

Black and White Answers on the Modern Dairy Cow

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Outline

- Significant changes have occurred in New Zealand Holstein Friesian (HF) cows
- Genetic progress over the last 30 years has delivered an extra \$539/ha economic farm surplus (EFS), as measured in the second year (2002/2003) of the Dexcel HF Strain Trial
- High \$BW cows need to be fed well to realise these gains in EFS/ha
- Different strains of HF with the same breeding worth (\$BW) gave quite different \$EFS/ha (\$1509/ha for NZ90's versus \$1074/ha for OS90's) when farmed in systems ranging from low to moderate comparative stocking rate (CSR) and producing 330-529 kg milksolids/cow
- Further improvements to the index or the sire-proving process can be made, most importantly in the areas of fertility, condition score and lactation length
- Different management is required for different HF strains to optimise \$EFS/ha
- Larger, higher producing cows struggle to eat enough pasture to run sustainable systems, and need high energy/high DM supplements
- The response of larger, high merit cows to supplementary feed is higher and different decision rules are required for when to feed supplements
- Future genetic progress will continue to deliver benefits if the breeding worth (\$BW) index reflects the traits required to maximise profitability and the sire-proving process collects the appropriate data
- These results are consistent with results from similar studies in Ireland

Why this is important

During the last six years the New Zealand dairy industry has invested in research that has evaluated the genetic progress of dairy cattle. This has been important because it has tested the

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national breeding objectives, and shown us if we need to change the way we manage our dairy cows.

A number of research programmes have been involved, and updates have been reported to the SIDE conference in recent years (Kolver 2001; Holmes et al. 2002; Macdonald 2002).

Initially the question of most interest was whether overseas Holstein Friesians of North American and European origin were suited to New Zealand pastoral dairying. This was important for two reasons; firstly because the high use of overseas Holstein Friesian (HF) during the 1990's was altering the genetic makeup of the national herd (the average HF cow in 2003 had more than 40% OS HF genetics); and secondly, farmers and overseas studies were questioning the suitability of OS HF for seasonal pasture-based systems.

However it became clear that the question was broader, and included whether the animal evaluation (breeding worth; \$BW) index was adequately predicting the economic performance of cows in pasture-based systems, and whether the various traits in the index were appropriately weighted to provide a more profitable cow in the future.

The research projects that have been making these evaluations are now finishing. The results and messages from this research have been clear and consistent, and have been supported by companion studies in Ireland and elsewhere. Recommendations are now being made to the National Animal Evaluation Committee User group and to the dairy industry.

This paper reports the main messages from this work in the form of answers to three dairy farmer questions:

- Has genetic progress over the last thirty years delivered farm systems benefits today?
- Do different strains require different management systems?
- Will continuing genetic progress deliver benefits in the future?

This paper is an interim report, as further analysis of the current season's results is underway. However it is not expected that the main messages will change.

Has genetic progress over the last thirty years delivered farm systems benefits today?

Yes, genetic progress has resulted in a large increase in economic farm surplus/ha (which is what was selected for), as well as other unintended results. It has generated large increases in the productive potential of HF cows, and this potential can be captured when cows are fed well. However, the gains in EFS/ha may not be realised at low feed allowances (high comparative stocking rates) that may be more typical of many farms in New Zealand. More feed per cow (approximately 20%) is required for modern HF cows because EFS/ha is optimised at a lower CSR, and because they have a higher liveweight compared to HF cows 30 years ago.

The Dexcel HF Strain Trial compared New Zealand HF genetics from the 1970's (NZ70's) and the 1990's (NZ90's). Results show that the last thirty years of selective breeding

in the New Zealand dairy herd has significantly improved the type of cow we farm. The changes reflect the traits that were selected for – the modern cow produces more milksolids, a greater ratio of milk protein to milkfat, more concentrated milk, and is consequently a more efficient converter of feed into money. The productivity gain from genetic progress is clear: a herd of modern New Zealand HF cows will produce more milksolids/ha from less cows.

Consequently, modern NZ HF cows (NZ90's) generated a much higher EFS than 1970's HF cows (NZ70's). In the 2002/2003 season when all the herds comprised first and second calvers, NZ90's cows produced \$539/ha more EFS than NZ70's across all the pasture-based farming systems in which they were tested (Table 1). This is equivalent to a gain of \$18 EFS/ha/year due to genetic progress over the last 30 years. This advantage was consistent with the large difference in genetic index (\$BW -20 versus \$BW 138).

However, some of the changes resulting from 30 years of genetic selection were unintended – modern cows are later maturing, and of higher mature liveweight, lose more condition after calving, are slower to put condition back on during lactation, and are harder to get back in calf because they take longer to start cycling after calving. With the NZ90's cow we now have an animal that can be very productive within seasonal, pasture-based dairying systems that range from low to moderate comparative stocking rate (CSR), but requires more reproductive intervention to get cycling.

All of these changes mean that the modern cow requires greater levels of feeding. Although the Strain Trial did not test low feed allowances (<4.5 t DM/cow), Figure 1 suggests that at low levels of feeding (high CSR), the differences between NZ90's and NZ70's may be small, and NZ70's may in fact be more profitable. This suggests that NZ90's cows may struggle to realise their genetic potential in many current pasture-based systems, and that at low feed allowances the productive advantages from genetic gain may not be realised at all.

Looking ahead, it is critical the industry has a clear vision of the type of cow required for our New Zealand farming systems, and that this is reflected in the animal evaluation index.

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Table 1: Economic farm surplus (EFS) per ha of 1990's high breeding worth New Zealand and overseas Holstein Friesians (NZ90's and OS90's), and low breeding worth 1970's New Zealand Holstein Friesians (NZ70s) averaged over a four farm systems ranging from all-grass to high input. Data is from the second year of the Strain Trial (2002/2003) at a \$3.60/kg milksolids payout.

	Average \$EFS/ha
NZ70s (\$BW -20)	970
NZ90s (\$BW 138)	1,509
Difference (due to genetic progress)	539
NZ90s (\$BW 138)	1,509
OS90s (\$BW 112)	1,074
Difference (due to strain of cow)	435

Do different strains of similar \$BW require different management systems?

Yes, but the same strain (NZ90's) was best in all of the seasonal, pasture-based systems tested, that ranged from low to moderate CSR and produced 330-529 kg milksolids/cow (Figure 1 and Table 5). Only when cows were fed a full total mixed ration (TMR) and produced in excess of 700 kg milksolids/cow have OS HF produced more kg milksolids/kg liveweight than NZ HF of similar \$BW (Table 2). It is clear that using CSR or pasture allowance per cow alone is not enough to manage different strains of modern HF, especially when supplements are used. Better indicators of response to feeding are required, such as relative feed deficit, body condition score, or kg milksolids/kg liveweight.

Figure 1 shows that at the same CSR, strains performed differently – but the NZ90's always had a higher EFS/ha than either OS90's or NZ70's. It is also clear that the highest EFS/ha for each strain occurred at different feeding levels. EFS/ha was maximised at a CSR of 92 kg Lwt/t DM (5.5 t DM/cow) for NZ70's cows, at 85 kg Lwt/t DM (6 t DM/cow) for NZ90's, and at 85 kg Lwt/t DM (6.5 t DM/cow) for OS90's. This shows that the overseas type animal required more feeding and more supplementary feed in the form of maize silage and maize grain to generate profits compared with NZ90's cows (and NZ70's cows), which required minimal levels of supplements to maximise profits. In addition to the higher liveweight of OS90's requiring fewer cows/ha to maintain the same CSR, the shift in optimum CSR with changing genetics is further reducing the cows/ha required to optimise profitability.

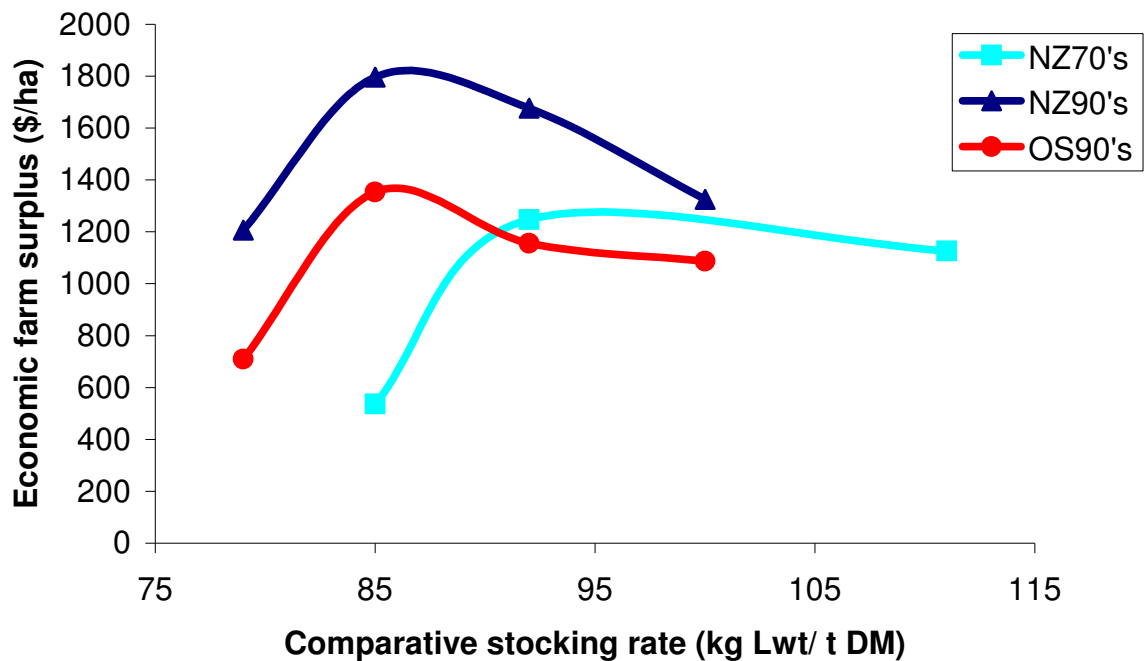


Figure 1. Economic farm surplus (EFS) per ha of 1990's high breeding worth New Zealand and overseas Holstein Friesians (NZ90's and OS90's), and low breeding worth 1970's New Zealand Holstein Friesians (NZ70's) farmed in systems ranging from all-grass (high comparative stocking rate) to high input (low comparative stocking rate). Data is from the second year of the Strain Trial (2002/2003) at a \$3.60/kg milksolids payout.

Management rules

The Strain Trial results were obtained from farms that were managed according to a very clear set of best practice decision rules regarding when to calve, when to dry off, and when to include supplementary feed in the diet. However, different rules may be needed for OS90s type cows.

Drying off

The largest penalty against OS90's performance was the early dry-off date due to low body condition. Milking on for longer, drying off at a low body condition score, and then feeding at high levels during the dry period to regain condition may allow OS90's cows to perform better in pasture-based systems. This practice was used during the last two years of the

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Strain Trial, but the lactation length of OS90's was still 10 days shorter than NZ90's, even though OS90's were dried off in 0.7 condition score units lower than NZ90's. This means that the OS90's require more feed during winter to achieve desired calving condition, or lower calving condition scores are accepted.

Supplementary feeding

Current decision rules for profitable supplementary feeding say that supplements should be fed to fill feed deficits to maintain optimal comparative stocking rate and to extend lactation. However it is clear that even when there is sufficient pasture, OS90's cows underperform, suggesting that high energy/high DM supplements are needed to achieve optimal per cow performance.

The highest feed allowance for both the NZ90's and OS90's in the Strain Trial modified current supplementary feeding decision rules by including a level of high energy supplement in the diet throughout lactation, even when there was sufficient pasture. The need for this change in the way we think about supplementing high producing cows of OS HF type was confirmed by a recent two-year study comparing NZ HF and OS HF type cows fed either 0, 3, or 6 kg concentrate DM/day of lactation (0, 780, and 1500 kg concentrate DM/cow/lactation). This study showed that OS HF type animals gave greater responses to supplement than NZ HF (74 versus 39 g milksolids/kg concentrate DM across the range 0-6 kg concentrate DM/cow/day), even when fed well on pasture and producing 431 kg milksolids/cow on grass alone. These higher responses show that the OS HF has a greater relative feed deficit compared to NZ HF, when fed generously on pasture.

Seasonal calving

Having to get in calf every 12 months in a seasonal system and having to regain body condition within 12 months for the next calving places a constraint on the ability of the OS HF type animals to get back in calf and achieve long lactation lengths. Longer lactations afforded by split calving systems or extended lactation systems may suit the OS HF type animal better, especially as they have been shown to have more persistent lactations when fed well. A Dexcel study is currently underway comparing the ability of NZ HF and OS HF type animals to milk for 670 days i.e. only calving every second year (Kolver, 2003).

Will continuing genetic progress deliver benefits in the future?

Yes, provided the \$BW index reflects the traits required in the future cow. Current high merit cows have a high genetic potential that isn't being realised physically or financially on many farms with high CSR. The challenge is to produce cows with high potential and high delivery in common farm systems. This will depend on the type of farm systems that are likely to be in use in 20 years time.

Each year improvements are made to the \$BW index so that it more accurately predicts the value of cows on New Zealand dairy farms. Until recently longevity and fertility traits were not part of the \$BW index. The effect of not including these survival traits (or adequately accounting for other traits such as lactation length) in the \$BW index has been made very clear in the recent Dexcel studies. In these studies, modern NZ and overseas HF (NZ90's and OS90's) with similar \$BW resulted in very different farm production and profitability. Simply put, NZ90's herds produced more milksolids/ha from the same feed allowance compared with OS90's herds.

Consequently, NZ90's cows generated a much higher EFS/ha than modern overseas HF (OS90's) across different seasonal, pasture-based systems that ranged from low to moderate CSR. In the 2002/2003 season when all the herds comprised first and second calvers, NZ90's cows had a \$435/ha higher EFS than OS90's across low to moderate CSR farm systems in which they were tested (Table 1). This difference in EFS/ha between the strains was much greater than would be suggested by their \$BW. In 2004 their \$BW were similar: NZ90's \$BW 138 versus OS90's \$BW 112. In 1998, prior to the recent inclusion of fertility into the \$BW index, NZ90's and OS90's had exactly the same \$BW.

Why the difference in profitability? Although OS90's produced the same amount of milksolids/day as NZ90's, OS90's had shorter lactations because they were more difficult to get in calf and because they were dried off earlier because of lower condition score. The recent inclusion of fertility in the \$BW index has provided a better prediction of the value of OS90's in our herds. However the gap between what the \$BW predicted and the actual profitability of OS90's indicates that further improvements to the index or the sire-proving process can be made.

The genetic make-up of tomorrow's national herd has already been decided by today's breeding decisions. However, refinements in the way we select sires should be able to deliver the type of cow most suited for New Zealand dairying. A general definition of a good cow will continue to be a cow that can produce the largest quantities of high value milksolids, most efficiently and sustainably, from the smallest amounts of physical and financial inputs (including feed and the various costs of labour, health and reproduction). The inclusion of essential functional characteristics (health and the abilities to walk and graze and to be milked with minimum labour) should now be included in genetic assessments along with the recently

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included fertility traits, as they will be associated with lower costs. Additional measures such as the number of days in milk, and body condition score throughout lactation, have been shown by the Dexcel studies to critically impact on the overall farm profitability, and data collected on these measures are now being included in the sire-proving process.

All types of farming systems should continue to use high \$BW cows to maximise their conversion efficiencies and outputs. If the appropriate emphasis has been placed on fertility, survival, and lactation length, the real value of OS HF and other genotypes will be predicted with much better accuracy by the \$BW index in the future. If these traits are not appropriately weighted in the \$BW index, farmers will continue to use other management practices such as crossbreeding to maintain reproductive performance, survival, and profitability, as has occurred in recent years.

The real questions that the NZ90's and OS90's comparison raises is where are we headed with our genetic progress – could the existing evaluation system drive the national herd towards an OS90's type of cow (later maturing, high mature liveweight, greater condition loss after calving with greater difficulty putting condition on during lactation, harder to get in calf in a seasonal system, and higher production of milk and lactose with lower fat and protein concentrations) anyway, without any OS genetics? And have the OS genetics that have entered the national herd simply accelerated the shift? It is sobering to note that the EFS/ha of the OS90's cows and the NZ70's cows is very similar (\$1074 versus \$970/ha, respectively) across the range of pasture-based systems tested.

These are the messages and questions that have been taken to the National Animal Evaluation Committee Group for their consideration. In particular, it is important that the data collected in the sire proving herds accurately reflect the lactation length and any costs associated with condition score differences.

In the next ten years however, it is clear that most black and white cows in the national herd will require increased levels of management to maintain condensed calving periods, adequate lactation length, and herd longevity.

Similar conclusions from studies in Ireland

The key results found in the New Zealand studies have been confirmed by similar long-term studies at Moorepark, Ireland. In three seasonal pasture-based systems with concentrate inputs ranging from 350 kg/cow to 1500 kg/cow, NZ90's cows achieved a better reproductive performance, produced milk with a higher fat and protein test, and were significantly more profitable than OS90's type cows. The Irish have recently upgraded their animal evaluation index based on the results from this study. The index has similar components to the New Zealand \$BW index, however they have placed a greater emphasis on the fertility of the cow.

As a result, their index can now predict the most profitable type of cow (the NZ90's type cow) for a wide range of seasonal, pasture-based systems.

Conclusions

The last thirty years of dairy cattle breeding have given us significant improvements in farm profitability. Now the industry must decide the type of cow it needs in the future to maximise profits – a cow that is well adapted to a largely all-grass, seasonal system, or one that has the ability to produce large amounts of milksolids at the expense of body condition and reproduction when not constrained to a seasonal, pasture system. Currently the \$BW index rates these two cows as having the same \$BW, however on-farm research has shown EFS to differ by 30% (\$435/ha).

This gap between predicted and actual profitability indicates that further improvements to the index or the sire-proving process can be made, most importantly in the area of condition score and lactation length. If these and other traits aren't appropriately weighted in the animal evaluation process, farmers will continue to use other management practices such as crossbreeding to maintain reproductive performance, survival, and profitability.

In the medium term, it is clear that the overseas HF type animal requires greater levels of supplementation to achieve the same performance as NZ HF type animals. Because OS HF have a greater relative feed deficit on pasture compared to NZ HF type animals, they give greater responses to supplementary feed during lactation (74 versus 39 g milksolids/kg concentrate DM). Other management changes will also be necessary to maintain condensed calving periods, adequate lactation length, and herd longevity.

References

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Appendix 1: Research results

Three major projects that Dexcel have been involved in during the last six years have been the Holstein-Friesian Comparison Trial (1998-2002), Dexcel Holstein Friesian Strain Trial (1998-present), and the Holstein Friesian Comparison; Response to Concentrate Trial (2002-2004).

Holstein Friesian Comparison Trial

This four-year experiment compared NZ HF and OS HF genetics of similar \$BW. It demonstrated key differences in production and survival between the two genetic strains. On an all-pasture diet, stocked at approximately 80 kg LW/t DM, OS HF lost more body condition during spring, gained less body condition and live weight during lactation, were less likely to get in calf, and produced less milksolids per kilogram of live weight (Appendix Table 1). In marked contrast, when fed an American-style total mixed ration (TMR), OS HF had similar fertility, gained live weight at similar rates during mid and late lactation, produced more milksolids and produced more milksolids per kg live weight compared with NZ HF.

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Appendix Table 1: Production and reproduction of New Zealand (NZ) and overseas (OS) Holstein Friesians (HF), with similar \$BW values, grazing pasture at approximately 80 kg LW/t DM or fed a total mixed ration (TMR) in 2000/2001.

	Pasture		Total Mixed Ration	
	NZ HF	OS HF	NZ HF	OS HF
Days in milk	300	298	300	298
Milksolids, kg/cow	465	459	602	720
(3 rd lactation cows)	508	494	696	773
LW gain during lactation, kg/cow	44	-20	92	77
Drying-off condition	5.0	4.6	7.6	6.1
Efficiency, kg MS/kg LW	0.94	0.81	1.08	1.14
Intake, % LW				
Spring	3.6	3.3	4.0	4.1
Summer	3.2	3.4	3.3	3.4
Autumn	2.3	2.9	3.0	3.3
Empty rate, % (No. of cows)	7(1)	62(8)	14(2)	29(4)*

* Two of the empty cows were scanned as pregnant but aborted following an infection.

On pasture, the poorer performance of OS HF seems to be the result of an inability of these animals to consume sufficient pasture required to meet their additional energy costs for maintenance and milk production. For example, in spring, OS HF had a DM intake of 3.3% of live weight, compared with 3.6% of live weight for NZ HF. Three possible explanations for this lower intake are: either the OS HF are not good grazers, or the limitations on intake imposed by grazing are more severe for larger cattle, or the OS HF lack some metabolic adaptation that is present in the NZ HF.

Conversely, with intensive TMR feeding, OS HF had a higher intake than NZ HF especially in late lactation (3.3 vs. 3.0% of live weight) and were more efficient producers of milksolids.

This information shows that the genetic differences between the NZ HF and OS HF were not adequately accounted for in the previous evaluation index, and that NZ HF and OS HF exhibited different milk production and functional traits when farmed in two very different farming systems.

Dexcel Holstein-Friesian Strain Trial

The strain trial based at No. 2 Dairy was reported at the 2002 SIDE conference (Macdonald, 2002). When it was initiated in 1998, the project was designed to provide farmers with the answers to three important breeding questions:

- What is needed to feed and breed high genetic merit Holstein-Friesian cows while maximising productivity?
- Which type of Holstein-Friesian is best suited to different farming systems?
- What changes have occurred in the New Zealand Holstein-Friesian cow as a result of 30 years of selected breeding?

This year is the third season comparing NZ HF of low (1970's) \$BW (NZ70's), with modern NZ and OS HF of high \$BW (NZ90's and OS90's) in eleven farm systems in which feed allowances range from 4.5 to 7 t DM/cow. Many of the results from the first two years are consistent with the Holstein-Friesian Comparison trial and many other New Zealand and overseas studies.

Appendix Table 2: Average daily milksolids production, and days in milk of 1990's high breeding worth New Zealand and overseas Holstein Friesians (NZ90's and OS90's), and low breeding worth 1970's New Zealand Holstein Friesians (NZ70's) for 2002/2003 (1st and 2nd lactation cows).

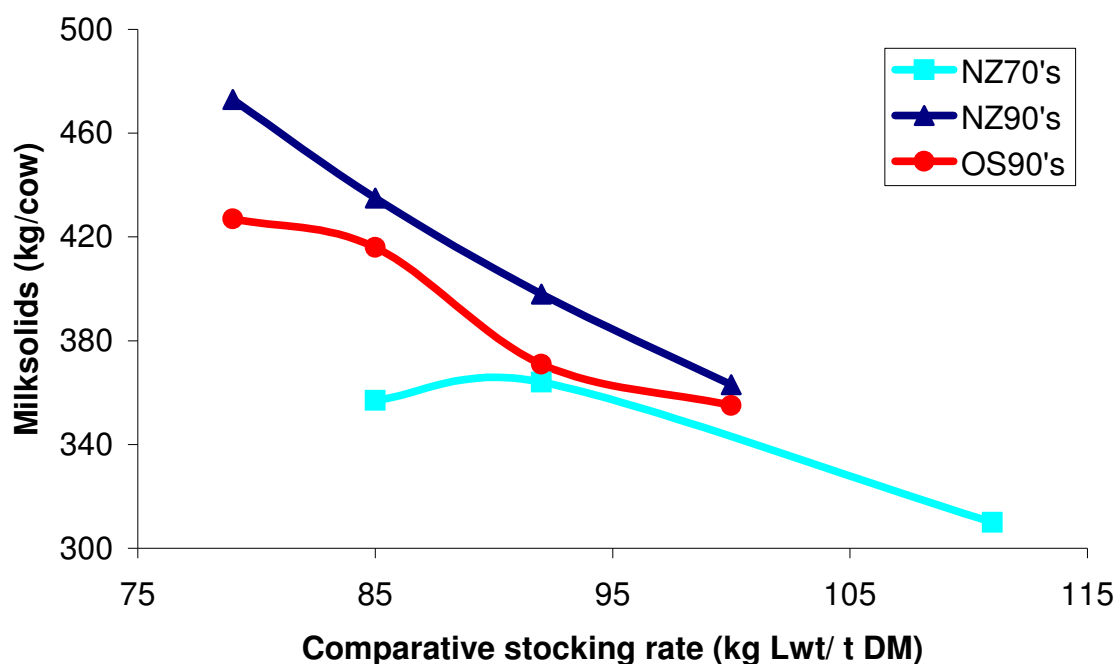
Feed allowance (t DM/cow)	NZ70's	NZ90's	OS90's	NZ70's	NZ90's	OS90's
	Average kg MS/cow/day			Days in milk		
4.5	1.20			259		
5.0		1.50			243	
5.5	1.32	1.55	1.53	276	257	232
6.0	1.23	1.53	1.52	290	283	244
6.5		1.67	1.61		284	258
7.0			1.67			256

Importantly, this study highlighted the performance of cow type and farm system. OS90's lost more body condition after calving and were slower in recovering body condition during lactation. This meant that OS90's were dried off earlier because of low body condition score and consequently had 17 less lactation days as heifers, and 20 days less as two and three year olds than NZ90's. Daily milksolids production of the OS90's cows was similar to that of the

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NZ90's, but the OS90's cows had a lower lactation yield because they had fewer lactation days (Appendix Table 2). On a feed allowance per cow basis, NZ90's are more productive than OS90's. Even on a comparative stocking rate basis, the ranking of the three strains for milksolids production remains clear (Appendix Figure 1). The results shown in Figure 1 and Appendix Figure 1 and Appendix Table 3 show that the NZ90's is the Holstein-Friesian strain best suited to the majority of current New Zealand farms.

Although supplements were used in late lactation on many of the farm systems, OS90's were dried off earlier than NZ90's because of lower body condition. Milking OS90's for longer, drying off at a low body condition, and then feeding at high levels during the dry period to regain condition may improve the performance of OS90's.



Appendix Figure 1: **Milksolids production 2002/2003 (1st and 2nd lactation cows)**

OS90's typically resume oestrus activity before the other strains, but this did not overcome the poorer fertility which resulted in a longer calving spread compared to the NZ strains (Appendix Table 3).

The first two years of this study suggest that the profitability of seasonal pasture-based dairy systems is highest when NZ90's cows are farmed. It has also shown the productive gains made in the last 30 years of selective breeding, with NZ90's cows producing 20% more milksolids per lactation day than the NZ70's cow.

Appendix Table 3: Calving data 2001/2002 (all heifers) & 2002/2003 (1st and 2nd lactation cows) compared to best practice (Repro Chequer Target).

	Days from calving to mid-point		% calved in 4 weeks		% calved in 8 weeks	
Repro Chequer Target	14		70		95	
Year	2002	2003	2002	2003	2002	2003
NZL	14	15	71	73	82	89
NZH	14	17	68	70	84*	91
OSH	23	21	56	59	89**	76

3% cows induced, ** 9% cows induced

The production for the current season (2003/2004) is shown in Appendix Table 4. It is interesting to note that the production of the NZ70's in the current season was 420 kg milksolids/cow and 1300 kg milksolids/ha on grass alone, again highlighting the old 90% feeding 10% breeding rule (which in this case based on milksolids production per ha and per cow was actually 85% feeding and 15% breeding). Even though breeding may only contribute 10-15% of production, Table 1 shows that breeding over the last 30 years has improved EFS/ha by over 50%.

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Appendix Table 4: Production to date for the 2003/2004 season. (Note: these data have not been statistically analysed as some of the herds had not yet dried off as of 14 May).

	NZ70's			NZ90's				OS90's			
Feed allowance, t DM/cow	4.5	5.5	6.0	5.0	5.5	6.0	6.5	5.5	6.0	6.5	7.0
Cows/ha	3.8	3.1	3.1	3.4	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Supplements, kg DM/cow											
Pasture silage made/fed	112	370	162	229	379	227	0	286	68	45	42
Maize silage	0	0	217	0	0	455	648	0	349	894	909
Maize grain	0	0	140	0	0	0	259	0	0	0	263
Days in milk	266	280	287	264	264	288	289	249	242	278	278
Milk yield, kg/cow	4358	5448	5252	5249	5594	5758	6190	5275	5468	6614	6789
Milkfat, %	4.69	4.46	4.64	4.60	4.59	4.89	4.78	4.28	4.17	4.15	4.15
Milk protein, %	3.31	3.28	3.37	3.52	3.45	3.71	3.77	3.43	3.40	3.45	3.48
Milksolids, kg/cow	349	422	421	426	450	496	529	407	414	503	518
Milksolids, kg/ha	1294	1303	1300	1401	1389	1531	1635	1258	1279	1553	1601
LW at 14 May, kg/cow	501	523	505	507	507	533	556	553	579	559	557
Condition score at 14 May	4.6	4.7	5.1	4.4	4.3	4.6	4.8	4.3	4.3	3.9	4.1

Holstein Friesian Comparison: Response to Concentrate Trial

From the previous comparisons of NZ HF and OS HF it was clear that the OS HF could not achieve the same DM intake (as a %LW) as the NZ cows on pasture i.e. even when fed well on pasture the animal was still in a greater relative feed deficit than NZ HF. As a result the current decision rules for when to profitably feed supplements needed to be modified for the OS HF animals. This experiment was designed to test whether the OS HF would give greater milksolids responses to a high energy supplement than NZ HF, even when offered generous pasture allowance (approximately 80 kg Lwt/t DM). The concentrate was 53% maize grain, 42% barley grain, and 5% molasses and 0, 3, or 6 kg DM/cow/day was automatically fed to cows in the rotary dairy every day of lactation. Cows receiving concentrate after calving also received 2 kg concentrate DM/day for a minimum of 10 days prior to calving.

The results were consistent with previous research – OS HF cows were larger, produced more milk with lower solids content, produced similar milksolids per day of lactation, lost more condition during lactation, struggled to regain condition by the end of lactation, and had a lower DM intake (as a % of LW) when fed generously on pasture (Appendix Table 5).

It was also clear that the OS HF gave much greater milksolids responses to concentrates than NZ HF, and that the size of the responses were not significantly diminished at high levels of concentrate feeding. This was because the OS HF animals had a greater relative feed deficit compared to NZ HF when fed generously on pasture. However, the greater condition score loss

of OS HF during lactation means that greater feed input is required in the dry period, thereby reducing this efficiency advantage.

One of the reasons for doing this experiment was to find out how much extra feeding was required to prevent the rapid loss of body condition by OS HF after calving, and the low levels of body condition during lactation even when well-fed on pasture. Feeding 3 or 6 kg concentrate DM/day did not change the rate of body condition loss during the first month of lactation, however cows that were fed more concentrate started gaining condition sooner. NZ HF fed 3 and 6 kg concentrate/day averaged 0.1 and 0.6 more condition score units during lactation compared with NZ HF fed only grass, and OS HF averaged 0.0 and 0.4 condition score units more than OS HF fed only grass, respectively.

Appendix Table 5: Production of New Zealand (NZ) and overseas (OS) Holstein Friesians (HF), with similar \$BW values, grazing pasture at approximately 80 kg LW/t DM and fed 0, 3, or 6 kg concentrate DM/cow/day of lactation. Results are an average of 2002/2003 and 2003/2004 seasons (2003/2004 season not completed – data only to 14 April).

	NZ HF			OS HF		
	Diet, kg concentrate DM/day			Diet, kg concentrate DM/day		
	0	3	6	0	3	6
Concentrate, kg DM consumed/cow	0	763	1512	0	746	1465
Days in milk	278	269	279	267	264	269
Milk yield, kg/cow	5298	5961	6322	5764	6709	7369
Milkfat, %	4.74	4.44	4.24	4.15	3.89	3.70
Milk protein, %	3.54	3.60	3.68	3.45	3.41	3.54
Milksolids, kg/cow	437	476	492	431	485	529
LW during lactation, kg/cow	478	491	502	577	570	579
Change in LW during lactation, kg/cow	-21	20	44	-47	-19	1
Condition score during lactation	4.3	4.5	4.9	3.9	3.8	4.3
Change in condition score during	-0.5	-0.1	1.4	-1.9	-1.8	0.2
DM intake during lactation, % of LW	3.0	3.2	3.2	2.8	3.1	3.2
Efficiency, g MS/kg LW	90	97	96	78	89	93
Response, g milksolids/kg conc. DM		51	36		72	67
Response, kg milk/kg conc. DM		0.87	0.68		1.27	1.10

Notes:

This information shows that cows of similar \$BW had different relative feed deficits when fed well on pasture, and as a result gave different responses to supplementary feed. This means that quite different decision rules are required for OS HF cows when farmed at the same CSR as NZ HF. It is clear that OS HF type cows have a requirement for a high energy/high DM supplement in order to achieve the same DM intake (as a % LW) as NZ HF. However the NZ HF was more efficient at a cow level, producing more kg milksolids/kg LW on all three diets tested. Feeding OS HF 3 or 6 kg concentrate DM per day of lactation improved the efficiency of milksolids production, but even then OS HF efficiency was only the same as NZ HF fed only grass for the entire lactation. Overall economic efficiency of the system will depend on per cow costs, feed costs, and milksolids payout.

Future research

Research during the next two years will work out whether the large differences in EFS between strains of HF cows of similar \$BW can be reconciled, and whether the system is showing the true costs and value of OS HF genetics. In particular, the importance of days in milk and body condition score in the animal evaluation index will be investigated, and calving condition score targets in relation to feeding decision rules will be re-evaluated. Extending lactation for 670 days (only calving once every two years) is also currently being studied.

If future farming systems become more diverse, marker assisted selection may help to make progress with smaller databases for each type of system. The industry is making significant investment in this technology.

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