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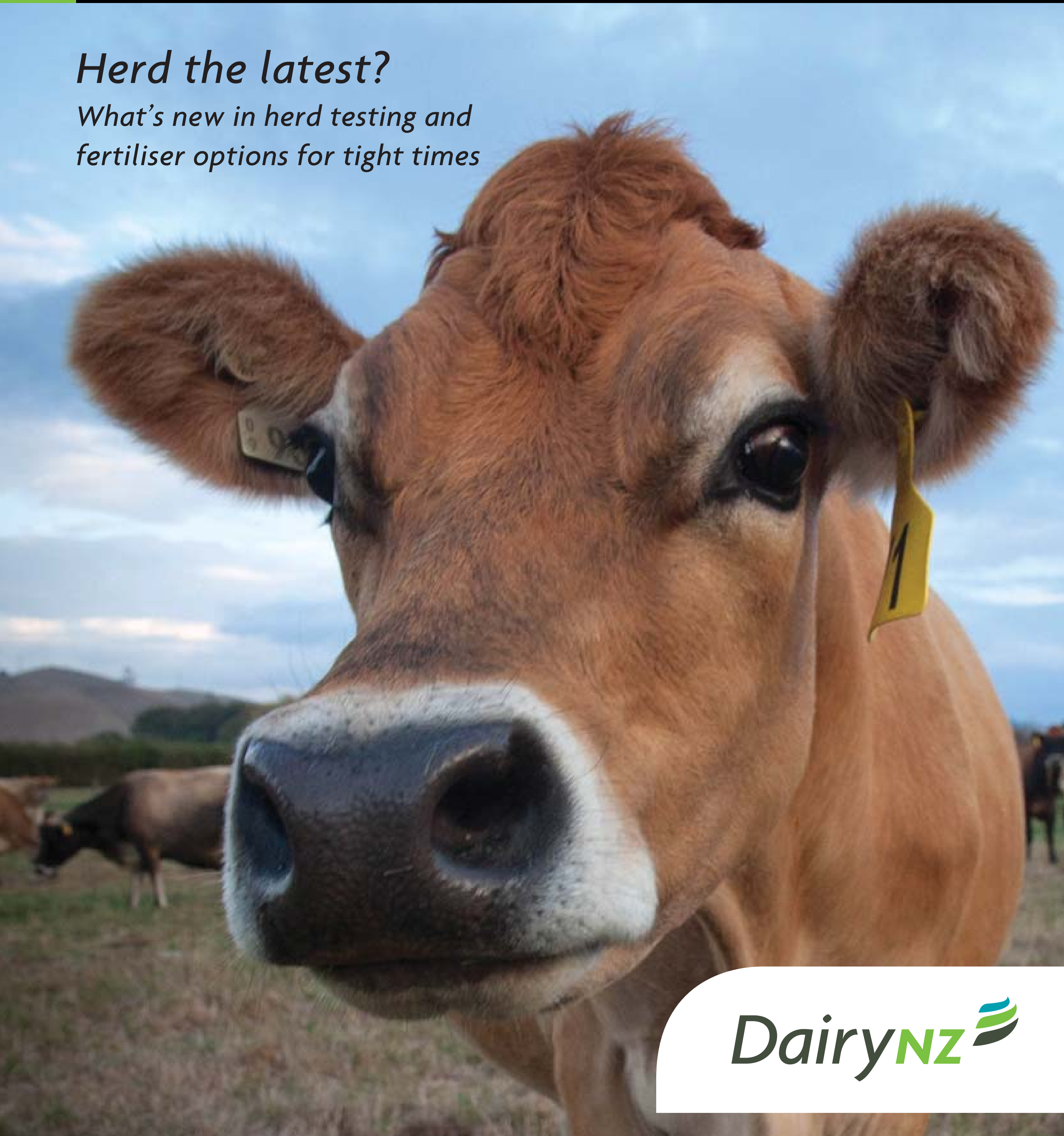

Herd the latest?

What's new in herd testing and fertiliser options for tight times

DairyNZ

WHY WE HERD TEST | HERD TESTING IN TIGHT TIMES | HERD TESTING FOR AUTOMATED SYSTEMS

Contents

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Herd testing – why you can't do without it

Herd testing is integral to the success of your farm and to New Zealand's dairy industry. It's not something to let slide, even when times are hard.

Sue Petch, DairyNZ.

Herd testing is an integral step in breeding cows with increased production potential in New Zealand dairy systems. Genetic gain is fundamental to the dairy industry. Increasing the productive potential of New Zealand dairy cows is essential for the dairy industry to be able to retain a competitive advantage in cost efficient milk production. This issue of the Technical Series summarises the value that herd testing provides to both the dairy industry and to dairy farmers.

Normal procedure on New Zealand dairy farms is to conduct up to four herd tests in a season. In tight times, cutting herd testing costs is often considered. However, loss of herd testing data is a loss for both farmers and the dairy industry. Each test gives farmers information on the total milk volume, milk fat and protein content and somatic cell count of every animal that is tested, which can be used to make management and culling decisions. Inclusion of this information in the Dairy Industry Good Animal Database allows the industry as a whole to improve continually the genetics of the national herd. The information is used for maintaining genetic gain and improving the reliability of genetic predictions for cows and bulls.

In this issue, three important elements of herd testing are covered. The value of herd testing is discussed in the article "Herd testing – it's essential to your farm" (pages 1-4). The on-farm testing regime that best suits an individual farmer's needs is considered in "Herd testing in tight times – what are the options?" (pages 5-8). This describes how the frequency of herd testing and the selection of the sampling regime impact the accuracy of ranking cow performance for increased genetic gain. The third article "Herd testing on the way for automated milking systems?" (page 9-11) summarises changes to the herd test standard and implications for farmers with automatic milking systems.

Finally, in "Fertiliser costs – what to do in the downturn?" (page 12-13), consultant Doug Edmeades advises how good knowledge of your farm's soils and appropriate use of fertiliser can save money.

Herd testing – it's essential to your farm

Herd testing remains invaluable as a tool for improving genetic performance and ensuring good farm management.

Melissa Stephen, DairyNZ
Jeremy Bryant, DairyNZ

Herd testing in New Zealand is a powerful on-farm management tool and also contributes significantly to the efficiency of the national herd.

Herd testing enables accurate genetic predictions which allow farmers to make good decisions regarding which animals to breed from and which to cull.

Meanwhile, the information generated from herd tests feeds back into the Dairy Industry Good Animal Database, improving the reliability of genetic predictions.

This genetic gain contributes $300 million annually to the industry.

Herd testing in New Zealand commenced in 1909. The first daughter-dam comparisons were produced in 1933, allowing farmers and breeding companies to identify genetically elite dams. These comparisons were the early precursor for our current estimate of genetic merit, Breeding Worth (BW)[1,2].

Herd testing is just as important today as it was in the early twentieth century.

Genetics value

Herd testing allows us to determine a cow's own productive ability and a sire or cow's ability to breed profitable replacements. Seventy percent of New Zealand dairy farmers herd test, and it is this data that makes the most significant contribution to our animal evaluation system. The information is used to generate animal indices, including Breeding Worth (BW) and Production Worth (PW)[3]. This data allows cows and bulls to be ranked objectively, and the accuracy of this ranking is improved as more data is received. ▶

Management value

Herd testing allows farmers to identify poor producers as well as cows with high somatic cell counts (SCC). These animals are candidates for culling during a drought or at the end of the season. Culling or drying off these animals allows farmers to prioritise feed within their system and reduce bulk SCC. The latter reduces the likelihood of incurring financial penalties for exceeding bulk milk tank SCC thresholds. It also allows farmers to identify cows that need dry cow therapy in preparation for the next season. Herd testing also offers a value-add benefit for a herd; potential herd purchasers are more informed about what they are buying and are usually willing to pay more for stock of higher BW[4].

Fast facts

- Herd test information allows bulls and cows to be objectively ranked and selected based on genetic merit.
- Genetic improvement contributes $300M annually to the NZ dairy industry.
- Herd test information is the most significant contributor to predicting a cow's Breeding Worth and Production Worth.
- Breeding Worth ranks animals on their ability to breed profitable replacements.
- Production Worth ranks female animals for their lifetime performance to aid culling decisions.

Use of herd testing information in genetic evaluation

An individual cow's herd test information affects not only her own estimates of genetic merit (BW and PW), but her relatives as well (see Figure 1). This is particularly important for bulls, where the accuracy of breeding values relies on information generated from cows across the national herd.

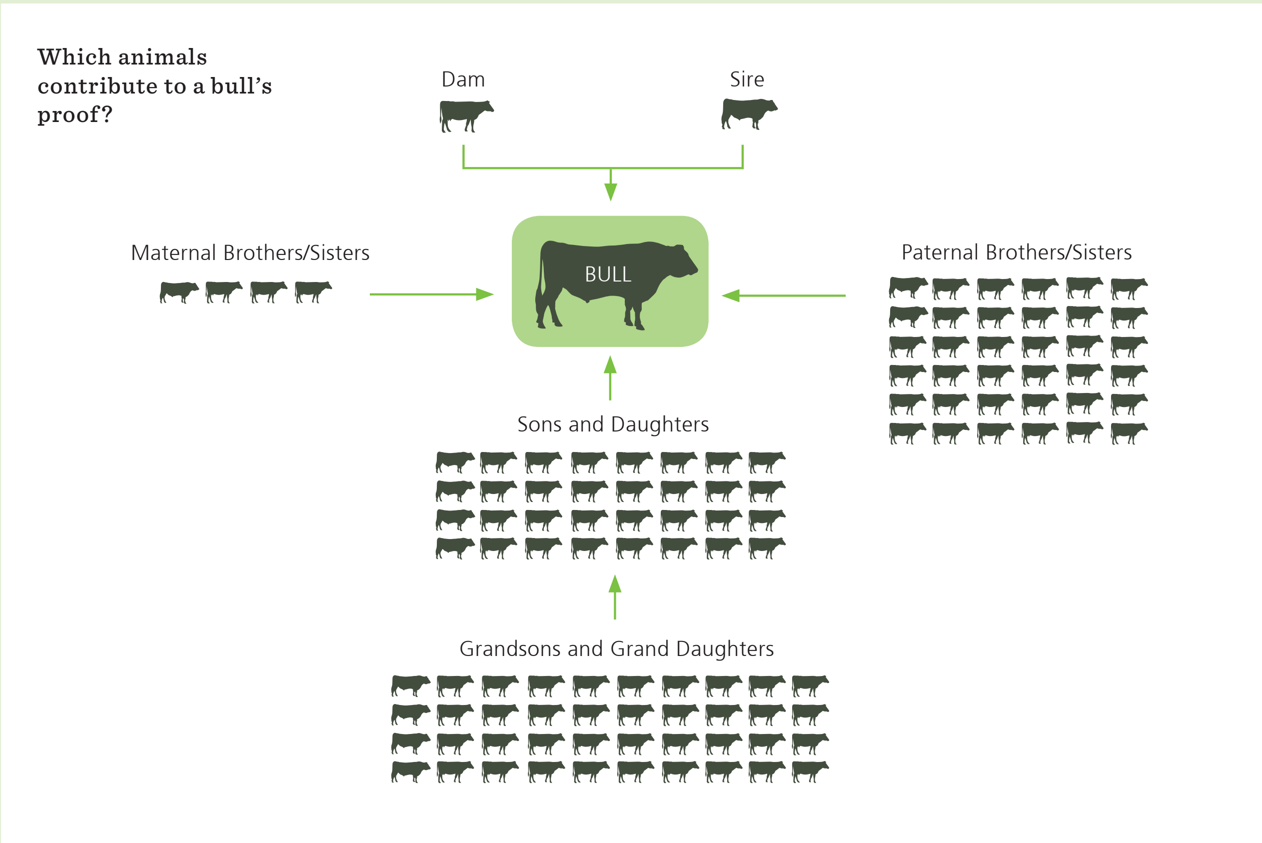
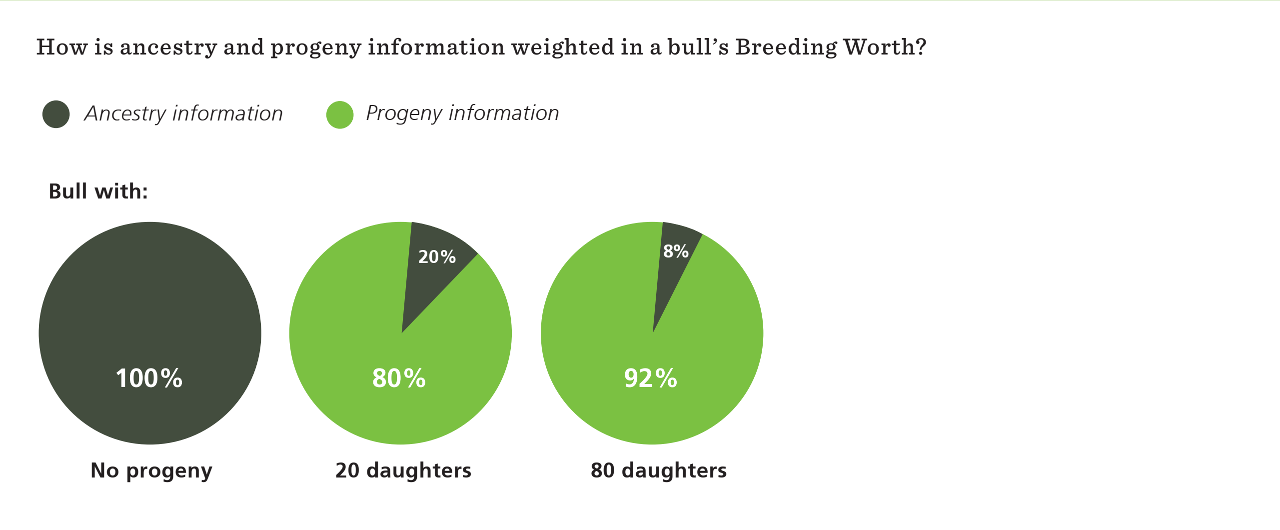


Figure 1: How herd testing contributes to a bull or cow's Breeding Worth or Production Worth.

For instance, contributing to the BW of Fairmont Mint-Edition are his sire and dam, plus 113 sons and 70,227 daughters, 97 paternal brothers and 51,324 paternal sisters, and other related dairy cattle.

Successful bull selection is also reliant on herd test information. After initially selecting bull calves by assessing the sire and dam BW, and BW based on genomic information, artificial breeding companies typically run progeny test programmes to collect production data from a large number of daughters for each selected bull. They use this data, and other trait information, to decide which bulls enter the marketplace.

Herd test data from the progeny of an animal gives us the best information on the genetics they have passed on. Therefore, progeny information carries the highest weighting in the calculation of a bull's BW (see Figure 2). Second to that are an animal's own records, which, in the case of cows, may be given the highest weighting because progeny information is often non-existent. For young stock, ancestor information is used. In the case of bulls, we rely on information from their daughters, sisters, aunts etc. In this situation, herd test information filters back to make genetic predictions more accurate (see Figure 2).



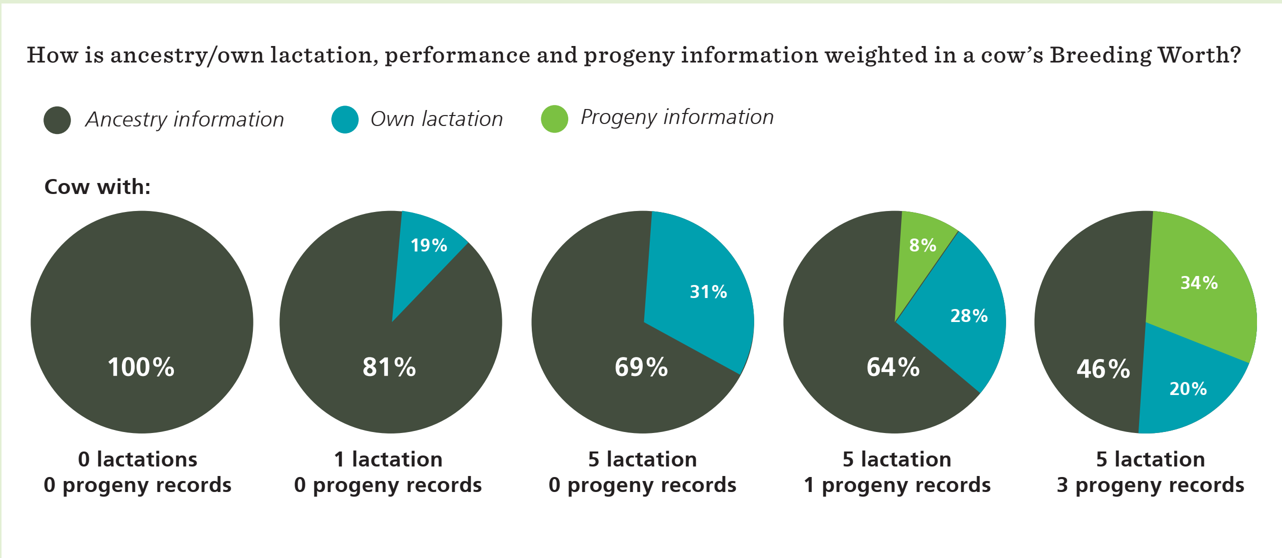
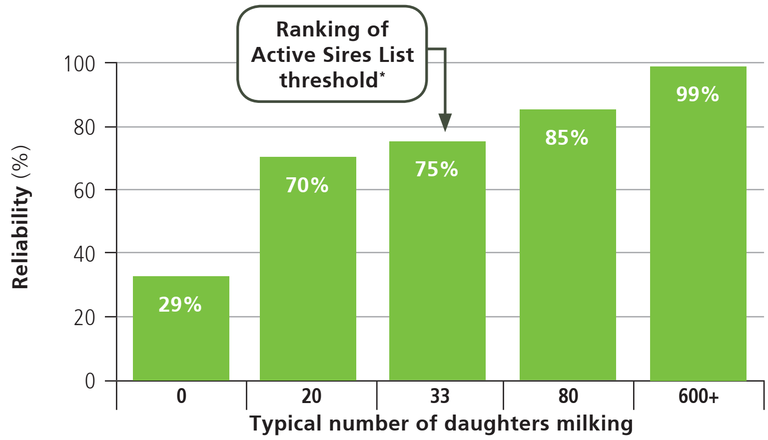


Figure 2: How ancestry/own and progeny information is weighted in sires' and cows' BW.

The more information there is about the animal itself and its relatives, the more confidence there is in the genetic predictions and the less likely they are to change over time (see Figure 3). To obtain a reliability of 99 percent requires at least 600 daughters to have been herd tested. Once a bull has 600 daughters tested, future testing should not shift the BW established by more than ± 12 units. Eighty-five percent reliability requires 80 daughters tested.

For more information see our online resource, "BW explained"[5].

Reliability explained



Expected maximum shift in BW (+/-)	100	71	59	46	12

*Eligibility to be on the top sires list for BW and breed category.

Figure 3: Expected maximum shift in Breeding Worth, as more of a bull's daughters are herd tested.

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Herd testing in tight times – what are the options?

It is tempting to try to save money by cutting back on herd testing. But if you don't perform a minimum amount of herd testing each year, your information isn't accurate.

Key findings

- More herd tests per lactation increases Production Worth and Breeding Worth reliability.
- Collecting milk samples at both AM and PM milking provides the most reliable data.
- Both the herd test interval and milk sample collection needs to be considered when reviewing herd test options.

Jeremy Bryant, DairyNZ
Peter Amer, Bram Visser, AbacusBio Ltd;
Sue Petch, DairyNZ

In tight times, farmers look for ways to cut costs. Herd testing often comes up as "maybe we could reduce herd testing frequency this year", but it is very important to consider the implications and options available before making such a decision.

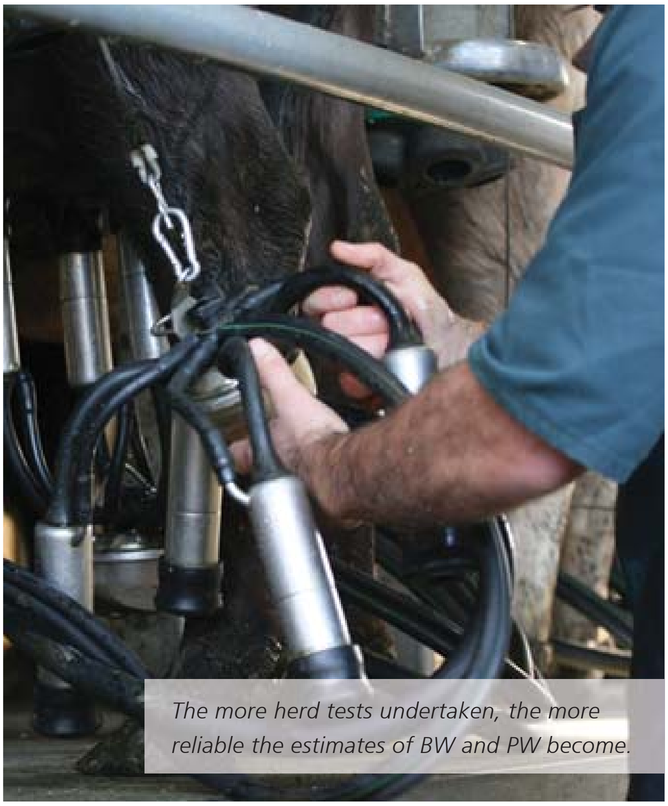
To obtain accurate genetic estimates for selection or culling purposes, a minimum of four herd tests a year are recommended as well as sampling at both AM and PM milking.

The reliability of Production Worth (PW) and Breeding Worth (BW) is reduced by any decision to cut testing back. ▶

The current herd testing service in New Zealand involves a physical visit to the dairy herd typically once every two months or four times per year, but more or less frequently as the farmer specifies. This system has been in place for over 100 years but there is now more flexibility around sampling regimes. Variations range from timing of sample collection (AM and PM, AM-only, or PM-only sample collection) to frequency of milking (once-a-day or twice-a-day)[1].

Importance for estimates of genetic merit

The more herd tests that are undertaken, the more reliable the estimates of BW and PW become. The PW reliability of a cow without any herd test records is very low, at about 20% (Figure 1). At that level of reliability, it is near impossible to determine if she is a highly profitable member of your herd and worth breeding from, or if she should be culled. A single lactation with herd test data increases the PW reliability to ~55%. With five lactations, reliability reaches about 90%. BW reliability is influenced by the cow's own lactation records and also those of her progeny. Simply put, without a whole season or multiple seasons of herd test records, it is very difficult to cull correctly on expected lifetime profitability of the cow.



The more herd tests undertaken, the more reliable the estimates of BW and PW become.

Figure 1: How a cow's own lactation and progeny records affect her Production Worth and Breeding Worth reliabilities. *(Adapted from Anon, 2009[2]).*

*For zero lactation, zero progeny records, ancestry is the only contributor to reliability.

How many herd tests?

For genetic evaluation, the ultimate goal is to predict an accurate 270-day yield for each cow. In Ireland, five or more AM and PM test-day records taken at 8-weekly intervals predicted 305-day yield with a high level of accuracy[3]. Only limited improvements in accuracy in predicting total yield were gained by herd testing more frequently than every eight weeks[3].

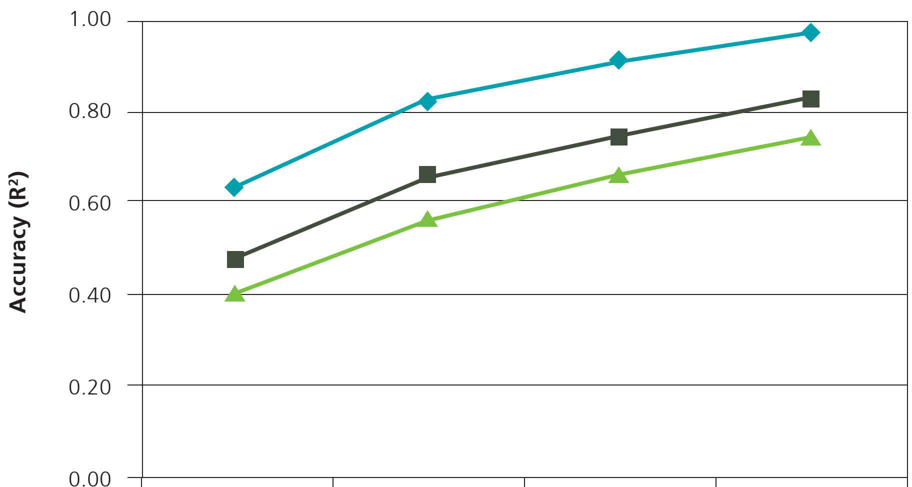
Several years ago, DairyNZ and AbacusBio Ltd calculated 270-day yields from cows for which milk, fat and protein yield records were available for every day of their lactation – the gold standard of herd testing. These yields were compared with 270-day yields estimated from herd testing on a monthly basis, or once, twice, or four times per year (herd test interval).

We found that four herd tests per year, both AM and PM, were needed to predict total yields with accuracy in excess of 0.9 (Figure 2). Thus, four tests per year allow reasonably accurate estimates for total yield, comparative ranking of animals and lactation persistency via the Test Day Model (see page 8).

Sample collection from the AM and PM milking (Figure 2) increased the correlation for all herd test intervals when compared with just AM or PM sample collection.

Hence, it is very important to consider both the herd test interval and the sampling collection regime when reviewing herd test options.

The benefits of greater frequency of herd testing also apply to somatic cell count (SCC) estimates. The more measures, the greater the accuracy, allowing better management choices for culling and for drying off (to manage bulk SCC in late lactation).



	1	2	4	9
AM+PM	0.63	0.82	0.91	0.97
AM only	0.47	0.66	0.74	0.83
PM only	0.40	0.56	0.66	0.74

Number of herd tests

Figure 2: Accuracy of total fat yield predictions using different numbers of herd tests and sampling regimes.

Test Day Model

- Introduced in 2006, the Test Day Model (TDM) allows better adjustment for stage of lactation, the environment specific to each test-day, and differences among cows in terms of maturity and persistency to be taken into account.
- The TDM also enables genetic estimates of 'persistency' for milk, fat and protein yield.
- Friesian sires have, on average, lower persistency breeding values than Jersey sires, The Breeding Values of Friesian-Jersey crossbreds and Ayrshires/other sires rank between the two main breeds.
- Lactation persistency is being considered as a trait for inclusion in BW due to differential payments for milk produced outside of the peak milk periods.

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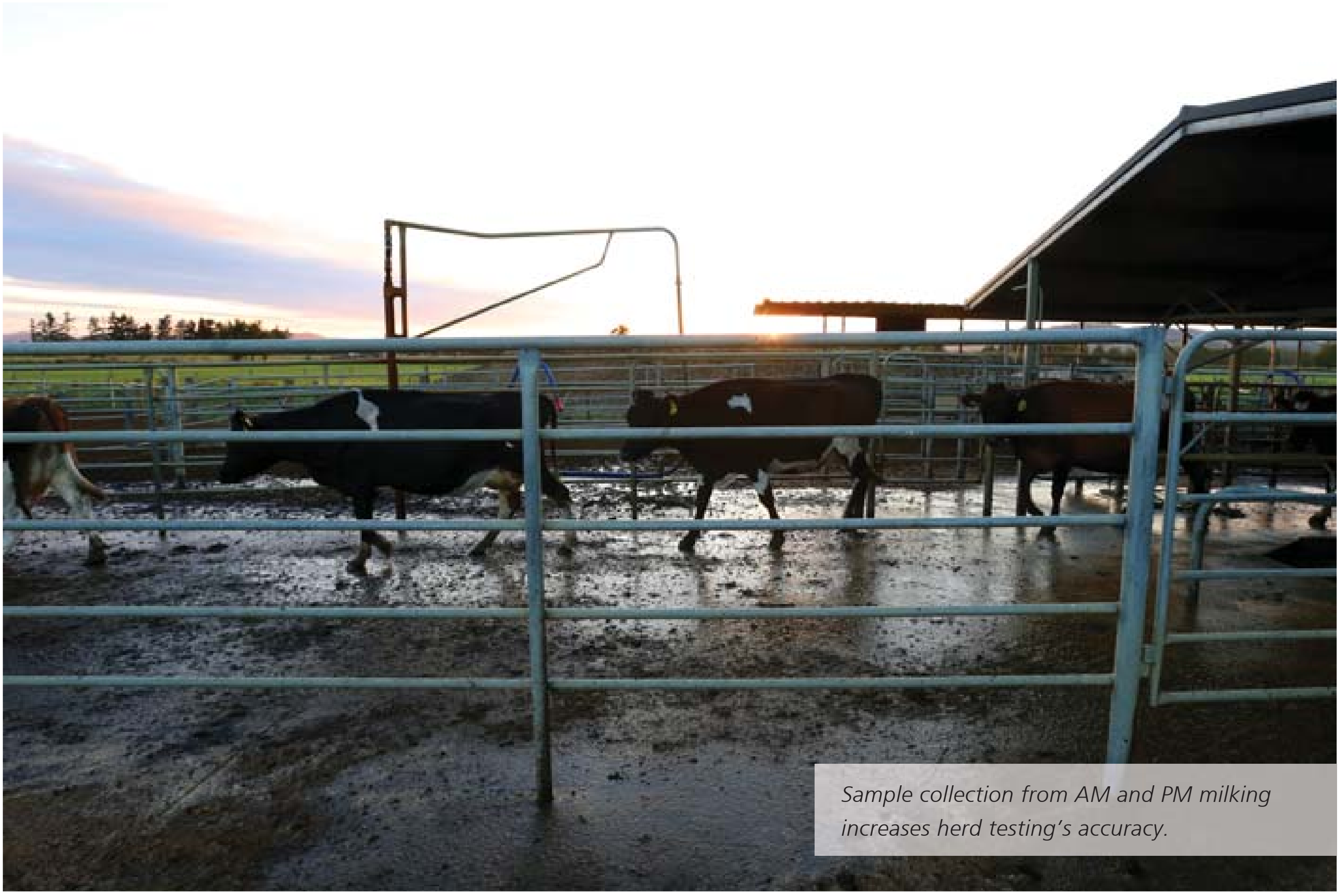


Sample collection from AM and PM milking increases herd testing's accuracy.

Herd testing on the way for automatic milking systems?

Changes to the New Zealand Dairy Herd Test Standard could soon make approved herd testing an option for farmers with automatic milking systems (AMS).

Key findings

- Herd testing for automatic milking systems (AMS) farmers should be an option with the publication of an updated New Zealand Dairy Herd Test Standard.
- The accuracy of properly calibrated and installed AMS milk meters (determining milk yield) and milk sampling devices is similar to, or better than, devices used in conventional herd testing systems.
- The duration of herd testing can be reduced from 48-hour to 36 or 16-hour, depending on the average milking frequency for cows in an AMS herd, while achieving similar 24-hour estimates for milk yield and milk components.

Claudia Kamphuis, Wageningen University, The Netherlands
Sue Petch, Sally-Anne Turner, DairyNZ

The New Zealand Dairy Herd Test Standard sets data quality limits on herd test data. The standard, developed in 2001 and updated six years later, did not include herd testing for AMS. At that stage AMS, where individual cows select their own milking times, were not considered a commercial reality for pasture-based systems. Consequently, farmers operating AMS today are not permitted to herd test and therefore receive estimates of genetic merit, BW and PW that are not as accurate as possible. This compromises farmers' ability to cull inferior animals and select cows to meet breeding objectives. To provide AMS farmers with the option of herd testing, the Standard requires another update.

48h herd test protocol

A protocol was developed for herd testing in AMS with low milking frequencies[1], using a similar approach to that used for herd testing in conventional milking systems (CMS). However, a longer herd test period was required because of the range of milk frequencies in AMS. The protocol stipulated collection of milk yields and milk samples from all cows, each time they were milked, during a 48-hour sampling period (48h Protocol). The milk samples were submitted to a certified laboratory for milk analysis. Results from the laboratory were then combined with milk yield estimates recorded by the AMS and converted to standardised 24-hour estimates (24h estimates).

Evaluation of 48h Protocol

In 2011, the 48h Protocol was submitted to the Standing Advisory Committee (SAC) of New Zealand Animal Evaluation Limited (NZAEL) for evaluation. Clarification was requested:

- Would the equipment used on AMS farms meet the Standard for providing data to the Database?
- Would the 48h Protocol suit a range of farm systems?
- Could a herd test period of less than 48-hours be used to reduce cost and inconvenience without compromising accuracy?

This prompted further research, funded by the NZ Government (through the Primary Growth Partnership programme), including an assessment of herd testing devices currently used for CMS for comparison with AMS[2,3].

How the study was undertaken

Between December 2011 and February 2013, data for 12 herd tests was collected from five AMS farms in the Waikato and the South island using the 48h Protocol (milk sample collected from every cow milked during a 48-hour period). All major dairy breeds, and several different farms systems, were represented by the five farms. Milk yield data recorded by the AMS milk meters and herd test milk samples were collected by a sampling device installed at each AMS unit. The laboratory results for milk composition were combined with the milk yield data to derive estimates for milk yield fat, protein and somatic cell count, comparable to conventional herd test results (standardised 24-hour estimates).

A similar sampling protocol was used during six herd tests on a research farm using CMS herd test devices. The AMS results were then compared with performance requirements set by the International Committee of Animal Recording (ICAR)[4] and the NZ standard[5], and with results from the CMS herd tests.

Reducing herd testing period

Milking frequency affects milk yield and composition. In CMS, milking frequency is approximately the same for all cows in a herd. Therefore, standardisation is relatively straightforward. In AMS, the milking frequency within and between cows can vary widely (e.g. between 1 and 3 milkings per cow per day). Consequently, more measurements are required to ensure that milking frequency does not affect these 24-hour estimates. To determine whether or not the herd test sampling period could be shortened without loss of accuracy, six alternative sampling periods (36, 24, 18, 16, 12, and 8-hour) were used to derive 24-hour estimates and these estimates were compared with that calculated for the 48h Protocol.

Reducing the herd test period from 48-hour to 36 and 16-hour resulted in very similar standardised 24-hour estimates to the 48h Protocol. However, decreasing the herd test duration further resulted in increased risk of cows not being milked within that period.
The percentage of cows in the herd without any herd test result increased from 0% on the 48h protocol to 0.6% at 36h and 8.0% using a 16-hour herd test period (Figure 1). The percentage of cows affected was influenced by the average milking frequency of the herd, and so a split protocol based on milking frequency was recommended to the SAC:

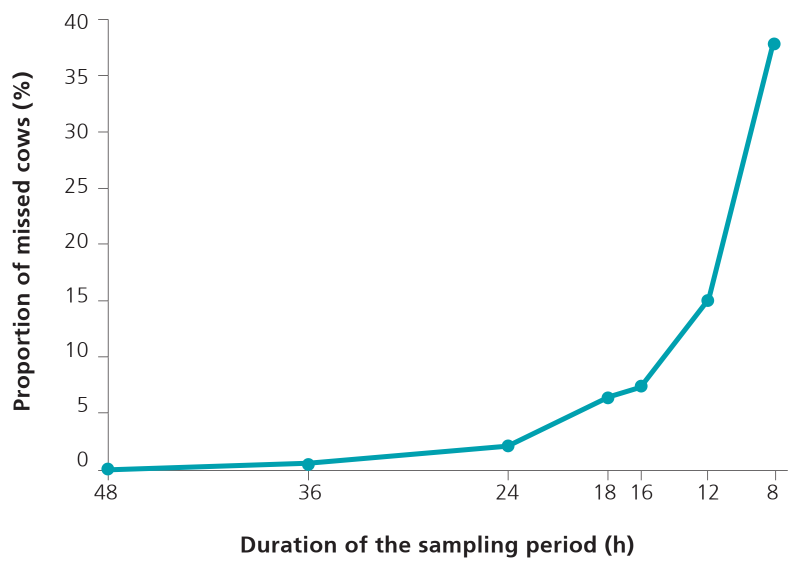
Where the average milking frequency of the herd is equal to or greater than 2 x per day, the herd test period would be 16 hours, and where the average frequency is below 2 x per day it would be 36 hours.

These recommendations provide acceptable herd test data accuracy while reducing herd testing costs, inconvenience and the number of cows with missing data.

Accuracy of AMS equipment

Farm type, breed, season and region did not appear to affect accuracy of devices used on AMS units. When all yield data was assessed, the milk meters and sampling devices on AMS units were as accurate, if not more accurate, than the herd testing devices used on CMS farms. Therefore, it has been recommended that herd testing for AMS farms be included in the latest herd test standard revision.

Figure 1. Average proportion of missed cow-herd tests (%) as the duration of sampling period reduces from 48 to 8 hours on five dairy farms with AMS.



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Fertiliser costs – what to do in the downturn?

When times are tight, good knowledge of your farm's soils and intelligent use of fertilisers can save valuable dollars.

Fast facts

- Fertiliser is expensive; therefore cutting nutrient inputs is often seen as a way to reduce costs in tight times.
- If soil nutrient levels are currently optimal (as indicated by soil tests), then P fertiliser inputs could be reduced in the short-term without compromising production. However, Olsen P will drop 1-2 units per year if fertiliser is withheld.
- Reducing K and S inputs is risky. These nutrients can be rapidly leached from the soil, thereby depleting nutrient supply below optimal levels.
- Lime is not a substitute for P, K or S fertiliser. It doesn't contain these nutrients. It can, however, increase productivity if soil pH is less than optimal (5.8 – 6.0).

Dr Doug Edmeades, agKnowledge Ltd

The latest DairyNZ Economic Farm Survey (2012/13) shows the three big items of discretionary expenditure on the average dairy farm are:

- feed (made, cropped or purchased) (21% of the total farm working expenses),
- wages (15%) and,
- fertilisers including N (about 14%).

Few opportunities exist to reduce wages, so when farm income is tight, what can be done about feed and fertiliser costs, noting that they are interrelated?

Clover-based pasture costs about 5-10 cents/kg DM. It is the cheapest feed, cheaper than N-fed grass, crops and supplements.

Therefore, to minimise input costs, attention should be directed to maximising pasture production.

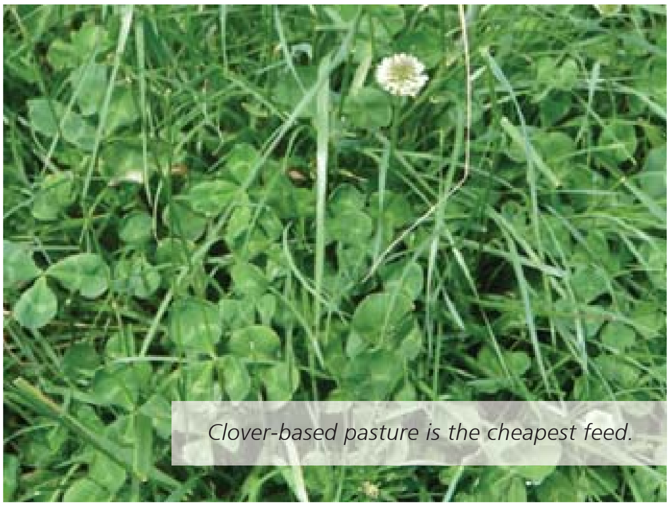
The fertiliser inputs and optimal soil nutrient ranges required for optimal pasture production of clover-based pastures are well defined. For potassium (K) the optimal range is Quick Test 7-10, and for sulphur (S, either sulphate S or organic S) the range is 10-12. These ranges apply to all soil groups. For phosphorus (P) the optimal range for high-producing dairy farms (1000kg MS/ha) depends on the soil group: 35-40 Olsen units for sedimentary and volcanic soils and 40-45 for pumice and peats. Assuming the P, K and S soil nutrient tanks are full, the annual inputs of nutrients to maintain the optimal levels are about 45-50kg P/ha, 80-100kg K/ha and 30-50kg S/ha.

The other inputs that may be required are lime and perhaps molybdenum (Mo). Soil pH levels should be 5.8-6.0, except for peat soils (about pH 5.5). There is no soil test for Mo and so to check soil Mo levels, clover-only samples are required. The Mo concentration should be > 0.1 ppm in the clover dry matter.

What options are available to reduce fertiliser costs?

- If current soil nutrient levels are all above the optimal ranges then fertiliser can be withheld without losing any pasture production.
- If Olsen P levels are within the optimal range then fertiliser P can be withheld for a year. This is because P does not leach – it 'stays put' in the soil and the Olsen P level will only decrease slowly (1-2 units per year) without any practical negative effect on pasture production.
- The nutrients K and S are mobile (they can leach). Withholding K and S inputs is risky because the soil nutrient levels, and hence pasture production, can decline rapidly.
- Pastures can only grow as fast as the most limiting nutrient. Therefore, targeting the most limiting nutrient will give the biggest bang for the fertiliser buck. For example if the P and S levels are adequate but the soil K levels are deficient, redirect the fertiliser dollar to correcting the soil K deficiency.
- Use the cheapest type of fertiliser to deliver the required nutrients. Essentially stick to the generic products (super, potash, urea) rather than the branded products.
- Determine the soil fertility on the various blocks on the farm (areas of similar slope, soil group, land use, history, productivity). Do not apply fertiliser to those blocks that are above the optimal nutrient levels (this may apply to the effluent block). Reduce the inputs on those areas that are less productive (e.g. steep hillsides).
- Lime is not a source of nutrients and it is not a substitute for fertiliser nutrients. If the soil pH is within the optimal range (5.8-6.0) or above, no lime is required for several years. Note that pasture responses to lime are small (0-5%) if the soil pH is in the range 5.5 to 5.8. By contrast, correcting nutrient limitations can increase pasture production by 10-30% depending on the severity of the deficiency. Liming is not a high priority.
- Review the fertiliser N policy. On clover-based pasture, nitrogen use is optimised (i.e. maximum kg DM grown per kg N applied) by using fertiliser N as a tactical input (about 25kg N/ha/application) in late winter/early spring and in late autumn, to drive out-of-season ryegrass production and hence broaden the seasonal pasture production profile. Note that clover is a better feed for ruminants than grasses (more kg MS/kg DM consumed) and overuse of fertiliser N can decrease pasture clover content (as a rule of thumb 3kg of clover N is lost for every 10kg fertiliser N applied).

To implement most of the options above requires good knowledge of the soil fertility of the farm. So in the first instance, ensure that you have a good soil fertility monitoring programme in place for the whole farm. Divide the farm into blocks (areas of similar slope, soil group, land use, history, productivity). Select a representative paddock within each block and collect soil samples annually from the same transect on that paddock at the same time each year. Clover-only samples should be collected and analyzed initially to check on clover Mo levels.



Clover-based pasture is the cheapest feed.

Science snapshots

DairyNZ levy funded or supported science

Maximising operator efficiency in rotaries *(Edwards et al[1])*

- This study quantified the effect of rotary size, platform speed, cluster-attachment time, milk yield and end-of-milking criteria on cow throughput, operator efficiency and return on investment.
- Milking duration data was collected from 80 commercial farms, with rotaries ranging in size from 28 to 80 bails.
- In general, increasing platform speed and applying a set maximum milking time routine or raising the automatic cluster removal threshold from 0.2 to 0.4 kg/min, or more, improved cow throughput.
- Economically, 50-bail rotaries delivered the greatest labour efficiency per dollar invested while 70 and 80-bail rotaries were generally no more efficient than 60-bail rotaries.
- Choice of rotary size will depend on the individual farm situation, but careful evaluation of the likely returns from rotary dairies larger than 50-bails is advised.

Efficient calves are efficient cows *(Macdonald et al[2])*

- Residual feed intake (RFI) is the difference between what an animal eats and what it is expected to eat on average to achieve a given liveweight gain in milk production.
- RFI during growth was estimated for ~2000 Holstein-Friesian heifer calves (6-8 months of age) in New Zealand and Australia.
- The most divergent (low and high RFI) animals were retained and re-evaluated during their first lactation to determine if the divergence in RFI observed as calves was maintained in lactation.
- During lactation those identified as the most efficient as calves ate about 3% less feed per unit of milk produced than the least efficient.
- There was no negative effect on total milk production.
- This study supported the hypothesis that efficient calves are also efficient as lactating cows.

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