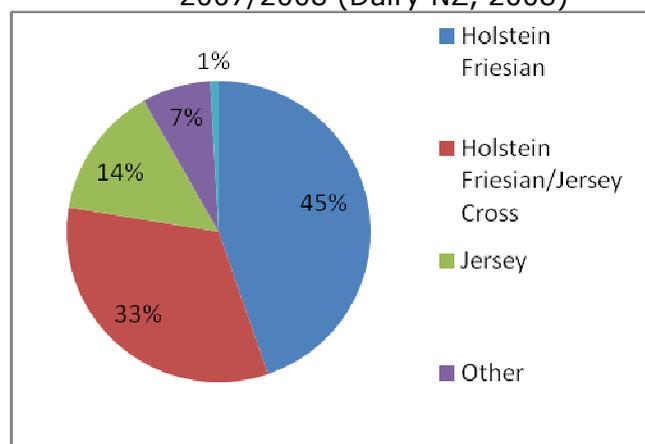
Liveweight and body size are also important measures for New Zealand dairy farmers. Big heavy animals are damaging the pasture more than smaller and lighter animals. And for smaller and lighter animals it is easier to walk the, sometimes steep, mountains which can be found in New Zealand.

4.2 Breed History

While the Jersey was the dominant dairy breed in New Zealand in 1955 (75%), due to farm management changes and raising more beef calves the Holstein Friesian was the dominant breed in 1970 (Pyman, 2006). This because Holstein-Friesians are more suitable for crossing with a beef breed than Jersey cows. The amount of imported overseas genetics increased and with that the milk production per cow, milk production per hectare, stocking rate and average herd size.

Since 1985 crossbreeding has been applied by New Zealand dairy farmers. Most crossbreeding is done with Jersey and Holstein-Friesian cows, although Ayrshires are also used for this purpose but at a low level (Montgomerie, 2002). From the moment crossbreeding was applied for the first time till now the amount of crossbred cows is increasing more and more. In the 2007-2008 season 32.8% of the cows in New Zealand were crossbred cows, 45% where Holstein-Friesians and 14% Jerseys (Dairy NZ, 2008).

Graph 4.2.1 Percentage of each breed in the national dairy herd of New Zealand in season 2007/2008 (Dairy NZ, 2008)



4.3 Breed performance

In New Zealand dairy farming is low cost and pasture based with seasonal calving. As explained above in paragraph 4.1, the farmers are rewarded the best by dairy companies for their milk solids. New Zealand farmers tend to have problems with the high feed intake and the, compared to the Jersey breed, the relatively low percentages of milk solids of pure Holstein-Friesians. Because they need more feed for the same amount of milk solids but their milk yield is higher and a reduction has to be paid for that. The Jersey needs less feed and has higher concentrations of milk solids but the milk yield of the Jersey is much lower than from the Holstein-Friesian.

As can be seen in table 4.3.1 the crossbred cow seems to have the highest kg of milk solids per kilogram of metabolic liveweight which is an important measure in the New Zealand dairy industry. The difference might only seem small but it is important for farmers because it tells them something about the efficiency of the breed.

Table 4.3.1. Average cow performance by breed 2007/2008 season (NZ dairy statistics 07-08).

	Holstein Friesian	Jersey	Crossbred
Number of cows	948,35	353,985	817,777
Milk Volume (L)	4,043	2,835	3,61
Milk solids (kg)	317.6	275.6	313.5
Liveweight (kg)	487	385	444
Milk solids per Kilogram metabolic liveweight * (kg)	3.06	3.17	3.24
Milk Fat (%)	4.35	5.66	4.93
Milk Protein (%)	3.56	4.09	3.81

*Defined as liveweight^{0.75}

The Breeding Value (BV) of an animal is the genetic merit of an animal for individual traits. The BV's are based on a cow born in 1985 and are set to zero. A breeding value of +40 indicates that a bull or a cow will produce daughters, which on average are genetically superior by 20 kg per lactation above the base cow (the 20 kg is because a parent on average only transmits half of its genetic merit onto its offspring) (Animal Evaluation Unit, 2009).

If you look at the breeding values in table 4.3.2 for the most important traits you can see differences between the different breeds. Jerseys have for example a better BV for somatic cell score, fertility, residual survival and liveweight. The last one is negative, which means that the weight will go down, which is positive in this case because smaller animals are wanted. The BW is also the highest for Jersey cows, which should mean that a Jersey cow will make the highest profit for a farmer. But the BV for milk fat and protein are higher for Holstein-Friesians, same as the BV for milk volume, which can be unprofitable in this case because of the volume deduction.

The Holstein-Friesian/Jersey crossbred cow is for no trait the best or the worst but is average everywhere. The breeding value for milk fat and protein are higher than from a Jersey but liveweight, somatic cell, fertility and residual survival are better than from a Holstein-Friesian. This is making the crossbred cow (Holstein-Friesian / Jersey) an all round cow.

Table 4.3.2. Average Breeding Worth and Breeding Values of all cows from the main breeds born in 2005 (NZ dairy statistics 2007-08).

	Holstein-Friesian	Jersey	Holstein-Friesian/Jersey
BW \$	135.3	172.1	156.3
Milk fat BV (kg)	32.1	24.2	29.2
Protein BV (kg)	34.7	13.9	25.4
Milk Volume BV (l)	1,012	29	560
Liveweight BV (kg)	60.3	-31.8	17.8
Somatic Cell BV (score)	0.34	0.24	0.29
Fertility BV (%)	-0.4	1.0	0.5
Residual Survival BV (days)	-58	-42	-51
Cow Numbers	402,230	130,286	271,455

A bull needs more than 400 daughters and a BW reliability of over 95% before his information is starting to be trustworthy. When a proven bull is around 8 years old he will get his reproof. This will give the data from all his progeny and his own performance. Everything will be taken in account again. Some think crossbred bulls are being worse in the reproof than purebred bulls. After comparing the different breeds in different years the average reproof results per breed as given in table 4.3.3 came up. But having only a few crossbred bulls per year that are trustworthy enough to compare with the purebred bulls makes it hard to get proper results. What can be found with the small amount of data available is that the results per year per breed are quite different what makes it hard to make a conclusion about crossbred bulls coming bad worse than purebred bulls during the reproof.

Table 4.3.3 Average Breeding Values of bulls from different breeds after their reproof (Animal Evaluation System)

	Fertility	Udders	Protein	BW
1998 Crossbreds	5.225	-0.359	4.05	115.075
Friesians	-0.825	0.425	3.575	176.35
Jerseys	3.125	0.013	4.175	178.225
2000 Crossbreds	1.063	0.285	3.925	137.71
Friesians	-0.513	0.335	3.625	183.213
Jerseys	1.6	0.305	4.088	168.288

4.4 Heterosis

An important reason for crossbreeding is heterosis or hybrid vigor. Because of heterosis the crossbred offspring performs better than the average of the purebred parental lines. Heterosis is caused by dominance and epistasis. Dominance is the interaction between alleles at the same locus and epistasis is the interaction of alleles at different loci. It is about the specific combining ability of two lines (Van Arendonk et al, 2006).

Table 4.4.1 below will give more information about the general percentage of heterosis maintained in the different ways of crossbreeding. As can be seen rotational crossing is the best way to keep a high percentage of heterosis in your herd. But rotational crossing will take more time for bull selection as well for the choice of which bulls to buy as during the insemination where the cows will be inseminated with a certain bull. Because of that most New Zealand farmers are seeing rotational crossing as no option in their big herds with having more cows to be inseminated on one insemination moment.

Table 4.4.1. Heterosis as a percentage of full heterosis for different types of crosses (Van Arendonk et al, 2006)

Type of cross	Heterosis %
F1 (S x T)	100
F2 (S x T) x (S x T)	50
Back cross S x (S x T) or T x (S x T)	50
Second generation of a rotational cross S x (T x (S x T))	75
Third generation of a rotational cross T x (S x (T x (S x T)))	62.5
Rotational cross after many generations	66.6
Second generation of a synthetic line (=F2) (S x T) x (S x T)	50
Third generation of a synthetic line (=F3) (S x T) x ((S x T) x (S x T))	50
Synthetic two-breed line after many generations	50
Synthetic three-breed line after many generations	66.6

S= Breed 1, T= Breed 2

The heterosis will differ between crosses of different breeds because it depends on the difference in allele frequency between the pure breeds. In this research the surveys that have been done are about crosses between crossbred bulls and purebred cows or with crossbred bulls and crossbred cows. The research is especially focused on Holstein-Friesian/Jersey crosses (bulls and cows) and purebred Holstein-Friesian and Jersey cows to get crossbred replacement.

4.5 Crossbred bulls

Since farmers started crossing in 1985 the pool of crossbred cows in the national herd was increasing. Because of the increasing demand of crossbred cows and the BW system which is regardless of breed it was possible to define bull mothers in this crossbred pool.

But the progeny from the crossbred cows will be crossbreds also. Because of that the use of crossbred bulls to breed bulls and cows must be accepted (Lopez Villalobos, 1998).

In 2000 breeding companies came out with their first crossbred bulls on the market. And since then they have been growing in popularity. The sales of crossbred bull semen are increasing while the sales of Jersey and Holstein-Friesian semen are decreasing (New Zealand Dairy Statistics, 2007-08).

There are no scientific papers on this subject which are useful. A lot of research is done about 'normal' crossbreeding in New Zealand but also in foreign countries. But no researches are done yet about the use of crossbred bulls in dairy cattle. Crossbred sires are used a lot in beef, sheep and pigs but all the researches done are on the performance of carcass growth. Meat production is important in these species and most animals are not used for further breeding like dairy cows are. This is the difference with the crossbred sires used with dairy farming, and that is the reason for some concern from several people about using these bulls, it is not clear where it is going on the long term with crossbred bulls. The cow has to give the profit and has to deliver proper replacement, so breeding is very important in dairy farming. But it is still too early to make a good analysis about the performance of the progeny of crossbred bulls because they are not used long enough for that. Problems that might arise are too much variety in the herd in different traits and the least wanted qualities might come up.

5. Methods

The research will be carried out by both desk study and field study. A literature research is done and information from colleagues at CRV AmBreed was gathered to get a feeling about what is going on in the New Zealand dairy sector and to get a better understanding of the meaning of this research. Questionnaires will be made, farmers will be surveyed and talked to at Fielddays (a large agricultural event) and on location and experts will be interviewed. It is a quasi experimental research. This is a case study.

An analysis will be done with excel. Graphs will be made and analyzed.

1. Getting informed about breeding cattle in New Zealand:
 - What do farmers want by choosing bulls for their herd?
 - How is the breeding market divided?
 - What is the history of the New Zealand dairy industry?
2. Identifying farmers from the CRV AmBreed records and from the field staff:
 - Farmers which are using cross bred bulls long enough to have data on the performance of the progeny (At least 3 years).
 - Farmers which are already using cross bred bulls for a long time.
 - Farmers who have used crossbred bulls but who stopped using them.
 - How much and which data is available from the CRV AmBreed database and how much more is needed? How to get that data? LIC, contacting farmers?
3. Identifying other people or organizations which can have an opinion or data on the use of crossbred bulls:
 - Think of (independent) farm consultancies, veterinarians, field staff of CRV AmBreed, experts in the field of breeding, genetics and/or dairy farming.
4. Contacting the experts who are having an important role on the market to get their opinion about the advantages and disadvantages of the use of cross bred bulls.
 - Making a questionnaire per expert (their importance, view and expertise can be different).
 - John Rendel; geneticist by Landcorp Farms (They use cross bred bulls).
 - Bill Montgomerie; working for AEU, the company that runs the national database.
 - Other experts identified by step 3.
5. Data collection by contacting the farmers and interview them:
 - Making a questionnaire for the farmers.
 - Gather information about the management, breeding goal, opinion etc of the farmers.
6. Managing a database:
 - The collected data must be managed in an organized sheet in excel.
 - The database must be able to make calculations, tables, graphs and if necessary statistical calculations or must be able to copy the data to a program which is able to do this.
 - Subdivisions have to be made in the data by the answers given during the interviews.
7. Doing a survey at Fielddays:
 - A survey at Fielddays will be done among farmers. At least 150 farmers over 3 days have to be interviewed to get a reliable overview.
 - A questionnaire has to be made to answer the sub questions.
 - The survey will be done by the assignee with a touch computer from the Touchpoll company and farmers inside the CRV AmBreed tent and walking beside will be randomly picked out for an interview. They will assist in making questions, will put all the data together and will make a report from the results.
 - Arrangements have to be made with the Touchpoll company.
8. Doing a survey at the website
 - A survey on the website will be done among farmers. 150 farmers are needed which will make the total amount of farmers helping in this research 300.
 - A questionnaire has to be made to answer (sub)questions.
 - An email has to be send to all the 'clients' in the system.
9. The data have to be analyzed and interpreted:
 - Excel will be used for this.

The (sub)questions have to be answered.

10. The data and the analyses have to be evaluated:

Is there enough data?

Is the data relevant enough?

If necessary more data can be collected or adjustments can be made.

11. A conclusion has to be drawn:

A final conclusion will decide what to do with the use of cross bred bulls.

Eventual there can be thought about an alternative 'program' to use.

6. Results

Surveys have been done in different ways. One survey was made for Fielddays where 189 farmers were interviewed and gave their opinion about the use of crossbred bulls. The survey was made of questions where the answers had to give an idea about the situation among the use of crossbred bulls. The survey questions can be found in the appendix in paragraph 11.2.

The website survey includes 105 farmers. The survey on the website are an improved version of the Fielddays survey. After Fielddays more questions came up and those are added. An invitation was made by email to everyone with a known email address, this includes CRV AmBreed clients but also clients of other companies. There was also placed a link on the website that was leading to the survey which had to attract farmers which were not in the CRV AmBreed email database. The survey questions can be found in the appendix in paragraph 11.4.

Further 8 farmers have been visited. The farmers were chosen by the field consultants of CRV AmBreed. Because they know what the farmers order, which bulls they use and for how long they use those bulls. Different kind of clients were coming up here, some did use crossbred bulls for a long time already, other ones just started to use them, some didn't like them at all and also clients from other companies were surveyed. Again similar sorts of questions were asked but the survey was also adjusted a few times when more questions came up. The survey questions can be found in the appendix in paragraph 11.3.

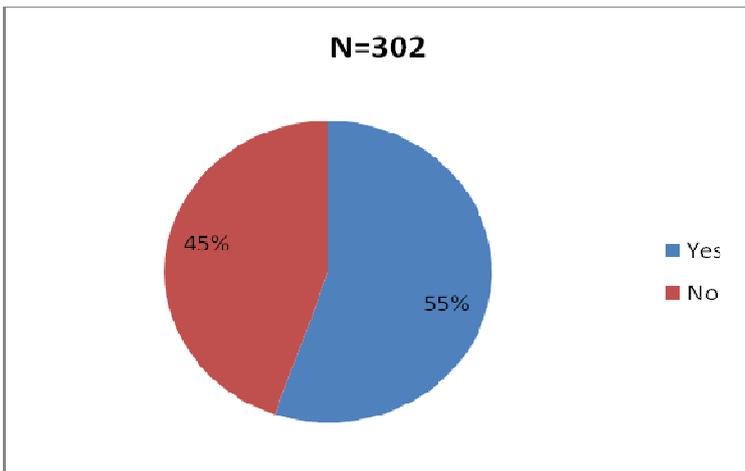
By doing the surveys on Fielddays and at the website without asking for names and who's client they are the surveys should have been open to do for all the farmers without having an opinion about different companies. The timing of the surveys, right before the new calving season when farmers are busy with gathering information about the different companies and their products is making the change of getting a wide spread of different farmers also larger. Therefore the survey results are likely to be seen as a general opinion of New Zealand dairy farmers.

There has also been interviews with two experts from the field. No question list was made for them but the idea was to let them talk about the subject themselves. When asking questions they might have been limited in what they would have said, while the idea was to get as much of their thoughts about the subject as possible.

6.1 Using Crossbred Bulls

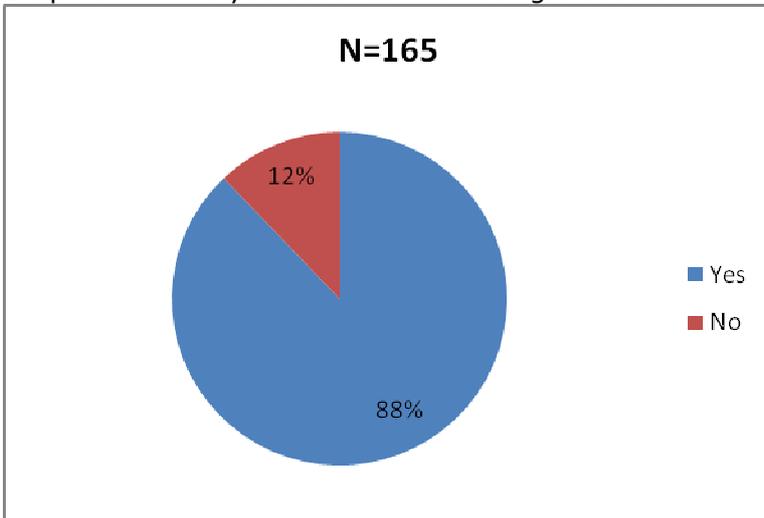
In total 55% of the interviewed farmers are using crossbred bulls and 45% are not. There is also looked at the difference between the outcome of the Fielddays and the website survey to see if there is a difference and if there is a difference of the total outcome can be truly seen as general or not. The percentage of farmers using crossbred bulls is different for the Fielddays survey and the survey on the website. Were 40% of all the farmers interviewed at Fielddays were using crossbred bulls, 80% of farmers which filled in the website survey did or do use them. If those outcomes are compared with the total outcome there can be said that the total outcome can be seen as general for all New Zealand farmers.

Graph 6.1.1 Do you use crossbred bulls?



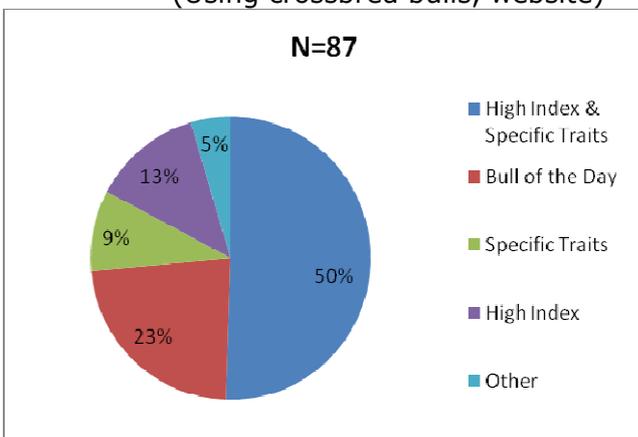
From all the farmers using crossbred bulls, 88% are satisfied with the results. On the website 84% were satisfied, and during Fielddays 92%. This percentage is very high and indicates that most farmers using crossbred bulls are satisfied with them and are getting the results they want.

Graph 6.1.2 Are you satisfied with using crossbred bulls?

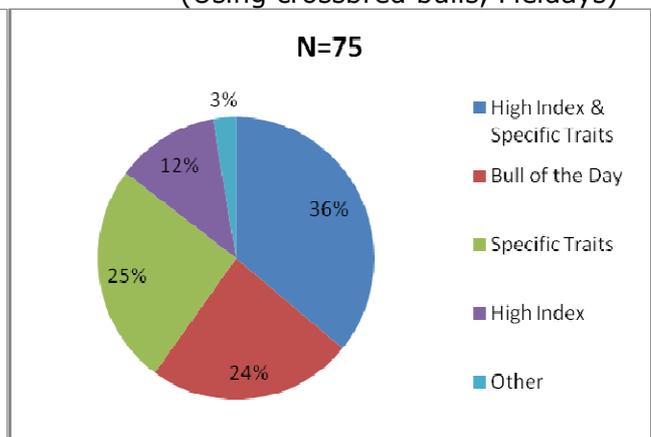


There are different ways farmers are choosing bulls. Some are just looking at the index (BW), some are looking at traits or both and other ones are choosing a breed and going for bull of the day (LIC's Premier Sires, no choice on bulls). Farmers that are using crossbred bulls select them as shown in these graphs.

Graph 6.1.3 Where do you select on?
(Using crossbred bulls, website)



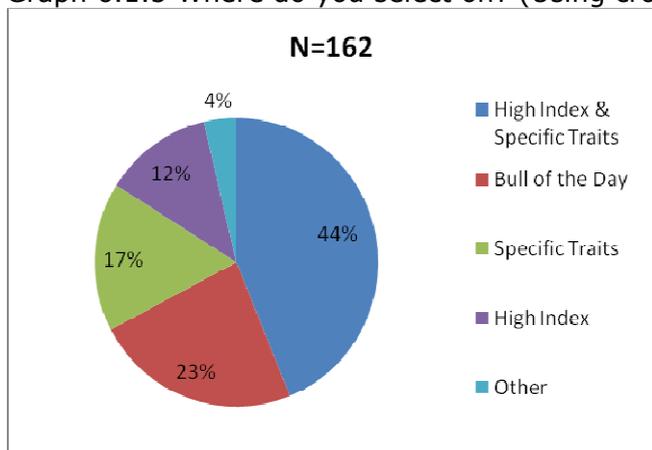
Graph 6.1.4 Where do you select on?
(Using crossbred bulls, Fielddays)



For both the website survey and the survey done on Fieldays, most farmers are selecting on a combination of High Index of BW and specific traits. For the website survey this is 50% and for the Fieldays survey 36% and very close after that with 25% for specific traits. These outcomes are different for the percentage of farmers selecting on specific traits from by the website survey were this was only 9%. Bull of the day is doing better here with 23% were it is only 17% at Fieldays. The difference here may have been a result of the Fieldays survey taking place on the CRV AmBreed site, and bull of the day being an LIC product. High index is further almost equal with 13% on the website and 10% from Fieldays.

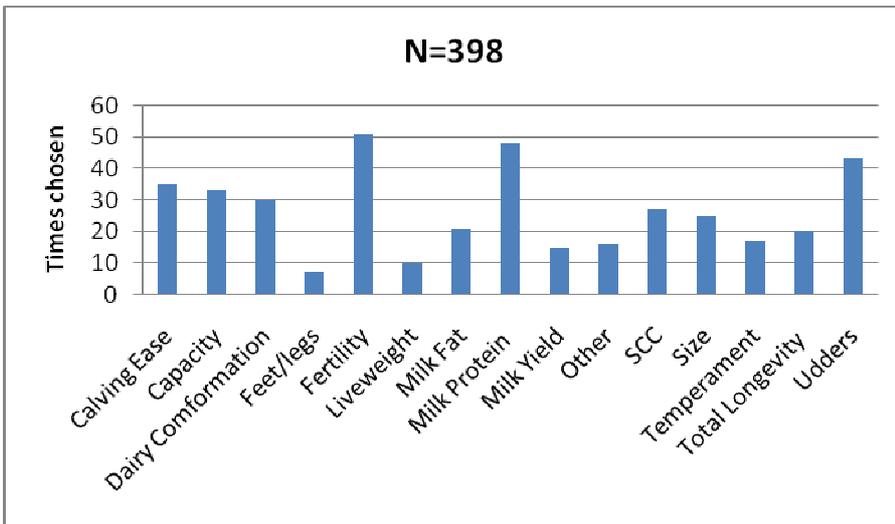
Putting the selection results together the following overall scheme can be made. For all the surveyed farmers that do use crossbred bulls the biggest group is selecting on a combination of high index and specific traits. Second comes selection on bull of the day and third specific traits.

Graph 6.1.5 Where do you select on? (Using crossbred bulls)



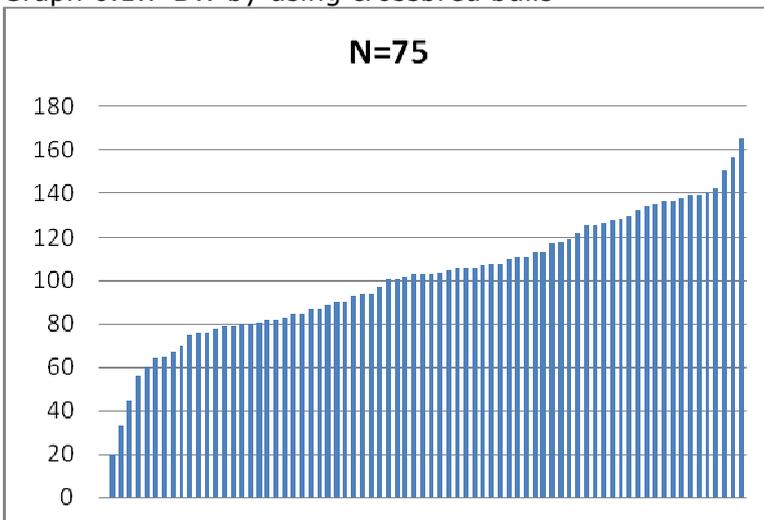
For farmers selecting on specific traits or on a combination of traits and high index from the graph above an other graph is made with the traits they select on (Graph 6.1.6). Fertility is the most important trait to select on for these farmers. Next most important is milk protein and a third place is for udders. On the website udders are the most important again followed by fertility and milk protein. Farmer surveyed at Fieldays found milk protein the most important, with fertility and udders equal. These traits are all important for profit. The milk payout is especially focussed on milk protein, and udders have to be strong to create a long-lasting cow with minimal problems. Fertility is critical because of the concentrated seasonal calving, where tight calving patterns mean more days in milk.

Graph 6.1.6 Selected traits (Using crossbred bulls)

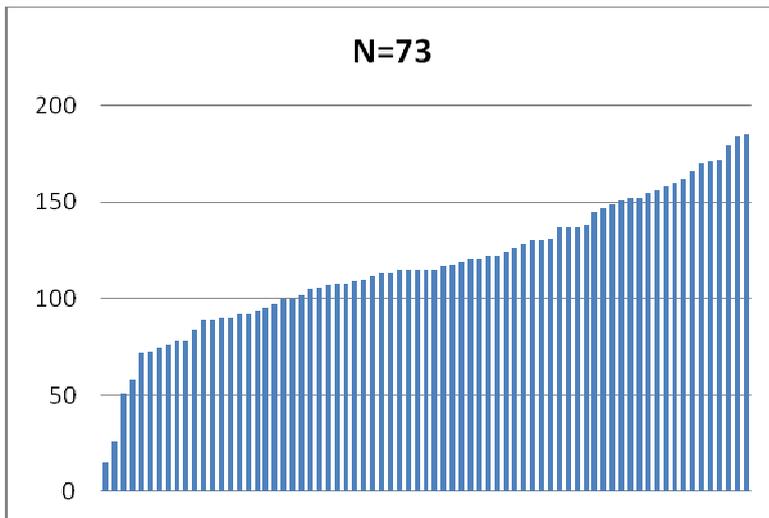


The BW and the PW are important measurements of the performance of dairy cattle in New Zealand. The BW and the PW given by the farmers can be found in the figures below. 17.33% is higher than the average BW per herd in the country which is 130 and 56% is above 100. 24.7% of the PW given by farmers is above the average of 140 per herd in the season of 2007-08. 72.6% of the PW's given by the farmers during this research are above 100.

Graph 6.1.7 BW by using crossbred bulls



Graph 6.1.8 PW by using crossbred bulls



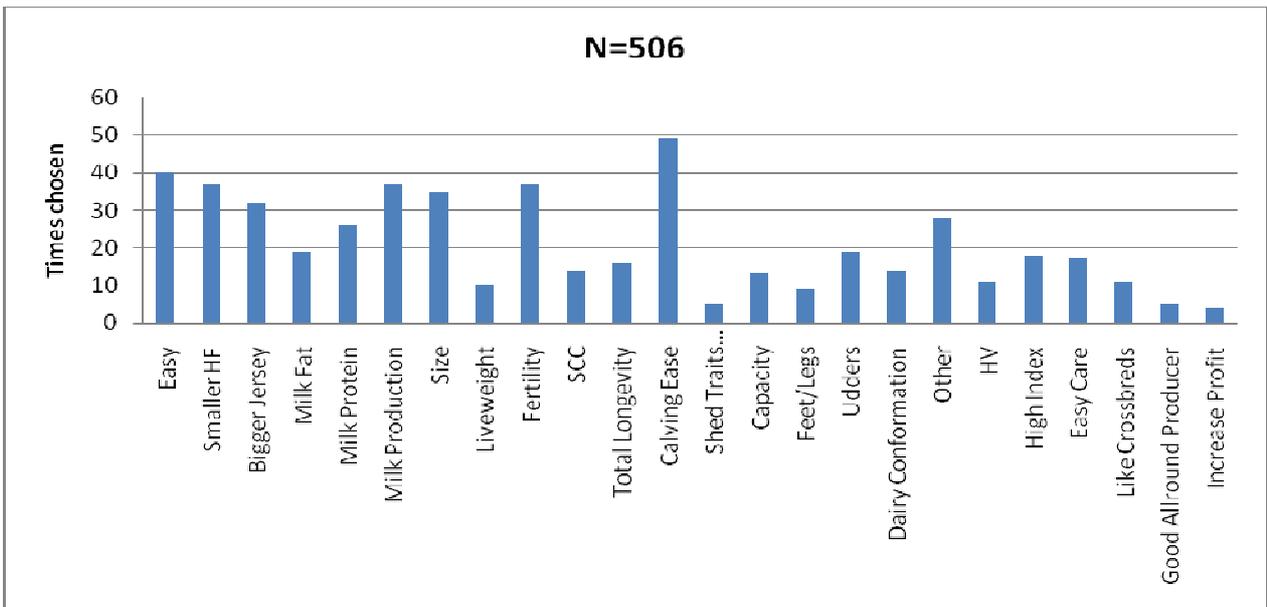
Why farmers start using crossbred bulls is important for the research because it can give an idea about the thoughts of the farmers, what they want in their animals and why they make certain decisions.

This question was a multiple choice question where more options were possible. There was also an option to put in another answer if the farmer's answer was not there.

The main reasons farmers give as an answer on the survey to use crossbred bulls are:

- To improve calving ease
- Easy to use for crossbreeding
- To get a smaller Holstein Friesian
- To improve milk production.

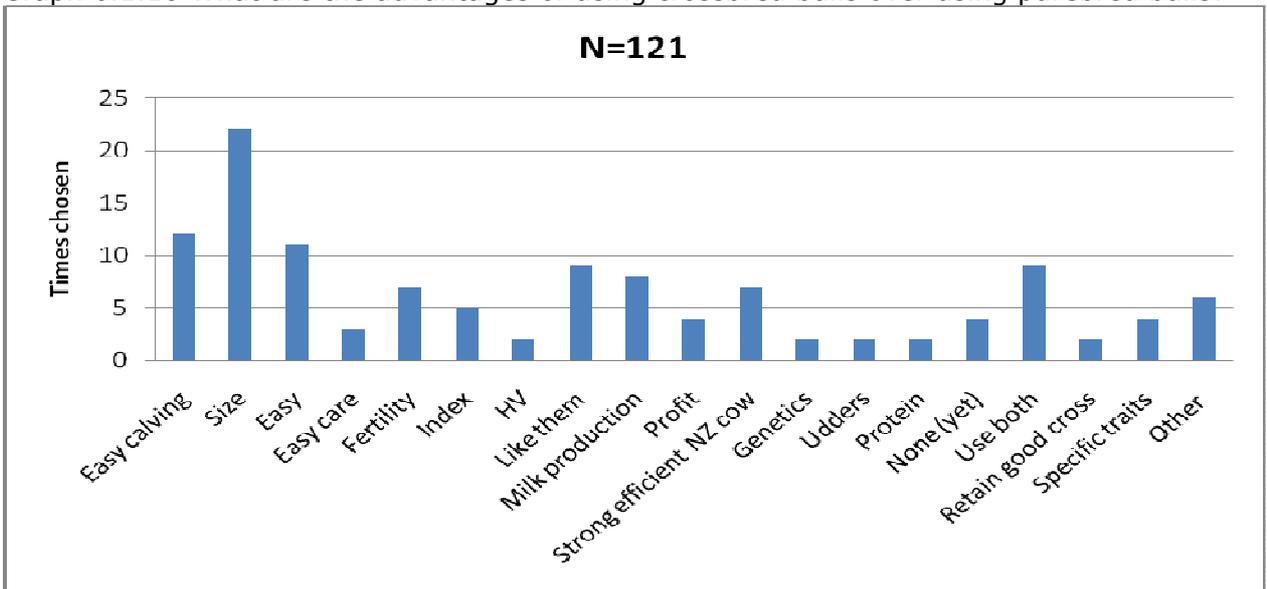
Graph 6.1.9 Why do you use crossbred bulls?



Everything has his advantages and disadvantages, as do crossbred bulls. But what do farmers think are the advantages and disadvantages of crossbred bulls over purebred bulls? The following factors were seen by farmers as an advantage in using crossbred bulls over purebred bulls:

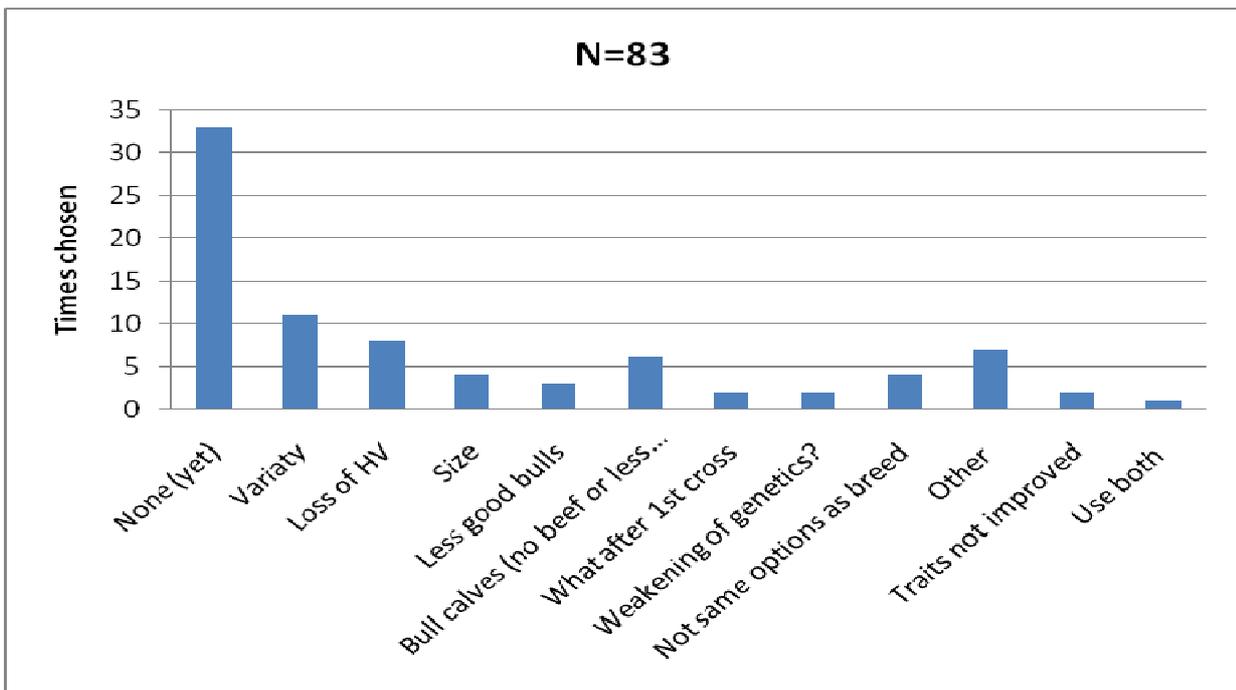
- Improving size
- Calving ease
- Easy to use for crossbreeding

Graph 6.1.10 What are the advantages of using crossbred bulls over using purebred bulls?



Most farmers do not see a disadvantage in using crossbred bulls over using purebred bulls. If they do see a disadvantage, it is especially the variability in the herd and the loss of hybrid vigor (HV).

Graph 6.1.11 What are the disadvantages of using crossbred bulls over using purebred bulls?

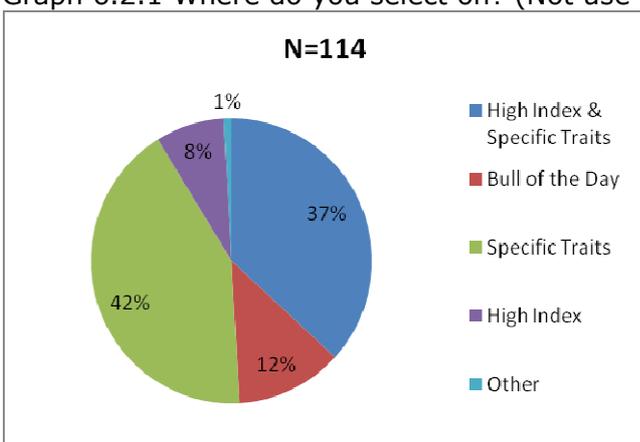


6.2 Not using Crossbred Bulls

Forty-five percent of the farmers interviewed are not using crossbred bulls. Are they making different decisions and why do they not use crossbred bulls?

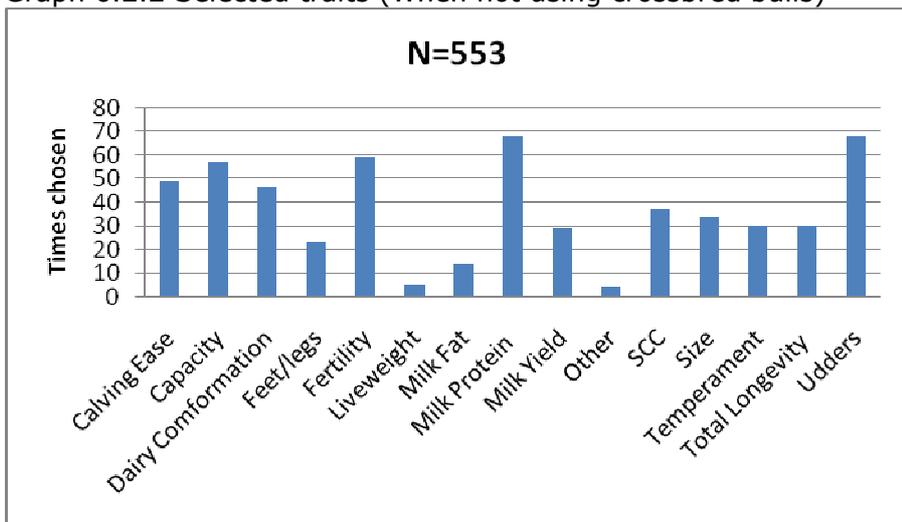
Farmers not using crossbred bulls are selecting more on specific traits (42%) than farmers that do use crossbred bulls. Followed by a combination of high index and specific traits (37%). The percentage of farmers using bull of the day is the biggest difference between using crossbred bulls and not using them. From the farmers who do not use crossbred bulls only 12% is using bull of the day against 23 and 24% for farmers using crossbred bulls. This is a likely result because one of the most given answers why crossbred bulls are used is because they are easy for crossbreeding. Farmers seem to think that using crossbred bulls means that they have to pay less attention to the breeding of the herd, that it will sort itself out. Less selecting on especially specific traits and using more bull of the day (no selection at all) than farmers that do not use crossbred bulls is a likely result of this.

Graph 6.2.1 Where do you select on? (Not use crossbred bulls)



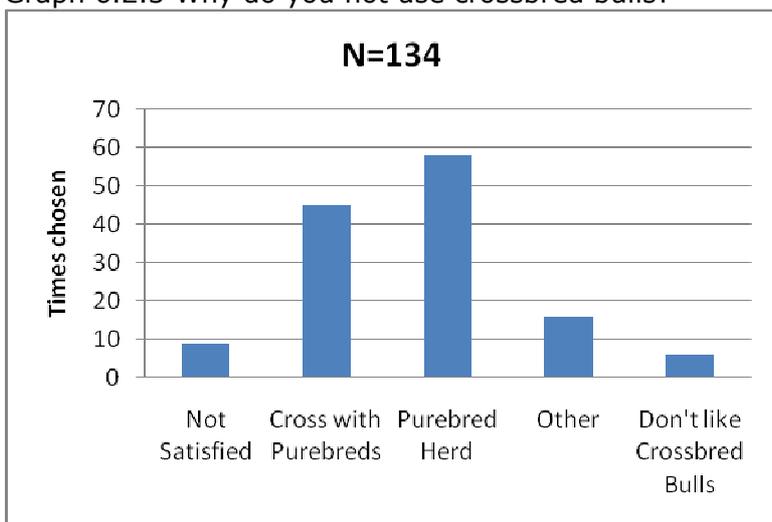
Also when farmers are not using crossbred bulls the most important traits they select on are fertility, milk protein and udders. Only the ranking of udders and fertility are changed. Udders are the most important for those using purebred bulls, while fertility is most important when crossbred bulls where used.

Graph 6.2.2 Selected traits (When not using crossbred bulls)



The reason for farmers to not use crossbred bulls is especially because they are purebred breeders which are mostly really committed to the breed or they use purebreds to cross with. This can be logical because CRV AmBreed is encouraging criss crossing with purebred bulls.

Graph 6.2.3 Why do you not use crossbred bulls?

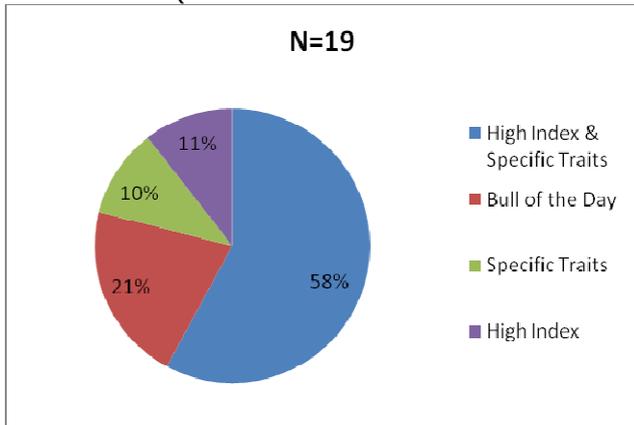


6.3 Satisfied or Not Satisfied

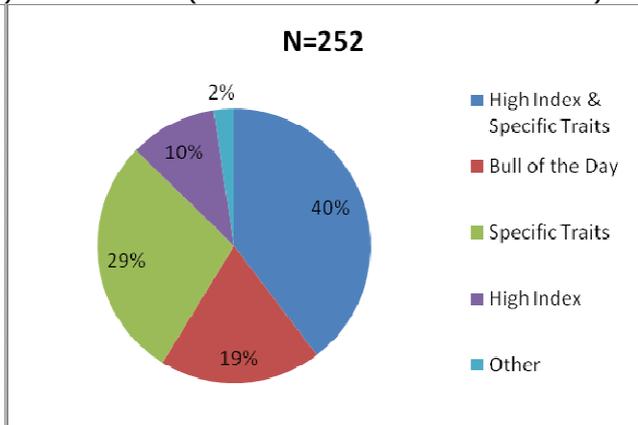
In some cases the difference of selecting bulls can be a reason for getting the results wanted or not, or for being satisfied or not. The difference in selection between farmers which are using crossbred bulls and are satisfied or not are especially found in the percentages from the high index and specific trait combination and the percentages of specific traits. Because

specific traits are important in both of these it seems to be that selection, in this case, cannot be seen as a reason for being satisfied or not.

Graph 6.3.1 Where do you select on?
(Not Satisfied with crossbred bulls)

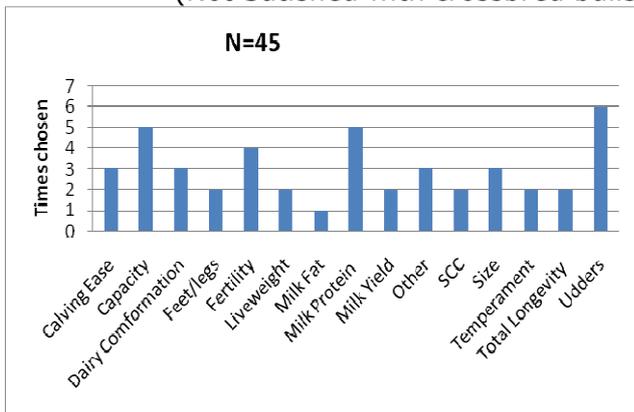


Graph 6.3.2 Where do you select on?
(Satisfied with crossbred bulls)

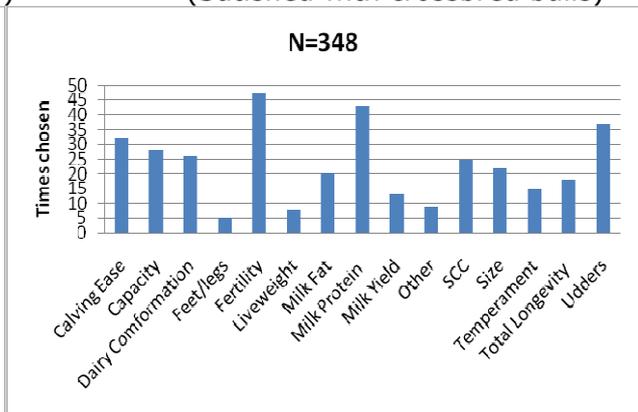


For farmers which are satisfied and selecting on traits; fertility, milk protein and udders are most important again. For farmers which are not satisfied, two of these traits are also the most important with capacity replacing fertility capacity as an important trait to choose. Udders are the most important followed by milk protein and capacity.

Graph 6.3.3 Selected Traits
(Not Satisfied with crossbred bulls)



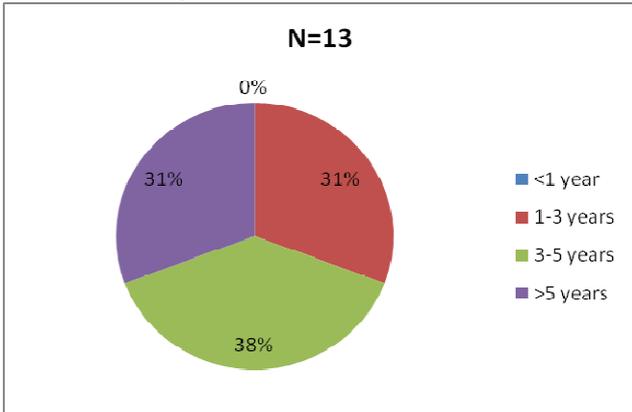
Graph 6.3.4 Selected Traits
(Satisfied with crossbred bulls)



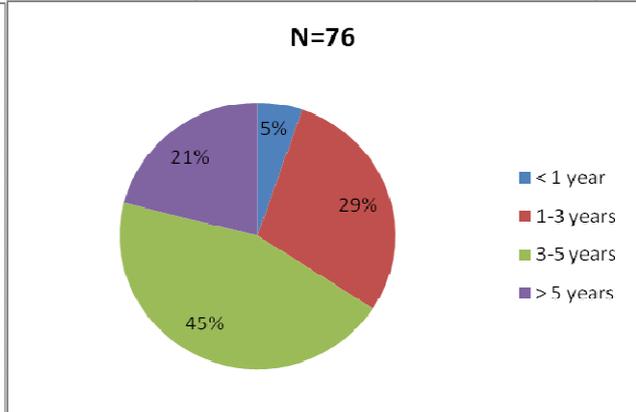
Most farmers from both satisfied and unsatisfied have been using crossbred bulls for 3 to 5 years. There are no unsatisfied farmers that have used crossbred bulls less than 1 year, what does mean that they give the progeny a change to show how they behave in their productive life. But 5% of satisfied farmers have used the bulls less than 1 year. Which means that their opinion is based on the calves they got from those bulls and that their opinion might change

over the years when those calves will get into production.

Graph 6.3.5 How long do you use crossbred bulls? (Not Satisfied with crossbred bulls)

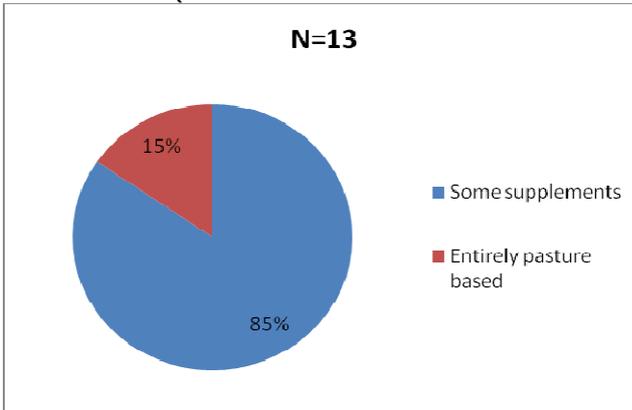


Graph 6.3.6 How long do you use crossbred bulls? (Satisfied with crossbred bulls)

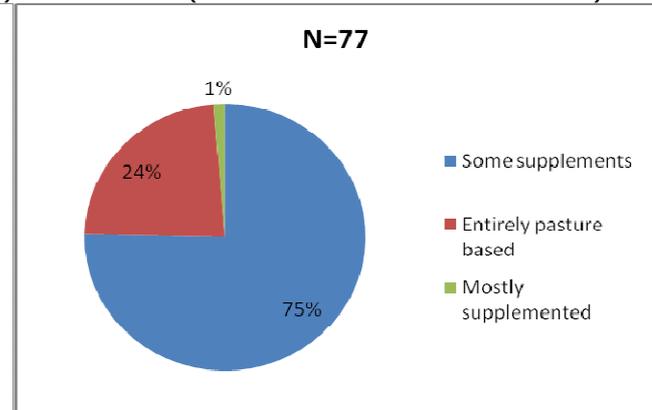


Most dairy cows in New Zealand are held pasture based and not much supplements are fed. But feeding is an important aspect influencing production. Considering this a comparison is made of the difference in feeding systems between the group of famers using crossbred bulls and being satisfied and unsatisfied. Most cows are held entirely pasture based. A small proportion of both satisfied and unsatisfied farmers, are feeding some supplements to the cows. Only a very small amount of satisfied farmers are feeding their cows mostly supplemented.

Graph 6.3.7 What do you feed your cows? (Not Satisfied with crossbred bulls)



Graph 6.3.8 What do you feed your cows? (Satisfied with crossbred bulls)



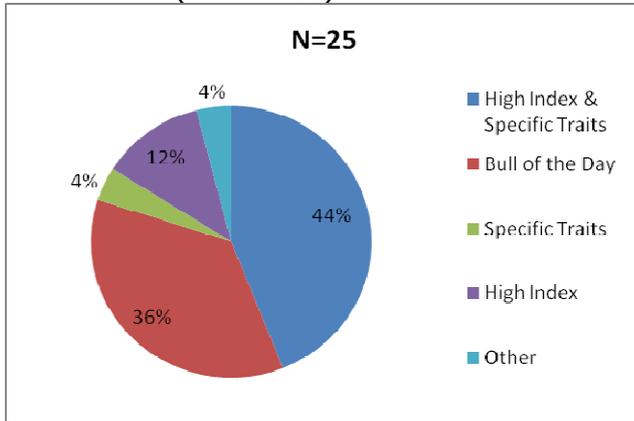
6.4 Relationship of Herd BW to Breeding Decisions

Herd BW, as explained in paragraph 4.1, is an important measure of the performance of a New Zealand dairy herd and can be influenced by many different factors. Breed, used bulls and environment are all playing an important role in the performance of the herd. But also the management and the decision making of a farmer are really important. To assess the influence

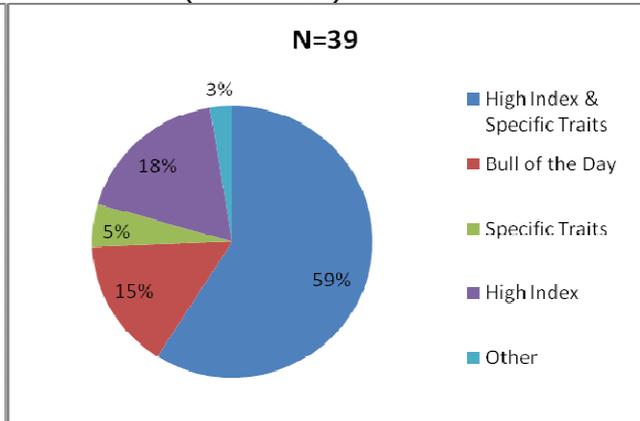
of the management and decision making of the farmer on herd BW two groups are made. A group with a BW below 100 and a group with a BW above 100.

When you look at the differences in selection, with BW above or below 100 it is obvious that 15% more farmers with a BW above 100 select on high index in combination with specific traits. Farmers with a BW below 100 are twice as likely to use bull of the day.

Graph 6.4.1 Where do you select on?
(BW < 100)

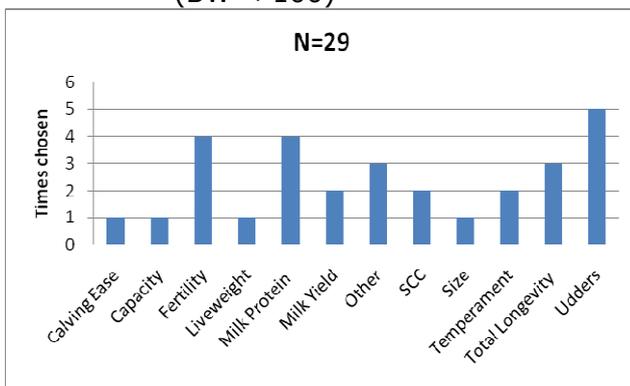


Graph 6.4.2 Where do you select on?
(BW > 100)

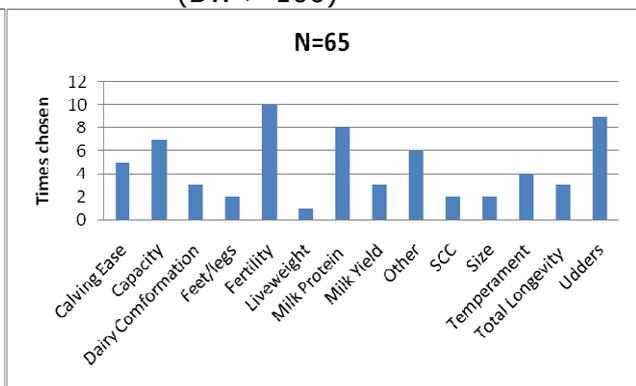


The most important traits for farmers are again fertility, milk protein and udders. This is the same for both groups, farmers with a BW above or below 100, although the order of importance is different.

Graph 6.4.3 Selected Traits
(BW < 100)



Graph 6.4.4 Selected Traits
(BW > 100)

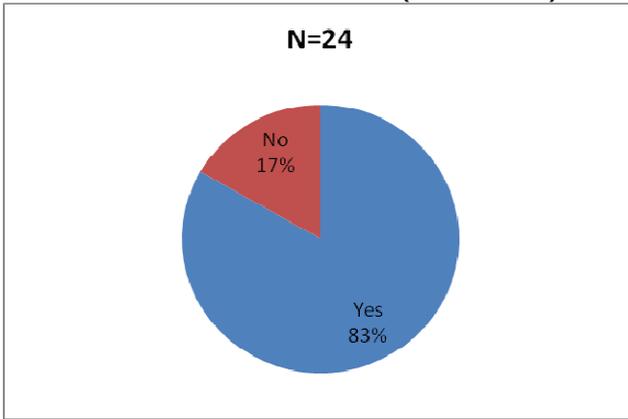


Only 7% more of farmers with a BW under 100 are unsatisfied over farmers with a BW above 100. This could mean that the cows perform better than their BW is telling them or that farmers are satisfied with how they perform.

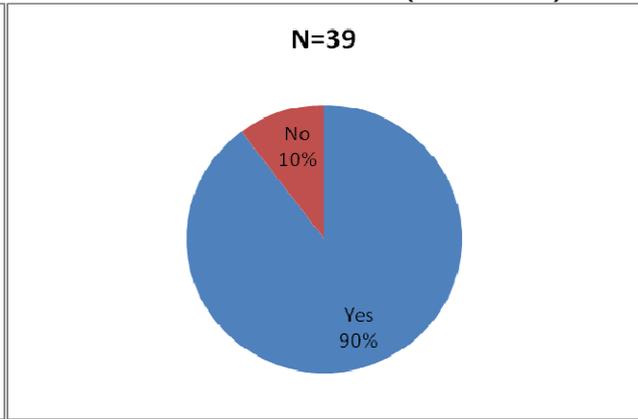
Graph 6.4.5 Are you satisfied with using

Graph 6.4.6 Are you satisfied with using

crossbred bulls? (BW < 100)

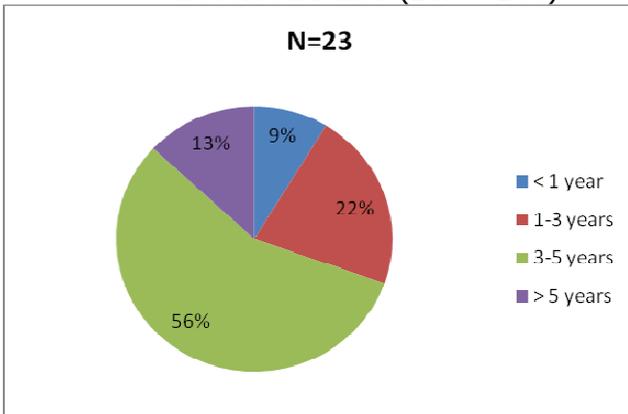


crossbred bulls? (BW > 100)

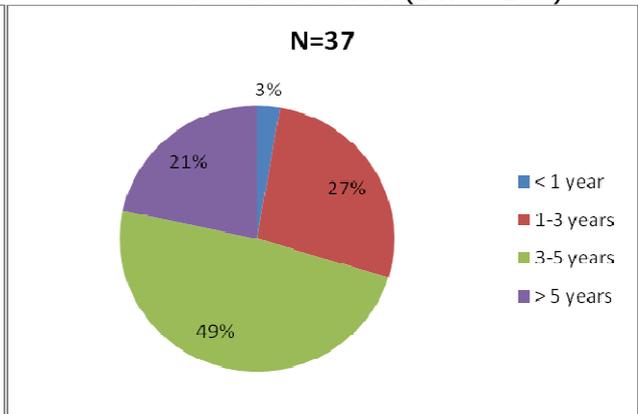


70% of both groups of farmers having a BW under or above 100 are using crossbred bulls for more than 3 years. Where fewer than 100 have 56% of farmers using them 3 to 5 years for above 100 this is 49%.

Graph 6.4.7 How long are you using crossbred bulls? (BW < 100)

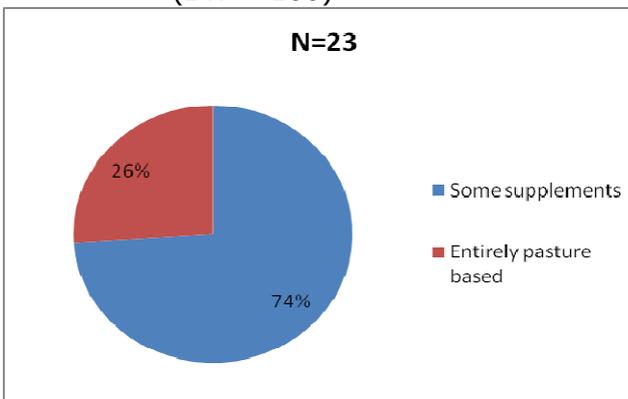


Graph 6.4.8 How long are you using crossbred bulls? (BW > 100)

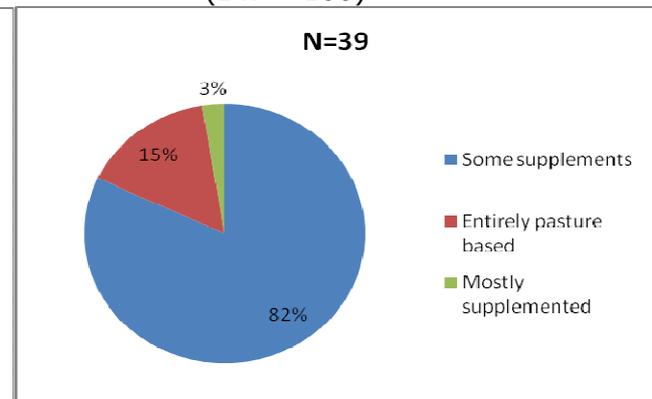


The biggest part of both groups is also feeding some supplements. After that comes entirely pasture based and a small part from the group with a BW higher than 100 are feeding mostly supplemented.

Graph 6.4.9 What do you feed your cows? (BW < 100)



Graph 6.4.10 What do you feed your cows? (BW > 100)



6.5 Specialists

Interviews are also done with Bill Montgomerie (Animal Evaluation Executive Manager) and John Rendel (Geneticist of Landcorp farms LTD). The Animal Evaluation Unit is managing the national database of dairy cattle in New Zealand and is run by LIC. Landcorp farming Limited is a corporate agribusiness and New Zealand's largest farmer. Landcorp approximately has 40

dairy farms and farms around 35,000 cows. On at least 38 of those farms they use crossbred bulls.

Bill Montgomerie said that Jerseys produce more fat but that they found in controlled experiments that Jersey and Friesians are almost identical in producing protein. Friesians produce more lactose and yield per hectare and Jerseys produce more fat per hectare. The complementary of these two breeds was that they would cover each other's weakness if they were brought together. Bill Montgomerie also told that we reach the point that half of the New Zealand dairy population is crossbred and it does not feel right to say that these dams could not be used as bull dams because they are an important part of the national dairy herd.

An other important comment he made was that if you are farming in an uncontrolled system, like pasture based in New Zealand, that you will need robust animals. Farmers cannot control the weather, the climate, pasture growth, pasture composition etcetera, which means that the animals have to be shock proof. He said that you have to be careful to produce a cow which is able to perform in different environments but which can also handle a shock. To do this they need some robustness about them to handle those influences. And therefore crossbreeding seems to be a logical thing to do for farmers. John Rendel is adding to this that the crossbred animals are more robust, having increased survival and are more fertile than purebred animals. John Rendel is adding to this that what they want in New Zealand is to breed for better cows which are more efficient converters of feed into production. About the evaluations he is doing in the national herd he said that he is not seeing more variances in performance of crossbred bull progeny compared to purebred bull progeny.

Bill Montgomerie always expected the sales of crossbred bull semen to grow. When he is getting a question from the field about how to adjust a breeding plan he would say try as much as rotational crossing as possible. Because that is the way to get the most hybrid vigor. But he said, that would be complicated and difficult and you need to spend a lot of time in it and make a good plan for your herd and most New Zealand farmers do not have the knowledge and the time to do this. So mostly he is saying to the farmers take the highest BW bull available in the price you want to pay to keep it the simple way, the way most New Zealand farmers like it. He also said that 3 way crossing should fit in your breeding plan and strategy and that a farmer has to be very careful with the third breed which is added to the first two.

In the Animal Evaluation system they do not see size as a reason for using crossbred bulls. According to him are crossbred cows calving a Friesian calf much more easy than a Friesian cow.

Bill Montgomerie does not think that crossbred bulls would cause any problems on the long term. As long as they keep their own genetic merit it is no problem at all. And he also said that it is very unlikely to get problems within the European typed cow, Bos Taurus. They also have not seen any problems in different compositions of the crossbred bulls yet (more Friesian or more Jersey type) which are also not seen by John Rendel.

He is also saying that a lot of AB companies are sticking to F1 bulls, but he said, with so much crossbred cows around you have to look further, and John Rendel is sharing this idea with him. Jersey and Holstein Friesians are completing each other's weakness. In the early days when the cow for the replacement calf was mated and there were 2 breed lines of sires available for the mating, farmers said quit often use the better one regardless of which breed that bull was. One day this would have been a Jersey bull and the other day a Holstein-Friesian bull. And because of that the generation now is better than expected. John Rendel said to this that it does not really matter for the breeding but that F1 bulls will have more heterosis for semen production. They will be ready on an earlier age and will produce more. AI companies have to decide for themselves if this is more profitable or not. It can be that they only need a team of 7 top bulls to reach the same production amount instead of having a team of 8. But the heterosis will still be quite significant in the F2.

An other important comment they both made was when farmers are dedicated to a breed they would never change this just because they are too convinced about it. For some farmers it is

also important which sires are behind the animal and start crossbreeding is going away from generations of using pure bred animals. For some farmer it is not only a strategic decision to be a pure bred farmer but also emotional influences could be involved.

John Rendel says that from a production point of view the production values, including heterosis, are more important than breeding values. That is what gives the value of that cow as a producer for them.

He is giving three important reasons for using crossbred bulls namely:

- Rotational crossbreeding was the ultimate way to go but that has to be managed. It is not that easy as just look at the cow and say that one is going to jersey and that one is going to Friesian.
- Most New Zealand dairy farmers do want a crossbred milking cow. There is a big pool with crossbred cows out there which genetic merit is higher than anything else in terms of purebred. What people intended to do was choosing the bulls with the highest value. One day it was jersey and the next day it was Friesian. Because of that the high pool of the crossbred bull dams should have a higher genetic merit than straight bred Friesians or jerseys. So if AI companies are doing their jobs right the farmers should have better access to better bulls and therefore better cows.
- The crossbred bulls has heterosis for semen production, this means that you need less bulls for the same amount of semen and that there is more semen available of the top bulls. And you get a top team with a higher genetic merit.

Reason 2 is a reason which Bill Montgomerie also mentioned. He is further saying about this that the main reasons for using crossbred bulls are money and simplicity and that if crisscrossing was more easy he would not have done that either because of the heterosis in the bulls. And also because of the fact that crossbred cows should be breeding value wise, genetically superior to any of the straight bred bulls. And he is also mentioning like Bill Montgomerie also did that the pool of young bull dams should be higher in the crossbred cows than in the purebred cows.

Further he is not hoping that it would create a new breed, John Rendel is thinking that top Friesian, Jersey or Ayrshire bulls have something to offer also. About Landcorp using crossbred bulls he said that they are doing where the market is asking for and the crossbred bulls are fitting in this.

The comments those experts gave are really interesting, they are already working with the crossbred bull concept from the start in 2002. They see results, they are having contact with different farmers in different situations and they have the knowledge which is needed to look at a concept like this from different perspectives.

7. Discussion

With having interviewed farmers on Fielddays, mainly in the CRV AmBreed stand, and by doing a survey on the CRV AmBreed website, by sending out an email to everyone in the database, it would be likely that most farmers which were doing the survey are CRV AmBreed clients. And

because CRV AmBreed is not really stimulating the use of crossbred bulls it would be likely to have a low percentage of farmers which are using crossbred bulls. But this seems to be quite high, 55%, and different than expected or there were more clients of the opposition taking part than expected. Also the visited farmers were selected by the field consultants. They know their clients and they know which are using crossbred bulls. Still not all of them were CRV AmBreed clients, but with not including this question into the survey it is not known how many were CRV AmBreed client and how many were not. Because the survey questions were adjusted a view times when more questions came up not all questions might have been asked to all farmers.

While cow size seems to be important for profit in New Zealand dairy farming it does not seem to be one of the most important traits for selection for the farmers interviewed. However it is seen as the biggest advantage that crossbred bulls have over purebred bulls by the surveyed farmers.

Because seasonal calving is used in the dairy sector in New Zealand fertility is important. And other than with the cow size this does seem to be an important trait for the surveyed dairy farmers in New Zealand to choose for. In all the graphs where the chosen traits were given where farmers are selecting on, fertility is in the top three except for the unsatisfied farmers. For farmers using crossbred bulls, satisfied farmers and farmers with a BW above 100 it is even chosen the most. It also makes a difference of position for using crossbred bulls or not, being satisfied or not and a BW under or above 100.

Total longevity is again the same as cow size. It seems to be important to reduce costs but does not seem to be an important trait to select on for dairy farmers in New Zealand.

That cows have to be efficient converters from feed into milk is also mentioned by John Rendel and Bill Montgomerie. Farmers also find this important but say that more with comments and not saying that in the answers on the questions in the surveys.

The main reasons for farmers to use crossbred bulls seems to be because they want to improve fertility, udders and protein. These results are coming back over and over again. But looking at the average breeding values for these traits from bulls of different breeds with a reproof they are never the best breed. The 1998 born crossbred bulls might be the best to choose for fertility, for udders they are negative and with protein in the middle. The in 2000 born crossbred bulls are in the middle for fertility and protein but are the least for udders again. This means that if farmers are selecting on these traits that they do not get the best bull for the trait if they use crossbred bulls.

8. Conclusion

Farmers seem to be satisfied with the crossbred bulls, although there are complaints about the quality of the crossbred bulls and the amount of proven crossbred bulls. A lot of farmers would like to see this amount of better quality crossbred bulls bigger. Expecting that those complains

come from farmers which do pay attention to the breeding in their herd these complaints have to be taken seriously. But there does not seem to be a big difference in the way farmers are selecting bulls. Satisfied and not satisfied farmers are tend to selecting both the most on a combination of high index and specific traits. Only the group of specific trait selectors is bigger for the satisfied farmers. A reason for this could be that they do find good traits more important than having good index values (BW).

Fertility, milk protein and udders seem to be the three traits which are the most important to choose for all farmers.

The biggest advantage of crossbred bulls over purebred bulls seems to be size. Most farmers do not see a lot of disadvantages.

From the BW given by the surveyed farmers 17.3% is above the average BW in New Zealand. For the PW is this 24.7%. 56% of the BW is above 100 and 72.6% of the PW is above 100. In both groups 70% of the farmers are using crossbred bulls for more than 3 years, which means that 70% of the farmers are having progeny of these bulls in production.

The main reasons for using crossbred bulls are calving ease, because it is easy and to get a smaller Holstein-Friesian. The main reason for not using crossbred bulls is because they are farmers with a purebred herd.

It is still hard to say how the progeny of the crossbred bulls really is performing. The bulls have only been used for about 7 years. There are almost no farmers using them longer than this which is making it difficult to see the complications on a long term. And most farmers do not use them longer than 5 years now, this means that they only have the first generation of the progeny of those bulls in production, maybe the second generation in the first lactation. To get a clear view on what will happen on the long term with using crossbred bulls, how their progeny will perform after several generations, more time is needed. One farmer was interviewed who was already using those bulls for 15 years, he was doing really well and he was really satisfied also. But the way he selected those bulls was really strict and per cow instead of per herd, very different to the way most New Zealand dairy farmers are selecting the bulls they use.

Farmers are using crossbred bulls frequently to get the ideal cow for their circumstances. And the expectation is that crossbred bulls will be used more and more in the future. Also big commercial farms like Landcorp prefer using crossbred bulls. To get big clients like Landcorp it is almost necessary to have a good team of crossbred bulls. Criss crossing is not an option for a company like Landcorp but also not for many smaller farmers, as it is seen to be too complicated and time consuming. The use of crossbred bulls appears to them to be the most logical way to get their ideal crossbred cow in order to get the highest profit in their situation. But the general outcome of the research is that, as well with using purebred as with using crossbred bulls, the way of selecting and mating the bulls is playing a big role in the performance of the offspring. Farmers that do not or only pay limited attention to the selection of the bulls are tend to get offspring which are performing less than farmers which are paying a bit more attention to this selection process.

9. Recommendation

With only using crossbred bulls for 7 years and not having an idea about the complications on the long term of using them it is hard to give a good recommendation. Complications which are already seen sometimes by farmers are difference in size, differences in calving ease,

differences in the temperament and the difference of a composition per cow in the herd (more Jersey or more Friesian). But what can be seen from this report is that a big percentage of farmers are using crossbred bulls and are satisfied about this for now because they get the crossbred cow they want without having to pay too much attention to their breeding plan. Still farmers would like to see better quality bulls and more proven bulls. On this moment there are not enough of those they say. Especially the last few years most 'better quality' crossbred bulls did not have a similar genetic background those farmers say.

Listening to the farmers, judging their cattle and their performance an important way to see the progeny of the crossbred bulls and to keep following them. In this way the performance of the progeny but also complications can be measured early.

To stop having quality and proven crossbred bulls would mean a loss of clients. Also for a breeding company it is important to know how their bulls are performing and what the farmers think of their progeny. They need to be able to advise the farmers with the right information and in the good way. Especially when 55% of the farmers dealing in this research are using crossbred bulls and from this 88% is happy with those bulls and no more, better or proven bulls are coming up as long as it the concept is not proven to be wrong they might change AB companies, no matter whose client they are now. Also big commercial farms like Landcorp are playing a big role in this. To keep a big client like them with at least 35,000 straws per year the company has to be able to give them what they want.

Still it is early to say how the progeny of the crossbred bulls are really performing and if they mean an advantage or a disadvantage in breeding dairy cattle on the long term. Because of this reason it is important to be also aware of the quality of the purebred cattle. With getting too many crossbred cows and bulls in the national herd the quality of those purebreds might get less or develop not as much as they should do. This could be for example because the 'good' genes will be used for the crossbreds instead of keeping them pure. Pure breeds will always be important and can also add a lot of value to crossbred cattle.

For now it is advisable for the AB companies, especially for CRV AmBreed, to concentrate on the quality of crossbred bulls and try to get them proven. At the same time the development of the crossbred bull progeny has to be observed and the selection procedures of farmers has to be judged. Maybe it is not the crossbred bull itself that will cause trouble but the way they are used, and this is not only important for the use of crossbred bulls but also for that of purebred bulls.

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11. Appendix

11.1 Fieldays Survey Questions

The survey questions are shown in the same way the farmers have seen them on the touch computer. They were send to the next question according the answer they gave as can be seen

in the questionnaire below.

Q0: START

Q1: Are you a dairy farmer?

1. Yes
2. No

Q2: Are you involved in servicing the dairy industry in any capacity?

1. Yes
2. No

Q3: Please give your business card to one of our staff members and define how you work with dairy farmers as this might be useful information for our research project. Press Ok to continue.

1. OK

Q4: Are you involved in the decision making around the breeding of your herd?

1. Yes
2. No

Q5: Do you select the bulls on certain traits or just on BW?

1. I just take the bulls available on that day
2. BW
3. Certain traits
4. Both
5. I don't select the bulls on either of these things

Q6: On what traits? Please select all the traits that you select on and then press continue

1. Milk Fat
2. Milk Protein
3. Milk Yield
4. Size
5. Liveweight
6. Fertility
7. Somatic Cell
8. Total Longevity
9. Calving Ease
10. Shed Traits (eg shed temperament, milking speed, etc)
11. Capacity
12. Legs
13. Udders
14. Dairy Conformation
15. Other

Q7: What other traits do you look for? Please provide more information, then press continue.

Q8: What do you select your bulls on? Please supply information, then press continue.

Q9: Do you use crossbred bulls?

1. Yes
2. No

Q10: Why do you use crossbred bulls? Please select all that apply, then press continue.

1. Because it is easy to use them on your crossbred cows
2. To get a smaller Holstein-Friesian
3. To get a bigger Jersey
4. To improve production of milk fat
5. To improve milk protein
6. To improve milk yield
7. To improve size
8. To improve liveweight
9. To improve fertility
10. To improve somatic cell
11. To improve total longevity
12. To improve calving ease
13. To improve the shed traits (eg shed temperament, milking speed, etc)
14. To improve capacity
15. To improve legs

16. To improve udders
17. To improve dairy conformation
18. Other

Q11: What other reasons do you use cross bred bulls? Please provide more information, then press continue.

Q12: Are you satisfied with the overall results from using cross bred bulls?

1. Yes
2. No

Q13: Why don't you use crossbred bulls?

1. Used them but was not satisfied with the result
2. Use purebred bulls to cross breed because you know what you will get
3. I am a pure breed dairy farmer
4. Other

Q14: What is the other reason you do not use crossbred bulls? Please provide more information, then press continue.

Q15: Why were you not satisfied about the use of crossbred bulls? Select all that apply, then press continue.

1. My cows were going backwards in capacity
2. My cows were going backwards in legs
3. My cows were going backwards in udders
4. My cows were going backwards in dairy conformation
5. My cows were going backwards in milk fat
6. My cows were going backwards in milk protein
7. My cows were going backwards in milk yield
8. My cows were going backwards in size
9. My cows were going backwards in liveweight
10. My cows were going backwards in fertility
11. My cows were going backwards in somatic cell
12. My cows were going backwards in total longevity
13. My cows were going backwards in calving ease
14. My cows were going backwards in shed traits (eg shed temperament, milking speed, etc)
15. It was generating too many differences in my herd (eg size, production, calving ease, fertility, etc)
16. Other

Q16: What is the other reason you were not satisfied when using cross bred bulls? Please provide more information, then press continue.

Q17: Have you analysed the PW (Breeding Value and Production Value) of your progeny from crossbred bulls as a separate group in your herd to compare?

1. Yes
2. No

Q18: If you know the average PW level (Breeding Value and Production Value) of your crossbred bull progeny, please tell us what the average PW is below, then press continue.

Q19: Have you analysed the PW (Breeding Value and Production Value) of your progeny from purebred bulls as a separate group in your herd to compare?

1. Yes
2. No

Q20: If you know the average PW level (Breeding Value and Production Value) of your pure bred bull progeny, please tell us what the average PW is below, then press continue.

Q21: Are you interested in sharing your data for this research project? We want to compare the results of the crossbred progeny with the purebred bull progeny. Only the performance and management data will be used, no further information and names will be used and we can send you a summary of our results and of your herd.

1. Yes
2. No

Q22: Please type in your full name and the best way of contacting you (e mail / phone number / mobile number or address) for this research project.

Q23: FINISH

11.2 Farm Visits Survey Questions

Two different question forms are made, one for farmers still using crossbred bulls and one for farmers who have been using crossbred bulls in the past.

Survey questions for farmers using crossbred bulls:

1. What do you want in a cow?
2. What is your breeding goal? Where are you selecting your bulls on?
3. Why did you start using crossbred bulls?
4. What did you want to reach with using crossbred bulls?
5. What did you reach with using crossbred bulls?
6. How long are you using crossbred bulls?
7. What are the advantages using crossbred bulls over using purebred bulls?
8. What are the disadvantages using crossbred bulls over using purebred bulls?
9. Are you satisfied with the use of crossbred bulls? Why or why not?
10. How big is your herd?
11. What do you feed your cows?

Survey questions for farmers that had been using crossbred bulls:

1. What do you want in a cow?
2. What was your breeding goal when you were using crossbred bulls?
3. What is your breeding goal now? Where are you selecting your bulls on? Why did you change your breeding goal?
4. Why did you start using crossbred bulls?
5. What did you want to reach with using crossbred bulls?
6. What did you reach with using crossbred bulls?
7. How long have you been using crossbred bulls?
8. What were the advantages using crossbred bulls over using purebred bulls?
9. What were the disadvantages using crossbred bulls over using purebred bulls?
10. What was going backwards using crossbred bulls?
11. Why did you stop using crossbred bulls?
12. Which bulls did you use?
13. How are you breeding now? Crisscrossing, purebreed etc?
14. Are you satisfied with the results of your new way of breeding?
15. How big is your herd?
16. What do you feed your cows?

11.3 Website Survey Questions

The questions asked in the website survey are as followed:

Are you currently using crossbred bulls in your herd, or have you used them in the past? : Yes
If you answered no above, what were your reasons for not using crossbred sires? :

BREEDING GOALS - IF YOU ANSWERED YES ABOVE, PLEASE ANSWER THE FOLLOWING QUESTIONS:

-
1. What do you want in a cow?
 2. What is your overall breeding goal?
 - I just take the bulls available on that day
 - BW
 - Certain traits
 - BW and certain traits
 3. What key factors do you select your bulls on?
 4. If you choose based on specific traits - which traits?
 - Milk fat
 - Milk Protein
 - Milk Yield
 - Size
 - Liveweight
 - Fertility
 - Somatic Cell
 - Total Longevity
 - Calving Ease
 - Shed traits (eg. shed temperament, milking speed, etc.)
 - Capacity
 - Legs
 - Udders
 - Dairy Conformation
 - Other

USE OF CROSSBRED BULLS

-
5. Why did you start using crossbred bulls?
 6. What goals did you hope to achieve by using crossbred bulls?
 7. Have you achieved these goals?
 8. How long have you been using crossbred sires?
 9. What are the advantages for your herd of using crossbred over purebred bulls?
 10. What are the disadvantages for your herd in using crossbred over purebred bulls?
 11. Are you satisfied with the crossbred bulls you are using?
 12. If you're NOT satisfied with using crossbred bulls, please state your reasons

GENERAL INFORMATION

-
13. How big is your herd?
 14. What is your current feeding system?
 15. What is your current herd BW (If known)
 16. What is your current herd PW (if known)
 17. What is your current herd NZMI (If known)
 18. Do you ONLY use crossbred bulls, or do you also use purebred sires?
 19. Is there anything you would like to add that you feel would be of importance to our results?