Dairy Australia

GROWING MORE PRODUCTIVE HEIFERS

2ND EDITION GUIDE

ACKNOWLEDGEMENTS

Dairy Australia gratefully acknowledges the contributions made by many people in producing this manual. In particular we would like to thank:

- David Beggs and Stephen Jagoe, authors and project leaders
- Our technical review panel: Ian Lean (SBScibus), David Barber (University of Queensland), Bill Wales (DPI Victoria), John Mulvany (OnFarm Consulting), Phil Shannon, Shannon Farm Consulting and Michelle Axford, DataGene
- Members of the farmer review panels in Victoria and New South Wales
- Pam Watson, Down to Earth Research
- Maria Rose, DPI Victoria
- Vicki Timbs, DPI NSW
- Michael Perich, Dairy NSW and Leppington Pastoral Co.
- Jocelyn Bevin, WestVic Dairy
- The Warrnambool Veterinary Clinic

CONTENTS

FORWARD

Heifers present a significant investment on dairy farms. The cost and value of dairy replacements has increased significantly over the last decade. As more farmers push herd size to achieve efficiency from their milking platform there is a flow on effect. There is a need for more replacements to maintain the increased core herd size, and these replacements often need to be fed on non-milking area in order to preserve that area for the herd. At the point of calving, it is estimated that a heifer has cost the dairy farm owner between $1,100 and $1,700. Therefore an average sized Australian herd, it has cost the business $100,000 to $155,000. To receive a return on this significant investment, heifers must get in calf quickly, calve without difficulty, produce well and get back in calf easily.

Research undertaken in Australia indicates that the most profitable heifers calve for the first time at 24 months of age or less, but to achieve good productivity must be well grown from day one.

Dairy Australia and its InCalf program have identified good heifer rearing as an opportunity to improve herd profitability. More heifers entering the herd result in a younger herd and a younger herd is inherently more fertile. Younger cows are also less likely to have the milk quality issues associated with older cows. If you have more heifers this will improve the opportunity to cull more selectively, or to earn an alternative income with the sale of animals excess to requirements.

This guide is designed as a resource for dairy farmers and can be used as a take away after attending a **Heifers on Target** workshop. It is the result of collaboration between a wide range of dairy farmers, farm advisors, veterinarians and dairy extension officers. It is intended to be a simple, practical and provide a set of guidelines for measuring and setting targets for replacement heifers. It includes recommendations for feeding heifers of different ages so that growth rates necessary to achieve a well-grown heifer can be easily estimated. It will be supported by electronic resources on the Dairy Australia website **dairyaustralia.com.au/heifersontarget**.

The guide is a companion manual to the Dairy Australia publication Rearing Healthy Calves, which provides resources aimed at producing a weaned heifer calf that has the potential to grow into a replacement heifer that will live a long and productive life.

SECTION 1 BENEFITS OF WELL-GROWN HEIFERS

Extensive research undertaken in Australia has shown that heifers that reach target weights perform much better in several key areas.

It is important that heifers enter the herd sooner rather than later and produce at a higher level so that the investment in them can be repaid sooner. Better heifers live longer, which means you need fewer replacements to maintain herd numbers.

How much does it cost to rear a heifer?

Modelling undertaken in 2021 by highly respected farm consultant, Phil Shannon, estimates cost of rearing replacement heifers is between $ 1,190/head and $1,718/head excluding the value of the calf at the time of birth. The modelling demonstrated that those heifer rearing operations that focus on reducing the cost of feed while still achieving target growth rates have the lowest overall cost. The breakdown of the cost of rearing replacements under a range of common scenarios are shown in Table 1. This example demonstrates that as more grazed feed is used, the cost of rearing decreases by up to $500/head. Whilst agistment is technically a form of feed cost, an example of full agistment is provided for illustration purposes.

Table 1 Estimates for the cost of heifer rearing based on Dairy Farm Monitor Project figures and input from farmers (Shannon, 2021).

	Scenario			
	Zero grazing	**40% grazing**	**75% grazing**	**Full agistment**
Birth to weaning	$315	$315	$315	$315
Weaning to 200kg	$239	$187	$142	$208
200kg to calving	$1,164	$934	$733	$852
Cost by input (and proportion of total rearing cost)				
Feed (incl milk)	$1,315 (77%)	$1,034 (72%)	$787 (66%)	$208 (15%)
Agistment	$0 (0%)	$0 (0%)	$0 (0%)	$852 (62%)
Labour	$140 (8%)	$140 (10%)	$140 (12%)	$53 (4%)
Vet/animal health	$263 (15%)	$263 (18%)	$263 (22%)	$263 (19%)
$/kg lwt	$3.12	$2.61	$2.16	$2.50
Total	$1,718	$1,437	$1,190	$1,375

The four scenarios included in the model included:

- Zero percent grazing; Representing a business that might keep the stock on farm and feed them on supplement only (a diet comprising concentrate and fodder).
- 40 percent grazing; Representing a business that provides some opportunity for grazing (40 percent of the diet) and the balance as concentrate and fodder.
- 75 percent grazing; Representing a business that provides opportunity for grazing (75 percent of the diet) and the balance as concentrate and fodder.
- Full agistment; Representing a business that places all stock out on agistment as soon as they are weaned. No supplement is used.

The assumptions behind feed costs are relatively simple. For each example the assumed cost of concentrate and fodder was held constant:

- Concentrate @ $350/tDM
- Fodder @ $300/tDM
- Grazed feed @$125/tDM

Whilst the purchased fodder cost may appear to be high, it is assumed that the fodder required for rearing replacements needs to be of high quality to provide a balanced diet, and to encourage reduced wastage. Additionally, the grazed feed cost used was based on the average cost of direct grazed feed from the 2019/20 Dairy Farm Monitor data. This is a major influencing input. The cost from birth to weaning remains the same in all examples.

A sensitivity analysis which looked at variation in the cost of grazed feed from $78/tDM (representing the lowest cost of direct grazed feed recorded in the 2019/20 Dairy Farm Monitor data set) to $213/tDM (representing the average cost of home-grown conserved feed recorded in the 2019-20 Dairy Farm Monitor data set) was also undertaken and as expected, demonstrated that any change in the cost of home-grown feed can have a significant impact on the overall cost of rearing replacements. The cost variation in the examples outlined in Table 1 were just over $300/heifer.

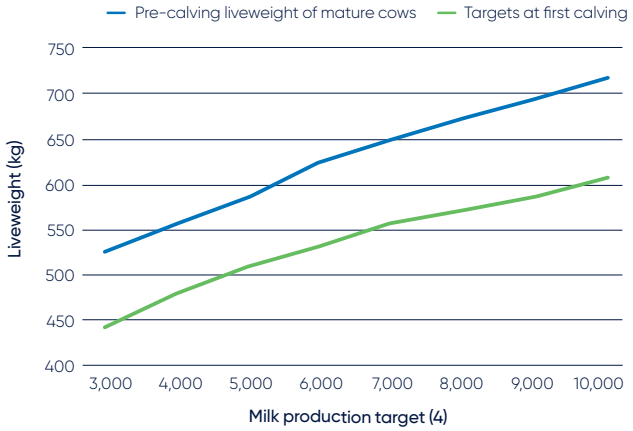
It is acknowledged that agistment costs are highly variable. In this scenario, the assumed cost of agistment per week was $7/head from birth to 12 months and $10/head from 12 months to two-years. It is likely that it will become more difficult to secure 'cheap' agistment given rising costs of land across most major dairying regions.

What is a target weight?

Throughout this manual the term target weight is used. Target weight is assumed to be the weight of a heifer at various stages of her growth to achieve a weight at calving which will maximise her productivity and longevity. Research has shown that the desirable weight at first calving is 85% of mature liveweight. Therefore for a herd with an optimal mature weight of 600 kg, the ideal heifer is 510 kg at the time of first calving.

Each dairy enterprise will have a different management system that will have different mature-cow liveweights. There is a correlation between mature-cow liveweight and average milk production target or potential (see Figure 1). A simple way to estimate mature-cow weights on an individual enterprise is to look at the dockets when you sell cull cows. Figure 1 can also be used to estimate ideal heifer weight based on annual cow production. For example, in a 6000-litre (440 kg MS) herd, mature-cow weight is likely to be 625 kg, and ideal heifers at calving should weigh approximately 535 kg.

Figure 1 Correlation between milk production, mature-cow and first-calving liveweight (from Smart 2010).



Heifer fertility

Liveweight is a much better indicator of when heifers commence oestrous activity (cycling) than age. Heifers which are well grown commence cycling at an earlier age than their lighter herd mates.

Research undertaken in New South Wales showed that the heavier the heifers at 12 months of age, the higher the percentage of heifers that were cycling. 30% of heifers were cycling when they weighed 200 kg compared to 65% when they weighed 260 kg. In New Zealand 90% of Holstein heifers were cycling when they weighed 300 kg.

In seasonal and split-calving herds, heifers can be between 13 and 15 months of age at first joining. This means that all heifers in a group must be grown so that they achieve liveweight targets by the time of joining. In year-round calving herds there is some flexibility in deciding at what age to join maiden heifers; however, it is less profitable to join heifers so that they calve at more than 24 months of age (or 15 months of age at first joining).

Heifers that are grown well get in calf more rapidly. InCalf research (see Table 2) has shown that in seasonal and split-calving herds, higher weights pre-calving result in heifers that calve sooner than heifers with a lower weight pre-calving. This means that heavier heifers have conceived at a faster rate than lighter heifers. Measures of three- and six-week in-calf rates increased as pre-calving liveweight increased (Table 2).

Table 2 Percentage of heifers in calf by three weeks and six weeks at different pre-calving liveweights.

Liveweight at first calving (kg)	3 week in-calf rate %	6 week in-calf rate %
<400	36	79
400–440	49	80
441–470	55	91
471–510	65	90
511–540	53	88
>540	68	94

First calver fertility

Once in the milking herd there are a number of challenges that confront heifers. As well as continuing to grow, they must recover quickly from their calving, start producing milk and resume cycling so that they get back in calf quickly.

In the original InCalf study, two-year-old heifers had a lower six week in-calf rates, 100-day in calf rate, and higher empty rates than animals aged three to seven years of age.

In a more recent InCalf analysis of Victorian dairy herds, two-year-old animals had lower six-week in-calf rates, higher 21 week not-in-calf rates and lower three-week submission rates than middle-aged animals in the herds studied.

InCalf research demonstrates that heifers that are heavier at first calving have the potential for superior reproductive performance (Table 3). Animals aged four to seven years in this study had a median six-week in-calf rate of 67%. Heifers with higher liveweight at first calving had superior reproductive performance compared to older animals in these herds (75% to 77% six-week in-calf rate compared to 67%). It is thought that the poorer reproductive performance of heifers is likely to be due to lower pre-calving liveweight. In addition, over twice as many light heifers would have calved later at their second calving, relative to heavier heifers, because they conceived seven to 21 weeks after mating start date.

Table 3 Effect of liveweight at first calving on subsequent six-week in-calf rate, 21-week empty rate and potential late-calvers as second calvers in seasonal/split calving herds.

Liveweight at first calving (kg)	6-week in-calf rate %	21-week in-calf rate %	Late calvers at 2nd calving
<400	49	79	30
400–440	60	87	27
441–470	68	89	21
471–510	68	87	19
511–540	75	88	13
>540	77	87	10

In year-round calving herds there were similar trends, with heavier heifers having better reproductive performance than light heifers (Table 4). Again, there is evidence that liveweight plays a part in these findings, as the median 100-day in-calf rate of four to seven-year-old cows was 51%.

Table 4 Effect of liveweight at first calving on subsequent 100- and 200-day in-calf rate for year-round calving herds.

Liveweight at first calving (kg)	100-day in-calf rate %	200-day in-calf rate %
<400	38	75
400–440	46	80
441–470	53	82
471–510	52	79
511–540	61	81
>540	61	77

Production

Tasmanian research results (Table 5) show that the benefit of higher liveweight at first calving is transmitted to the second and third lactation. Similar production responses seen in this research have also been consistently demonstrated in several studies in other dairy farming systems in Australia. For a heifer calving 50 kg heavier than her herd mates there is an increase of 1041 litres of milk, 38.5 kg butterfat and 42.5 kg protein (81 kg MS) over the first three lactations. Depending on the farming system, this equates to an extra $400 to $500 in milk income per heifer. The cost of achieving an extra 50 kg liveweight (at 3c per MJ) is likely to be about $70 and the energy cost of producing this extra milk is about $160.

A second benchmark to measure of the success of heifer rearing practices is the ratio of milk production of first calvers compared to mature-cows in the herd. In very high producing herds in Israel (more than 10,000 litres per lactation) heifers need to produce 90% of mature-cow production in order for herd production levels to be sustained. Under Australian conditions, a target of 85% of mature-cow production is achievable. Production ratios of less than 80% indicate that there are significant opportunities to benefit from improved heifer rearing.

- Larger heifers produce more milk for several reasons:
- There is less competition for the nutrients required to support growth as well as milk production.
- Size determines dry matter intake and larger heifers can eat more.
- Larger heifers can utilise body reserves early in lactation to support milk production.
- Larger heifers have an increased ability to compete with mature animals for feed.

Longevity

Heifers that enter the herd at their target weights will be more likely to survive longer in the herd as milkers. Better-grown heifers calve early in the calving period, get back into calf more quickly and produce more milk There will be fewer reasons for first-calvers to be culled.

In a study undertaken in year-round herds near Camden, NSW, 33% of first calvers were culled before their second calving. In New Zealand studies, 13.4% of two-year-olds were culled for various reasons. In Northern Ireland, 22% of heifer calves identified as herd replacements never enter the milking herd, while in a United Kingdom study, 11% of replacement heifers were lost before calving and 19% were culled in their first lactation.

Worldwide, it seems that too many heifers are culled too early. This provides a potential opportunity for dairy farmers—reduced culling of heifers results in a need for fewer replacements to be reared, which results in better welfare outcomes and a reduced carbon footprint from the dairy industry. Alternatively, there is greater opportunity to cull older animals for important reasons such as poor milk quality, or for farmers to derive an income from the sale of excess animals.

A second measure of the success of rearing heifers is the ratio of second-calvers to first-calvers. In herds where successful heifer-rearing practices are occurring more than 85% of first-calvers will calve for the second time.

Table 5 Increase in milk and milk solids due to increased liveweight at calving (from Freeman 1993)

	Extra production from an extra 1 kg liveweight			Extra production from an extra 50 kg liveweight		
	Milk (l)	**Fat (kg)**	**Protein (kg)**	**Milk (l)**	**Fat (kg)**	**Protein (kg)**
1st Lactation	4.0	0.18	0.18	203	9.0	9.0
2nd Lactation	8.3	0.26	0.39	415	13.0	19.5
3rd Lactation	8.4	0.33	0.28	422	16.5	14.0
Totals	**20.8**	**0.77**	**0.85**	**1041**	**38.5**	**42.5**

Table 6 Recommended measures of replacement heifer rearing performance

Key measure	Measurement	Target	Trigger
Age at first calving		24 months	>27 months
Heifer fertility	% calved by 3 weeks	70%	<60%
	% calved by 6 weeks	95%	<85%
First calf heifer fertility	6-week in-calf rate	60%	<50%
	21-week not in-calf rate	6%	>10%
	100-day in-calf rate	53%	<45%
	200-day not in-calf rate	12%	>18%
Production	Relative to mature-cows	>85%	<80%
Longevity	% second calvers to first calvers	>85%	<80%
	% of cows 4–8 years old	>50%	<40%

SECTION 2 ACHIEVING WELL-GROWN HEIFERS

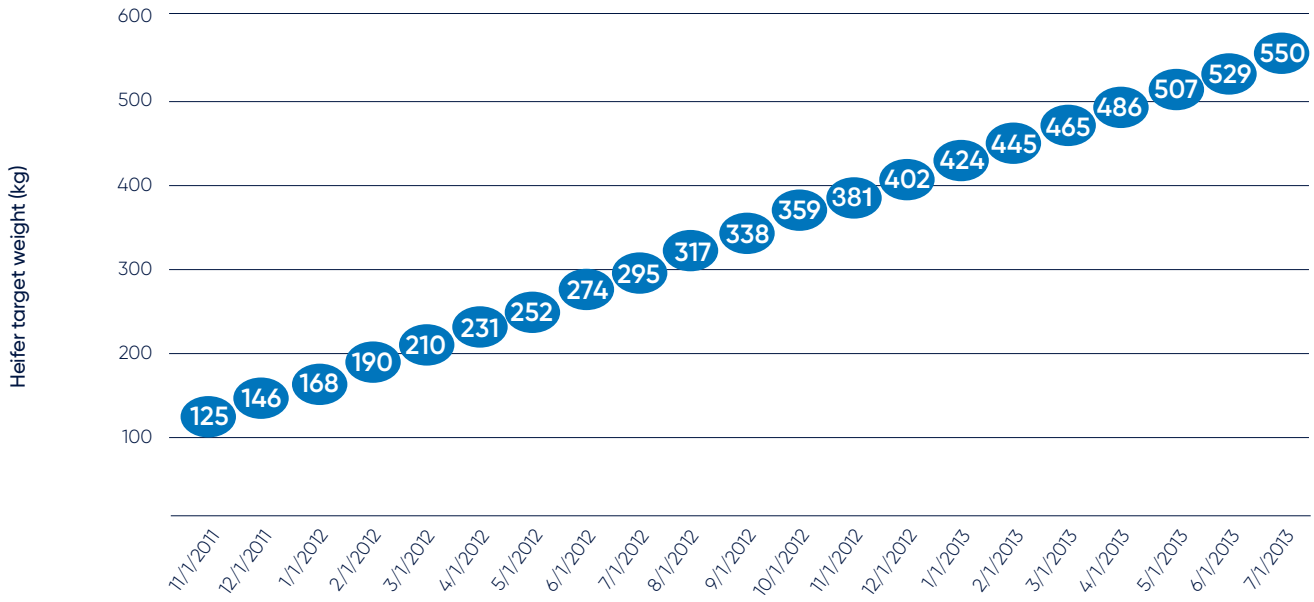
There are eight main dairying regions in Australia, each with its own characteristic feedbase and growing season.

In the southern dairying regions (Victoria, Tasmania, South Australia and southern NSW) the main pasture species is ryegrass, which has the potential to provide high-quality fodder for dairy replacements. In northern NSW and Queensland, tropical grasses form more of the feedbase. These grasses have a lower nutrient profile than ryegrass and the opportunity to provide high-quality feed for replacement heifers is more limited. Despite these differences some general principles of heifer nutrition apply.

Setting your own target weights

The optimum liveweight for first-calvers depends on the milk yield the dairy enterprise wishes to achieve for mature-cows (see Figure 1 on page 3). Once a desirable target weight has been selected it is possible to develop a typical growth curve that will assist in setting target weights at different ages, based on achieving 85% of mature liveweight at first calving. The Heifers on Target app, available on the Dairy Australia website, allows you to create an individualised chart for your own enterprise. Figure 2 shows an example for a farm where the target weight is 550 kg at calving.

Figure 2 Heifer target weight of 550 kg at calving



Nutritional requirements at different ages

There are three important stages in heifer growth post-weaning:

- **Weaning to nine months of age** is a critical time in the life of a heifer and is a time of higher nutrient requirements. As rumen capacity is limited at this age, a diet high in protein and energy content should be provided (see Table 7). During this period of growth it is important to stimulate lean body growth and not to deposit excessive amounts of fat. Lean body growth—muscle and skeletal growth—results in increased frame size while maintaining a consistent body condition score. Growth rates of at least 0.7 kg/day in Holsteins and 0.5 kg/day in Jerseys are required to achieve lean body growth. Improved skeletal development results in taller heifers that suffer fewer problems with difficult calving.
- **From nine months to joining at 15 months of age** heifers require a diet lower in protein and energy density than younger heifers, but they also require more feed. A rising plane of nutrition should be provided for heifers that are due to be mated for the first time.
- **Older heifers** require growth rates to be maintained but from feed with lower nutrient density than that fed to younger heifers. Attempting to put weight on, or to grow heifers just before calving, risks producing fat heifers without accompanying skeletal development and may increase the risk of calving difficulty.

Energy is measured in megajoules (MJ ME). Calves require energy to live, known as 'energy for maintenance', and energy to put on weight, known as 'energy for growth'.

An important concept to understand when rearing heifers is that they become less efficient at using energy for growth as they get older. A heifer calf weighing 100 kg requires about 20 MJ ME to put on a kilogram of liveweight, while a 400kg heifer requires double that—40 MJ ME to put on the same weight. This is shown in Table 7. (The table is also included in the Heifers on Target app, available from **dairyaustralia.com.au/heifersontarget**

Table 14 The typical energy required for growth and maintenance, and the protein level required in the diet for heifers of different weights.
Adapted from Holmes & Wilson (1987)

BW	Maintenance	Growth	Protein
Kg	MJ ME/day	MJ ME/day	%
25	6	10.4	17
50	10	13.2	17
75	14	14.6	17
100	17	19.8	17
125	20	21.5	17
150	24	23.3	17
175	27	25.0	17
200	29	26.7	17
225	32	28.4	17
250	35	30.0	15
275	38	31.7	15
300	40	33.3	15
325	43	34.9	15
350	45	36.4	14
375	47	38.0	14
400	49	39.5	14
425	52	40.9	14
450	54	42.4	14
475	56	43.8	14
500	58	45.2	14

Balancing diets to achieve target growth rates

Grazed pasture is the cheapest feed source on most dairy farms for growing cattle. However, must be of sufficient quality to satisfy the requirements for growth as well as maintenance. In southern Australia, if spring pasture is managed correctly heifer growth rates can be maintained on pasture alone. At other times of year, however, when pasture quality is lower, supplements are required to maintain heifer growth rates. There will be other times of the year (especially winter in many regions) where pasture quality will be satisfactory, but pasture growth rates may not be sufficient to maintain dry matter intakes to maintain growth and supplementation will be required.

In the northern dairy regions, tropical grasses that are managed for optimum quality can satisfy nutrient requirements to achieve heifer growth. Supplementation (especially protein sources) may be required to maintain heifer growth when pasture quality and quantity is low.

Usually, protein and energy supplements will be required when pasture quality deteriorates. As a general rule when pasture quality is poor, high-quality supplements containing at least 11.5 MJ ME/kg dry matter and 16% crude protein will be required.

It is unwise to ignore the macro and micro-mineral needs of heifers. In much of Australia, selenium and copper deficiency is common and cobalt deficiency can be present, especially in southern Australia. In southern Australia, calcium and phosphorus concentrations in pasture can be inverted and insufficient for desired skeletal growth.

There are several tools available to assist with the calculation of nutrient requirements of growing cattle. Heifer management tools developed by Dairy Australia are available at dairyaustralia.com.au/heifersontarget. An example of calculating the requirements of a group of heifers using the tool Heifer Diet Calculator is shown on page 10.

Calculating feed requirements of heifers

Step 1 Calculate growth rate required to achieve pre-calving target weight. In this example heifers joined for a 1 July calving average 400 kg at a weighing on 1 January, 2013. To calve at a target weight of 510 kg, they need to grow at 0.61 kg per day to achieve the target.

Step 2 To estimate if supplementation is required, the next step is to calculate the nutrient requirements of the group of heifers.

Step 3 Estimate the type of pasture heifers will be consuming.

Step 4 Use estimates of the feed values of available feeds to calculate a diet that will satisfy the requirements of a group of heifers.

Step 5 The Heifer Diet Calculator estimates the energy and protein value of the total diet to be fed to heifers to determine if requirements are satisfied and predicts a growth rate that might be expected.

In the sample diet on the next page, there is too little protein and too little energy—the fibre in the diet is such that heifers cannot physically eat the amount that would be required.

The Heifer Diet Calculator assumes that there is enough pasture in the diet to satisfy dry matter intakes. If pasture is limiting the Calculator has an option of no pasture available.

It is important to balance diets so that protein and energy requirements are satisfied, otherwise the estimated growth rate may not be realised. It is also important in times where pasture availability is low and where concentrate supplements are provided that concentrate levels in the diet of greater than 50% are not exceeded, as the risk of acidosis will be increased. Acidosis risk will also be increased at levels of less than 50% of the total diet if concentrates are able to be rapidly consumed, and where fibre (NDF) levels are less than 35%.

This calculator is based on rules of thumb only and is designed to give an idea of the growth rates that might be achieved from a given diet—it is not a replacement for a nutritionist!

When providing supplements to growing heifers it is advisable to seek professional advice to ensure that the diets are suitable for the animals being fed, and that mineral and trace element requirements are being satisfied.

Heifer diet calculator (sample)

This calculator is designed to work out what growth rate your heifers are likely to achieve on their current diet.

Step 1 Current targets

Current heifer weight:	300	
Growth rate required:	1	

Step 2 Requirements

Your heifers require...

Energy for maintenance:	40	MJ
Energy for growth:	33.3	MJ
Total energy:	73.3	MJ
Protein :	15	%

Step 3 Pasture availability

What sort of pasture is available?

	ME	Protein	NDF
Pasture–Summer	9.5	12	55

Step 4 What supplementary feed are you giving them?

Feed (in DRY MATTER)	Kg DM/Day	MJ/ Kg	Protein %	% NDF
Barley	1	12.4	11.3	20
Canola		12.5	39	20
Hay–average		8.5	10	60
Hay–good		10	14	50
Hay–vetch		10.5	18	45
Lupins	0	13	31.3	20
Palm kernel extract		11	17	57
Silage		10.5	15	50
Wheat	0	13.3	10.5	10
Summary	**1**	**12.4**	**11.3**	**20**

Step 5 Analysis

Total diet protein %:	11.9	Protein level is too low!
Pasture required (kg):	6.4	Heifers cannot physically eat this much!
Max pasture intake (kg):	5.0	

Assuming the grass above and that heifers are eating as much as they can we can calculate the expected growth rate:

Total diet protein %:	11.9	Protein level is too low!
Dietary ME from pasture:	47.2	
Dietary ME from supplements:	12.4	
Total dietary ME (MJ):	59.6	
Expected growth rate (kg/day):	0.59	Protein level is too low! Growth rate may not be achieved

Note: these calculations are based on rules of thumb only. You should seek professional advice before acting on these calculations. Diets containing more than 50% concentrates increase the risk of acidosis.

SECTION 3 CHOOSING WHICH HEIFERS TO REAR

What is genomic testing?

Genomic testing using the Australian genetic evaluation system analyses an animal's DNA from a sample such as ear tissue or a tail hair, to predict future performance under Australian conditions. Heifers can be tested as young calves, so farmers can make early decisions about their future in their herd.

Genomic testing is available for Holstein, Jersey, Red Breeds and Holstein, Jersey and Red Breed crossbred cattle.

Genomic testing costs about $50 per sample and allows farmers to:

- save money on rearing costs by not rearing heifers that are unlikely to perform
- make more informed decisions on which heifers to sell, use of sexed or beef semen and/or purchasing of females
- significantly fast-track genetic improvement in the herd for traits of importance such as fertility, longevity, heat tolerance, type or A2/A2.

The typical cost of rearing a heifer to two years of age is between $1,100–$1,700.

In herds where no surplus heifers are available, farmers may also consider selling less desirable heifers and replacing them with higher quality, genotyped heifers. If doing so, it is important to consider biosecurity.

Genomic testing accurately determines animal identification and parentage and reduces pedigree errors. Pedigree errors occur in about 15 per cent of Australian dairy calves. Testing is also a straightforward way to establish pedigrees in many herds that do not have adequate records or do not have time to construct pedigrees.

DataGene estimates that around 15 per cent of calves are incorrectly identified at birth.

Collecting samples

Samples for genomic testing are easy to collect and can be taken at the same time as routine husbandry procedures such as ear tagging or disbudding. To obtain Tissue Sample Units (TSUs) and pliers or hair sample cards, contact your genomic service provider.

KEY MESSAGES

Genomic test results predict a heifer's future performance

Save money on rearing costs and make more informed mating decisions

Samples are easy to collect

Genomic testing of dairy females is increasing rapidly

Figure 1 Collecting an ear tissue sample for genomic testing using a Tissue Sampling Unit (TSU)

Results

Genomic testing using the Australian genetic evaluation system, produces a Balanced Performance Index (BPI) and Australian Breeding Values (ABVs) for each animal.

The ImProving Herds project found that on average, high BPI cows produced more milk solids and last as long or longer (Table 1) than their low BPI herd-mates.

Table 1 Average difference between high and low BPI cows for milk production in 27 Australian farms (ImProving Herds, 2018)

Compared to their lower BPI herd mates, high BPI cows	
Milk (L)	Produced 649 L/cow/year more
Fat (kg)	Produced 50 kg/cow/year more
Protein (kg)	Produced 38 kg/cow/year more
Fat (%)	Produced 0.29% higher fat percentage
Protein (%)	Produced 0.19% higher protein percentage
Productive life (months)	Lasted 8 months longer

Results will be sent to you by your genomic service provider or can be accessed on **DataVat**.

Genomic testing in Australia

The use of genomic testing of dairy heifers is rapidly increasing in Australia. The most recent data shows commercial genotyping of females in Australia has almost tripled in recent years.

Some genomic service providers offer genomic testing using international evaluation systems (e.g. Total Performance Index or TPI in the USA and the Lifetime Profit Index or LPI in Canada) for both bulls and heifers. Note that only the Balanced Performance Index (BPI) and Australian Breeding Values (ABVs) have been validated to date on Australian dairy farms.

To get started, contact a genomic service provider. Genomic service providers currently operating in Australia include:

- Holstein Australia
- Jersey Australia
- Zoetis
- Neogen
- Total Livestock Genetics (TLG)
- ABS Global Australia
- Semex
- ST Genetics Australia
- Weatherbys Scientific Australia

"Since we have been testing and having a bit more of a focus on the calves and their quality, it has meant we have put more effort into growing them well and feeding them well."

Huw Evans
Gippsland, 350 cows

"I use genomics to pick out the ones I am going to sell and export."

John Pekin
South-west Victoria, 330 cows

APPENDIX 1 READY RECKONER FOR NUTRIENT REQUIREMENTS

The following table provides estimations of energy, protein, calcium and phosphorus requirements for heifers of different weights growing at different rates.

Liveweight	Growth rate	Maintenance	Growth	Total ME	Calcium	Phosphorus	Crude Protein
kg	g/day	MJ ME/d	MJ ME/d	MJ/day	g/day	g/day	%
100	600	17	12	29	17	9	17
	800	17	16	33	19	10	17
	1,000	17	20	37	19	10	17
150	600	24	14	38	18	11	17
	800	24	19	42	20	12	17
	1,000	24	23	47	20	12	17
200	600	29	16	45	21	14	17
	800	29	21	51	22	15	17
	1,000	29	27	56	22	15	17
250	600	35	18	53	22	16	15
	800	35	24	59	23	17	15
	1,000	35	30	65	23	17	15
300	600	40	20	60	23	17	15
	800	40	27	66	24	18	15
	1,000	40	33	73	24	18	15
350	600	45	22	66	25	19	14
	800	45	29	74	26	19	14
	1,000	45	36	81	26	19	14
400	600	49	24	73	25	20	14
	800	49	32	81	26	21	14
	1,000	49	40	89	26	21	14
450	600	54	25	79	27	21	14
	800	54	34	88	28	21	14
	1,000	54	42	96	28	21	14
500	600	58	27	85	27	21	14
	800	58	36	94	28	21	14
	1,000	58	45	103	28	21	14
550	600	62	27	90	27	20	14
	800	62	36	99	28	21	14
	1,000	62	45	108	28	21	14
600	600	67	27	94	28	21	14
	800	67	36	103	28	21	14
	1,000	67	45	112	28	21	14

Adapted from Lean (1987) and Holmes (1987)

References

Anon: *Heifers: big girls XL*. Dairy Australia (2011).

Freeman M (1993) *Why have Bigger Heifers?* In "Your Heifers in the balance: the importance of liveweight". Dept Primary Industries & Fisheries, Tasmania.

Brickell JS and Wathes DC: *A descriptive study of the survival of Holstein-Friesian heifers through to third calving on English dairy farms*. J Dairy Science 94:1831–1838. 2011.

Dobos RC, Nandra KS, Riley K, Fulkerson WJ, Lean IJ, Kellaway RC: *Effects of age and liveweight at first calving on first lactation milk, protein and fat yield of Friesian heifers.* Australian Journal of Experimental Agriculture, 41(1): 13–19. 2001.

Hoffman PC and Kester KL: *Estimating Dry Matter intake of Dairy Heifers.* In Heifer Management Blueprints. Dept Dairy Science. University of Wisconsin. 2012.

Holmes CW and Wilson GF: *Milk Production from Pasture.* Butterworths of New Zealand. Revised Edition, 1987.

Lean IJ: *Nutrition of Dairy Cattle.* Post Graduate Foundation in Veterinary Science. July, 1987.

Lean IJ: *Calf to Cow Care & Profit.* SmithKline Beecham Animal Health. 1994

McLean D: Current Australasian *Studies on Heifer Growth and its Effect on Milk Production.* Dairy Research and Development Corporation. September 1995.

Moran J: *Calf Rearing. A Practical Guide.* 2nd edition (2009). Landlinks Press.

Morton JM: *The InCalf Project Progress Report: a reference for farmers managing or working in seasonal, split and batch calving herds.* Dairy Research and Development Corporation. September 2000.

Morton JM: *InCalf Fertility Data Project 2011.* Dairy Australia.

Simmonds J: *What is a profitable, sustainable replacement rate?* Livestock Improvement Authority, NZ (1984).

Smart V (2010) *Rev-Up Replacements Heifer Extension Program.* DPI NSW.

Stevenson MA: *Risk Factors for culling in Dairy Cattle.* PhD Thesis 1995.

Williams SH: *The InCalf Project Progress Report. A reference for farmers with year-round calving herds and for their advisers.* Dairy Research and Development Corporation. July 2001.

Tips from farmers ...

Finally, some tips and quotable quotes that were too good to miss from farmers who helped along the way...

"Heifers need to be actively managed, not just left in a paddock."

"Heifers are the most important animals on the farm."

"Heifers need supplementary feeding for 20 weeks a year."

Triggers to change heifer management

- As soon as paddock feed quality decreases, start feeding replacement heifers.
- As soon as the milkers start dropping in production, start feeding replacement heifers (in seasonal calving herds).
- If you are going to the expense of using sexed semen, your heifers will need to be in ideal condition to recoup the greater semen cost.
- Use pasture growth rate as a trigger to feed heifers (for example using Pastures from Space).

Simple practices which improve heifer performance

- Wean calves only when they are looking good (based on Body Condition Score, rumen fill).
- Wean calves onto green grass and they tend to look after themselves.
- Summer time is critical and heifers will need to be carefully looked after for two summers.
- 3–4 months after calving an independent person should not be able to pick out first-calvers in a milking herd from the mature-cows.
- It is easier to catch up suboptimal performance when calves are younger.
- Spend time with heifers to find poor performers (don't concentrate on the good looking animals).
- Pull out poor performers—use sentinel animals and if they do poorly the others are not performing to targets.
- Pull out bigger animals when their grain intake is greater than 3 kg/day average.
- Treat Jerseys and crossbreds as Friesians up to 240 kg and then separate (pull out poor performers before this target).
- Measure success of your previous heifer management by looking at your first-calvers: production, size and fertility.
- Measure average age at calving for first-calvers.
- Take photos of heifers and feed conditions for future reference.

Acknowledgement

Dairy Australia acknowledges the contribution made to A guide to growing more production heifers, 2nd edition guide by the Commonwealth government through its provision of matching payments under Dairy Australia's Statutory Funding Agreement.

ISBN 978-1-922529-65-7 (print) 978-1-922529-66-4 (digital)

Dairy Australia Limited ABN 60 105 227 987
Level 3, HWT Tower
40 City Road, Southbank Vic 3006 Australia
T +61 3 9694 3777 F +61 3 9694 3701
E enquiries@dairyaustralia.com.au
dairyaustralia.com.au

4765 | Nov 2022