DairyNZ

FACTS & FIGURES

A quick reference guide for New Zealand dairy farmers

PREFACE

Have you ever needed the facts on cow nutrition requirements, the dry matter percentage of mature maize or average pasture growth data for your region and can't remember where to find it?

The second edition of Facts and Figures for New Zealand Dairy Farmers may have just what you're after – right at your fingertips!

First published in 2010 and reprinted numerous times, Facts and Figures has been DairyNZ's most sought-after resource by farmers, rural professionals and students.

It brings together the key information as a quick reference when you're hunting for the facts. It's not intended to be the whole story on every aspect of dairy farming – but it will help you find where to go to get more information.

As well as updated existing content, new in this edition are key facts, figures and financial performance indicators for the people and business aspects of the New Zealand dairy farm system.

The information in this booklet is a compilation of established research and practical knowledge, and a huge number of people have contributed to the content and development of both editions. Thank you all!

For more information, visit **dairynz.co.nz**

Facts and Figures for New Zealand Dairy Farmers, 2nd Edition, 2017

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CONTENTS

1. PEOPLE

Dairy farming is about people. It is the people who make the decisions, do the work, and make farming successful and enjoyable – and our dairy farms need to be enjoyable, safe and rewarding places for them to work.

1. PEOPLE

A great on-farm work environment is built on a solid foundation created by complying with the law. On top of that, the five pillars of good practice shown above, work together to create an environment attracting and keeping the motivated and talented people the industry needs.

For practical tools, tips and resources for good people management visit **dairynz.co.nz/people**

Career development

Many people progress through the industry following a logical progression pathway.

The dairy industry has an agreed set of role definitions that describe the experience, skills, level of supervision, knowledge and attributes expected in the five key on-farm role categories, along with opportunities for training. For more detail, visit **dairynz.co.nz/roles**

Dairy industry standard roles

Farm assistant

- New entrant onwards
- Generally under full supervision
- Assists with day-to-day tasks on-farm, including feeding, milk harvesting, animal health and environmental management.

Herd manager

- At least 2 years on-farm experience
- Requires limited supervision
- Completes day-to-day tasks on-farm, often taking responsibility for the running of the dairy shed and other routine tasks.

Assistant manager

- 3-4 years on-farm experience
- Requires minimal supervision
- Assists with the management of day-to-day activities linked to farm production. Implements farm policies and plans, including day-to-day planning and staff management in the absence of the farm manager/owner.

Farm manager

- Minimum 5 years on-farm experience
- Operates with minimal input from owner
- Responsible for meeting farm goals, including all aspects of production, stock, environmental and staff management. Should be involved in the budgeting process but will not set the budget.

Business/operations manager

- 5 years or more experience on-farm
- Operates independently with occasional reporting on progress to a board
- Responsible for meeting overall business goals. Leading farm management including the areas of planning, budgeting, targets and resource requirements. May be responsible for multiple farms or be part/full owner of the business.

There are several types of common business ownership agreements including:

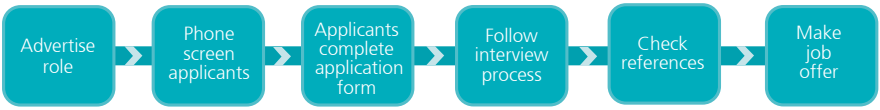
- contract milking
- variable order sharemilking and
- herd owning sharemilking.

New variations and business ownership models are continually being developed to suit the dynamic nature of the dairy industry.

All dairy farming business agreements allow farmers to grow their business knowledge beyond being an employee. It is also a successful pathway that allows people to build equity and achieve dairy farming business goals.

Recruitment

A well thought out recruitment process will help you to attract and select the best person for your team.



Application form

All applicants you choose to interview should complete an application form. This ensures you collect all relevant information from each candidate. It asks for information from a potential employee including contact details, ability to work in New Zealand, criminal convictions, relevant licenses, past employment and education, current health and reference names. To be considered true and correct it must be signed by the applicant.

Interview process

1. Review the job description and person specification
2. Phone-screen applicants to identify who you will interview
3. Short list applicants
4. Plan for the interview - set aside appropriate time and place. Prepare questions
5. Interview the person – try and make then as comfortable as possible
6. Be prepared to answer questions about the farm, your management style and the package
7. Use the information/criteria you prepared and noted at the interview to go back over the person's suitability
8. Carry out reference checks
9. Make a decision
10. Call the successful candidate and offer them the job
11. Formally send a letter and employment agreement to the successful person

Example questions

Physical	Do you have any previous injuries that may prevent you from doing all the duties required in this farm job?
Experience	Have you worked with an effluent system? What are the main things you have had to monitor when working with them?
Attitude	Can you think of an example of when you have had to use your initiative?
Qualifications	What training have you had both on and off farm with your previous employers?
Fit with team	What sorts of people do you like to work with?

Reference checking

Past behaviours are usually the best indicator for future performance so it is important to ring an applicant's referees and find out more about the applicants skills, experience and attitude. Reference checking also allows you to confirm what the applicant has told you in the interview and to identify any potential hiring risks. It is best to make up a standard set of questions to ask each applicant's referees. Add any questions that are unique to an applicant, such as specific concerns, areas where you require more detail or points to clarify from the interview.

Always contact more than one referee to ensure a balanced view. Remember that legally you can only contact referees the applicant has nominated.

Employment compliance checklist

Before the first day of work:

- Signed employment agreement
  - Ensure the potential employee is given at least a week to seek legal advice before signing
  - Have the right employment agreement for the job:
    - Permanent full-time
    - Permanent part-time (where there is a consistent pattern of work e.g relief milker working every second weekend)
    - Fixed term (must be for a genuine reason eg calf rearer, summer student)
    - Casual (no expectation of ongoing work, works from time to time on a required basis)
- 90 day trial period:
  - Must be signed before any work starts and cannot be for more than 90 calendar days
  - Employee must not have worked for the employer before

- Description of the work, also known as a job description
- Tenancy agreement in writing
- Evidence that the person is allowed to work in New Zealand

First seven days of employment

- Complete tax code declaration form IR 330
- Collect completed KiwiSaver forms
- Clarify details of citizenship, residence, or work visa

Ongoing employment compliance (records kept for 7 years)

- Record of hours worked (timesheets)
- Record of wages and holidays (payslips)
- Evidence of providing correct leave and holiday entitlements
- Ensure all employees are paid at least the minimum wage for every hour worked. Averaging can only occur over the pay period and no greater than 14 days.

Managing people tips

Typically, people perform their best when they

- understand what you are trying to achieve
- understand what is expected of them
- have the opportunity to do a variety of tasks
- are involved in any decision making which affects them
- feel like a valued and respected part of the team.

To achieve these outcomes you need to communicate with your people. To really get the best from your people requires both good management and good leadership from you.

Team meetings

The best team meetings are well organised – you know what you want to achieve and that you follow a regular agenda. Note down any actions that arise and document either on a white board in the dairy, or distribute copies to everyone by email or paper. These can then be checked back at the following meeting.

Consider including the following:

- health and safety
- current production rates for the season, compared with targets and compared with last year

- roster changes / leave
- key tasks that need to happen this week and why
- any changes to procedures on-farm
- trouble shooting any concerns on-farm.

One-on-one reviews

One-on-one reviews are a more structured way of providing feedback to your employee. One-on-one reviews are about sitting down and discussing openly:

How things are going

- Is your employee enjoying their work?
- Do they think they are doing it well?
- Do you think they are doing it well?
- How can you support your employee better?

Discussing what is coming up on farm

- What will your employee's key tasks be?
- Does your employee require any training to complete these tasks?
- Clarifying what you are expecting from them.

Training plans

A training plan gives you and your employee something to work towards. For each employee it may be helpful to discuss the following headings:

Area for focus	Training required	By when	Training provider	Progress update

For comprehensive information on recruitment, selection and creating a high performing workplace including templates go to **www.dairynz.co.nz/people.**

2. BUSINESS

Good financial management provides more control and more choice.

2. BUSINESS

Five features of profitable and successful farming businesses

A successful business has:

1. an effective business structure, a business plan and strategy to achieve goals
2. a cash management system, well-maintained budgets, benchmarked performance
3. routines, practices, policies and procedures that enable the business to meet regulatory requirements and obligations
4. good record keeping and a productive office space
5. a good support team.

Know the important numbers

Monitoring a small number of financial key performance indicators (KPIs) helps steer the farm business in the right direction. Cash, profitability, risk and wealth creation are important to consider when analysing your business.

The following series of KPIs help form a financial picture of your business.

- Breakeven milk price
- Operating profit
- Operating profit margin
- Debt to asset ratio
- Operating Return on Dairy Assets
- Equity growth %

Breakeven milk price

This important KPI calculates any cash surplus and helps you focus on costs for all aspects of the business. Maximising the cash surplus allows you to grow your business, invest in other opportunities, reduce debt, and achieve family or business goals.

The breakeven milk price shows how much income from milk is required to pay farm working expenses, interest, rent, tax and drawings in any given season.

Calculate cash surplus: Subtract breakeven milk price from the current milk price to determine your surplus, e.g. milk price = $6.00 the cash surplus is $0.25.

To improve the cash surplus and reduce the break-even milk price requires a focus on all aspects of the business, from increasing milksolids at minimum cost to reducing farm costs and controlling personal expenditure.

CALCULATION EXAMPLE:

Cashflow per kg milksolids sold	Example $/KgMS
Farm working expense	**$4.00**
interest and rent	**$1.35**
tax	**$0.25**
drawing	**$0.65**
Total cash expense	**$6.25**
Less net stock sales + other dairy cash income	**$0.50**
Breakeven milk price	**$5.75**

Note: This does not include principal repayments nor capital expenditure

Operating profit

Operating profit is defined as gross farm revenue less operating expenses. It is a measure of farm profitability but does not include interest and therefore takes no account of how the business is funded.

Operating profit can be broken down using the following equation:

Operating profit $ = *gross farm revenue* - *operating expenses*

Operating profit is derived by adjusting the net cash income and farm working expenses with five non-cash adjustments that impact either income or expenses.

1. Non cash adjustments
2. Value of change in dairy livestock
3. Labour adjustment (unpaid family labour)
4. Feed inventory adjustment
5. Owned support block adjustment
6. Depreciation

CASH	$/KG MS	$	NON CASH ADJUSTMENTS	$	CASH + NON CASH	$
DAIRY SALES					**DAIRY GFR**	
Net milk	4.05	1,221,625			Net milk	1,221,625
Net livestock	0.41	124,994	+ value of change in dairy livestock	40,009	Net livestock	165,005
Other dairy	0.00	0			Other dairy	0
NET CASH INCOME	**4.47**	**1,346,621**				**1,386,630**
CASH FWE			**NON CASH ADJUSTMENTS**	**$**	**OPERATING EXPENSES**	**$**
Wages	0.48	145,287	+ labour adjust	125,348	Labour expenses	270,635
Stock expenses	0.71	213,979			Stock expenses	213,979
Supplementary feed	0.97	292,029	-feed inventory adj	0	Total supplement expenses	292,029
Grazing and support block	0.27	80,495	+ owned supp block6	63,000	Total grazing and support block	143,495
Other working expenses	0.63	188,487			Other working expenses	188,487
Overheads	0.22	67,144	depreciation	91,097	Total overheads	158,241
FARM WORKING EXPENSES	**3.27**	**987,421**				**1,266,866**
CASH OPERATING SURPLUS	**1.19**	**359,200**	**NET ADJUSTMENTS**	**-239,436**	**DAIRY OPERATING PROFIT (EFS)**	**119,764**

Operating profit can be expressed as $/kgMS, $/ha, $/cow enabling comparisons to be made with other farms.

A key driver of operating profit/ha is operating expenses/kgMS i.e. farms with low operating expenses/kgMS tend to have a higher operating profit/ha regardless of farm system, herd size, farm size or region. Operating profit can be increased by:

- reducing expenses if any resulting reduction in revenue is less than the reduction in expenses.
- increasing revenue (milk and stock) if any resulting increase in expenses is less than the increased revenue.

See the latest Economic Survey to learn more about profitability for owner operators and sharemilkers **dairynz.co.nz/economicsurvey.**

Operating profit margin

This KPI is a measure of efficiency and is defined as operating profit as a percentage of gross farm revenue. Operating profit margin is a measurement of what proportion of a farms revenue is left over after paying for variable costs of production such as wages, grazing, R&M, depreciation, etc.

$$\text{Operating margin \%} = \frac{\text{operating profit \$}}{\text{gross farm revenue \$}} \times 100$$

This indicates dairy operating profit as a percentage of dairy gross farm revenue – the higher the margin, the better. This KPI is a risk measure and a large margin helps cope with fluctuations in milk prices, milk production and input prices.

Farmfact for operating profit is available at dairynz.co.nz. If you are a member of DairyBase the operating profit margin is calculated for you on the main KPI page.

Debt to asset ratio

This measures the proportion of the asset value that is borrowed by the business. It is not a measure of performance but can be used to assess an important area of risk in the business.

$$\text{Debt to asset ratio \%} = \frac{\text{closing total liabilities \$}}{\text{closing total assets \$}} \times 100$$

Farmers who operate profitably and have high return on assets can withstand higher debt levels and continue to grow their business. For farmers with moderate or poor profitability be cautious about increasing debt, even with high equity levels.

Operating return on dairy assets (RoDA)

This measures how much profit the business is generating andand is often compared to the return on money 'in the bank'.

$$\text{Return on dairy assets \%} = \frac{\text{Dairy operating profit \$ + support block adjustment - rent \$}}{\text{Operating dairy assests \$}} \times 100$$

This KPI does not include capital gain or loss. As a rule of thumb, if the RoDA is lower than bank interest, risk levels rise and without capital gain, equity will reduce over time.

Equity growth %

This is the ultimate financial KPI for a business and measures growth in equity as a percentage of opening equity.

$$\text{Growth in equity \%} = \frac{\text{Closing equity \$ - opening equity \$}}{\text{Opening equity \$}} \times 100$$

A high level of wealth creation or equity growth over time comes from:

- investing in productive assets
- not paying too much for them
- operating them efficiently
- investing the resulting profits wisely
- capital gain.

Key resources

Business resources

For planning tools, budgeting templates, break even milk price calculators, and tips for developing KPIs for your business and monitoring your finances visit *dairynz.co.nz/business*

Benchmarking

DairyBase analyses resources and farm performance allowing you to track your business over time and benchmark against other dairy farms. *Visit dairynz.co.nz/dairybase*

Budgeting

For templates for annual and monthly cashflow budgets *visit dairynz.co.nz/budgets*

Industry information

For historical trends and analysis use the Economic Survey for financial data and the Dairy Statistics for physical data (by district and region in many cases).

dairynz.co.nz/economicsurvey
dairynz.co.nz/dairystatistics


Operating Performance Summary
Training - Farm A
Benchmark
Dairy Operating Profit ($ per ha)
5,000
4,000
3,000
2,000
1,000
0
2013-14
2012-13
2011-12
Milksolid
1,250
1,000
750
500
250
0
Your Operating Profit for the 2013-14 season was $5,092 per hectare
Operating Profit is made up of Gross Farm Revenue
Gross Farm Revenue ($ per kgMS)
7.50
5.00
2.50

3. PASTURE-BASED PRODUCTION SYSTEMS

Excellence in pasture management and feed budgeting is required for retaining New Zealand's competitive advantage in dairying.

3. PASTURE-BASED PRODUCTION SYSTEMS

Five farm production system definitions

As New Zealand pastoral farming is about profitably balancing feed supply and demand, five production systems have been described by DairyNZ primarily based on the amount of imported feed and/or off farm dry cow grazing. The definitions do not include grazing or feed for young stock.

These definitions are intended to improve the understanding and description of feed resources used on farms in relation to common performance indicators such as milksolids per ha. They are not intended as a ranking system or any indication of DairyNZ's preferences.

System 1 – All grass self-contained, 100% home grown feed with all adult stock on the dairy platform

No feed is imported. No supplement fed to the herd except supplement harvested off the effective milking area and dry cows are not grazed off the effective milking area.

System 2 – 90-99% of total feed is home grown feed.

1-10% of feed is imported either as supplement or grazing off for wintering dry cows.

System 3 – 80-89% of total feed is home grown feed

11-20% of total feed imported to extend lactation (typically autumn feed) and for wintering dry cows

System 4 – 70-79% of total feed is home grown feed.

21-30% of feed imported and used at both ends of lactation and for wintering dry cows

System 5 – 50 to 69% of total feed is home grown feed.

More than 31% of feed imported and used throughout lactation. Feed imported could be greater than 50%.

Principles for profitable and sustainable pasture-based dairy systems

PRINCIPLE 1	Dairy systems that are robust to risk and in particular milk price volatility, have low unit costs
PRINCIPLE 2	Optimising 'pasture grown' per hectare is a key contributor to operating profit/ha
PRINCIPLE 3	There's a strong positive relationship between home grown pasture and crop eaten/ha (i.e., t DM/ha;) and operating profit/ha
PRINCIPLE 4	Match stocking rate (herd demand) as closely as possible with the supply of home grown feed so that pasture eaten/ha by the grazing herd is a high proportion of the annual pasture grown.
PRINCIPLE 5	Managing rotation length and grazing residual optimises pasture grown and harvested
PRINCIPLE 6	The optimum body condition score at calving is 5.0 for mature cows and 5.5 for 2 and 3-year old animals
PRINCIPLE 7	Supplementary feeds and crops should only be used when available pasture is less than herd demand
PRINCIPLE 8	Crops should only be used if the benefits outweigh the costs.
PRINCIPLE 9	The breeding worth system identifies the most profitable cow genetics for the system, irrespective of cow breed

The four pillars of a resilient farm system

Although there are many components to a successful farm system, DairyNZ believe that there are four pillars that define resilient farm systems, irrespective of region, rainfall, or farming philosophy.

Resources

- Pasture growth (kg DM/ha)
- High N use efficiency
- Supplementation

Animals

- High breeding worth
- High milksolids + fertility
- Easy care

People

- Sufficient time off
- Development opportunity
- Simple & repeatable systems

Business

- Profit focused
- Capital reserves
- Measurement & budgeting

Pasture first management: a seasonal approach

Managing pasture cover

1. APC – start with the right pasture cover at PSC.
2. Allocate feed accurately.
3. Adjust area grazed per day as needed (Spring Rotation Planner) and monitor APC.

Tools include the Spring Rotation Planner, feed budgets, Spring Survival Guide.

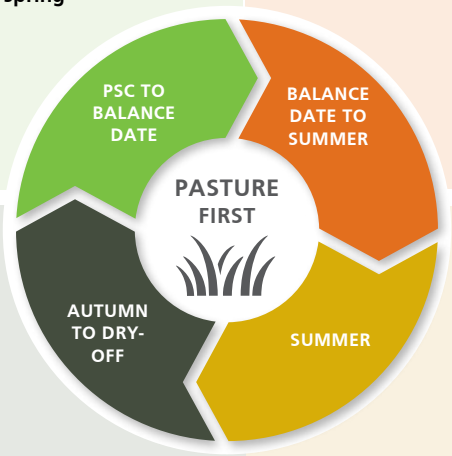
Visit **dairynz.co.nz/spring**

Managing pasture quality

1. Surplus management - maintain residuals, quality and ensure survival of new tillers.
2. Stop supplement use.
3. Summer strategy prepared.

Tools include feed wedges, spring feeding check.

Visit **dairynz.co.nz/feedtools**
dairynz.co.nz/spring



Set up for planned start of calving (PSC)

1. Make decisions around milking on or drying off.
2. Monitor soil nutrient levels.
3. Map out next season's feed budget.

Tools include pasture eaten calculator, supplement price calculator, annual feed budget, financial forecast.

Visit **dairynz.co.nz/feedtools**

Maintain pasture quality

1. Residual management – avoid over-grazing.
2. Regrassing/renewal: getting it right.
3. Review supply and demand decisons (milk, supplement, cull cow and nitrogen prices).

Tools include the summer management plan, supplement price calculator, autumn management tool, Forage Value Index (FVI).

Visit **dairynz.co.nz/summer**
dairynz.co.nz/feedtools
dairynz.co.nz/fvi

Pasture allocation

How to calculate pre-grazing cover

(Stocking rate x intake x rotation) + *Optimum residual = Pre-grazing cover*

(___ cows/ha x ___ kg DM/cow x ___days) + _____kg DM/ha = _____ kg DM/ha

e.g. (3.0 cows/ha x 17.5 kg DM/cow x 22 days) + 1500 kg DM/ha = 2650 kg DM/ha

Target grazing heights (covers or residuals) for ryegrass/clover pastures

Grazing covers are expressed as "clicks" on the Rising Plate Meter (RPM) or in kg DM/ha based on the winter formula (clicks x 140 + 500) and are for ryegrass dominant pastures. One click = 0.5 cm compressed height.

Post grazing cover height= 1500 kg DM/ha =7.0 clicks on RPM.

Focus on achieving target post-grazing residuals of 1500-1600kg DM/ha or 7-8 clicks on a rising plate meter during spring and early summer.

This optimises pasture utilisation and subsequent pasture growth and quality. For more information **www.dairynz.co.nz/feed/pasture-management.**

How to convert from kg DM/ha to rising plate meter (RPM) clicks

Pre-grazing cover height in clicks	=	**(2,650-500)/140**	=	*15.4 clicks*
Post-grazing cover height in clicks	=	**(1,500-500)/140**	=	*7.0 clicks*

PASTURE ALLOCATION:

HERD DEMAND *Is the pasture requirement for 12 or 24 hours?*

Required per cow x number of cows = demand e.g. 18 x 200 = 3600 kg DM

SUPPLY PER HECTARE

Pre-grazing yield – residual = supply *e.g. 2800 – 1500 = 1300 kg DM/ha*

AREA REQUIRED

Demand ÷ supply = area required *e.g. 3600 ÷ 1300 = 2.8 ha/day*

(Area x supply) ÷ number of cows = pasture available/cow

e.g. (2.8 x 1300) ÷ 200 = 18 kg DM

AREA ALLOCATION:

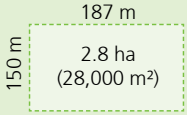
M² PER COW TO COWS PER HA *A stride is approx. 1 m.*

10,000 ÷ m²/cow = cows/ha *e.g. 10,000 ÷ 140 = 71 cows/ha (1ha = 10,000 m²)*

AREA REQUIRED BY HERD

Total cows ÷ cows/ha = area required *e.g. 200 ÷ 71 = 2.8 ha*

BREAK SIZE



Area (m²) ÷ paddock width = required length for break

e.g. (2.8 x 10,000 = 28,000 m²) 28,000 ÷ 150 m = 187 m

Collecting pasture growth data

Annual pasture growth can be farm (and paddock) specific. While relying on district average growth data (such as that published here) for feed budgeting is a good starting point, it's possible to obtain a good knowledge of your farm's pasture growth, and which paddocks contribute well and which contribute poorly to annual pasture yield on your own farm.

Pasture measurement

There are several ways to assess and measure pasture. Some of the common methods are calibrated eye assessment and manual measurement using the Rising Plate Meter (RPM), or an electronic meter or probe. Another approach is a sensor attached to a quad or ATV bike such as the C-Dax Pasture Meter (also known as the Rapid Pasture Meter).

What's required

- A farm map with the area (ha) of individual paddocks known.
- Regular pasture assessment (kg DM/ha) of each paddock throughout the year.
- Computer software that records each paddock's pasture mass assessment, grazing events, calculates pasture growth rates, feed wedges and average pasture cover.

The Rising Plate Meter (RPM) and C-Dax Pasture Meter

This approximates pasture mass and puts hard numbers (kg DM/ha) on the grazing management plan. They are designed to measure the height of ryegrass and clover pastures and provide a point of reference when several people are making pasture decisions. The height measurement is converted to kg DM/ha by established calibration equations.

THE RPM EQUATION:

Changing clicks to kg DM/ha

Average compressed pasture height	X	150	+	400	=	kg DM/ha
Readings from RPM	X	the multiplier	+	the adder	=	kg DM/ha

*The equation "average compressed height x 140 + 500" is the best fit for most situations and makes the data produced the easiest to understand (winter formula). Multiplier range is from 115 (when grass is growing the fastest) to 185 (used in very dry conditions of slow growth)

Calibrated eye or visual pasture assessment

This can be as good as any current tool, but requires practice and calibration. Calibration can be achieved through DairyNZ discussion groups, regular farm walks with a farm consultant or the farm team, or through occasional comparison with a tool like the rising plate meter.

Considerations

	C-DAX	Rising Plate Meter	Calibrated eye (visual score)
Advantages	Quantifies pasture mass on farm		
	A consistent way of measuring pasture height for reliable data. Measures height and converts to kgDM via a formula.		Manage yield variation at a paddock level / assess pasture were ground is uneven
	A tool anyone can use, easy to understand.		Assess pasture composition
	Can be used with software to transfer data to a computer	Some brands can save data for transfer to a computer	Assess different species

	C-DAX	Rising Plate Meter	Calibrated eye (visual score)
Considerations	An approximation of pasture available, allocation must be made with consideration to post-grazing residuals and with observation that stock are grazing for a sufficient time		
	Adverse environmental conditions will impact on accuracy		Regular calibration to maintain accuracy
	Maintenance is critical to ensure accuracy and reliability of reading.		Requires knowledge of how the pasture characteristics contribute to quantity (e.g. leafiness, density)
	Driver speed can impact reliability of reading	Operator technique must be consistent – best if used by the same person	

Recording and decision support

Regular pasture assessment, which is well recorded (notebook, spreadsheet or in a suitable computer program) can provide valuable information. Aim for generating monthly pasture growth rates for your farm, based on the average of several (more than 2) assessments of growth rates during the month.

Regular pasture data can be used to calculate:

- annual farm growth rates
- individual paddock growth rates
- seasonal average pasture cover targets.

This information can be used to build a feed wedge, increase accuracy in feed budgeting and to assess paddocks for renewal or development.

There are a range of computer programs and software available through commercial suppliers aimed at helping make decisions from pasture data.

Pasture assessment tools	
C-Dax	c-dax.co.nz
Electronic plate meter	jenquip.co.nz
Electronic plate meter & P Plus software	platemeters.co.nz
Electronic plate meter	tru-test.com
LIC SPACE	lic.co.nz
Pasture-io	Pasture.io
Pasture management software	
Agrinet	agrinet.ie
Farmax	farmax.co.nz
FarmIQ	farmiq.co.nz
Feedflo	feedflo.co.nz
Hawkeye	hawkeye.farm
Minda Land & Feed	lic.co.nz
Pasture coach	pasturecoachnz.co.nz

Average pasture growth for your district (kg DM/ha/day)

Data is based on averages over several years, and may include nitrogen fertiliser. The data should be viewed simply as a guide as it is not often based on more than several years' data.

Northland												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Awanui	42	30	23	34	44	34	43	45	58	70	55	53
Okaihau	30	25	29	36	37	27	26	33	37	47	47	50
Dargaville- NARF	37	35	29	32	34	37	30	41	52	64	62	53
Tomarata	29	21	23	23	26	28	19	27	30	45	28	28
Bay of Plenty												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Matata	47	40	35	36	41	25	14	31	43	70	64	55
Otakiri	38	44	36	32	33	28	20	36	51	63	54	50
Galatea	43	42	42	35	39	33	24	36	54	60	49	52
Waikite Valley	38	32	21	23	24	15	9	20	40	54	66	56
Waikato												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ngatea P3	32	21	19	29	41	38	32	39	49	53	55	56
Ruakura/Newstead	67	42	34	25	29	22	26	35	64	83	87	65
Gordonton (peat)	42	25	20	27	32	26	18	33	57	74	61	65
Tokoroa	46	37	28	36	33	25	17	23	45	60	55	41
Matamata	39	28	28	39	37	31	24	38	61	72	60	56
Otorohanga	49	41	32	37	37	24	17	32	47	64	60	62
Taupo	61	52	51	35	32	15	18	14	23	69	36	40
Te Aroha	33	41	34	29	38	29	21	34	50	57	45	46
Te Awamutu	35	26	25	29	40	28	18	33	56	65	56	56
Te Kauwhata	25	15	17	35	51	44	31	43	54	60	52	47

t DM/ha	From	To	Notes
16.0	2010	2015	N use unknown
13.1	2012	2015	N use unknown
15.4	2008	2016	150 kg N/ha
10.0	2010	2014	N use unknown

t DM/ha	From	To	Notes
15.3	2010	2011	
14.5	2009	2014	
15.7	2009	2015	N Use unknown
12.1	2009	2015	N use unknown

t DM/ha	From	To	Notes
14.1	2013	2016	182 kg N/ha
17.7	1996	2017	175 kg N/ha
14.5	2003	2017	150 kgN/ha
14.3	2010	2013	N use unknown
15.8	2009	2015	N use unknown
15.4	2009	2015	N use unknown
15.0	2010	2012	N use unknown
13.8	2009	2015	N use unknown
14.5	2009	2015	N use unknown
15.1	2013	2015	N use unknown

Average pasture growth for your district (kg DM/ha/day)

Taranaki												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hawera WTARS	51	41	27	27	26	22	20	31	51	67	68	67
Stratford	53	40	38	39	25	13	9	19	49	65	62	57
Waimate West	55	39	34	34	32	20	22	35	64	78	77	70
Lower North Island												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Manawatu Sands	25	47	38	45	41	39	18	23	53	65	56	33
Greytown (irrigated)	45	44	44	48	40	20	16	22	46	64	57	56
Kaiwaiwai (dry)	31	17	18	38	36	29	24	25	33	55	66	51
Massey University No1 Dairy	30	33	31	31	32	20	18	24	42	49	48	46
Massey University No4 Dairy	31	39	27	34	38	20	12	22	25	39	41	47
Taratahi (irrigated)	54	46	41	40	34	27	17	19	36	55	58	58
South Island												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Culverden	67	50	70	48	38	8	9	18	47	71	67	73
Oxford	72	58	51	43	28	21	8	17	39	65	68	61
LUDF	80	82	75	55	32	17	15	28	48	79	85	90
Lincoln University research farm P21 High N	73	69	67	45	23	7	20	27	40	72	70	87
Lincoln University research farm P21 Low N	60	68	66	43	23	4	19	26	41	68	62	72
Dunsandel	81	77	69	57	27	20	8	11	35	67	75	84

t DM/ha	From	To	Notes
15.1	2008	2016	160-180 kgN/ha
14.2	1992	2016	141 kgN./ha
17.1	2001	2016	180-200 kgN/ha
t DM/ha	From	To	Notes
14.8	2011	2011	N use unknown
15.8	2010	2015	N use unknown
12.5	2013	2015	N use unknown
12.6	2010	2013	N use unknown
11.6	2010	2013	N use unknown
14.4	2012	2015	N use unknown
t DM/ha	From	To	Notes
20.0	2014	2016	265 kgN/ha
19.0	2014	2016	330 kgN/ha
21.4	2008	2015	Irrigated , more than 300 kgN/ha
17.6	2012	2015	309 kg N/ha calibrated RPM data
16.3	2012	2015	154 kgN/ha calibrated RPM data
21.7	2014	2016	280 kgN/ha

Average pasture growth for your district (kg DM/ha/day)

South Island												
Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pendarves	67	59	60	48	29	12	11	22	41	67	67	73
Ruapuna	71	71	62	64	38	10	5	9	37	67	76	77
St Andrews	83	74	70	59	30	17	14	13	49	73	82	76
Westport	47	44	55	49	28	17	7	13	39	60	62	49
Greymouth	53	46	39	50	38	15	8	17	33	45	57	57
Ikamatua	57	48	70	64	32	17	7	14	52	73	70	66
Kotuku	38	33	38	33	14	7	3	6	21	42	44	44
Kowhitirangi	35	41	42	37	16	6	5	11	28	46	50	38
Woodlands	45	49	45	34	14	7	4	9	21	42	64	51
Seaward Downs	40	44	47	38	16	7	4	13	35	53	51	42
Edendale	39	48	58	37	19	10	5	10	34	53	69	33
South Hillend	35	38	34	28	13	5	4	12	33	49	53	29
Wallacetown	51	50	50	42	21	9	7	17	41	60	68	55
Riversdale	26	25	24	17	10	2	1	9	24	43	45	22
Tapanui	38	39	36	26	13	4	5	13	28	50	50	34
Telford	48	41	41	31	23	10	3	12	28	46	50	45

- P3 Hauraki
- Northland Dairy Development Trust
- Graeme Pitman
- Wayne Reynolds
- Joe Clough
- BOP Focus on dairy
- DairyNZ Farmwatch
- DairyNZ Research
- DairyNZ (WTARS)
- Farmers, ie DairyNZ Farmwatch farmers

DairyNZ would like to thank all of the above that supplied data. The majority of this information results from regular whole farm measurements and calculating growth rates from difference in covers from one measurement to the next, excluding paddocks that were grazed between measurements.

t DM/ha	From	To	Notes
16.9	2007	2016	Irrigated, 225 kgN/ha
17.8	2014	2016	300 kgN/ha
19.4	2014	2016	288 kgN/ha
14.2	2008	2012	179 kgN/ha
14.9	2012	2015	N use unknown
17.2	2008	2012	286 kgN/ha
9.7	2008	2012	223 kgN/ha
10.6	2008	2012	120 kgN/ha
11.0	2007	2012	0 kg N/ha cage cut data
11.8	2007	2012	94 kg N/ha
13.3	2008	2015	N use unknown
10.1	2007	2012	132 kg N/ha
14.3	2007	2012	176 kg N/ha
7.6	2007	2012	6 kg N/ha
10.2	2007	2012	60 kg N/ha
11.5	2007	2012	136 kg N/ha

Choosing a ryegrass cultivar (variety)

Endophyte selection

Before selecting the cultivar select the endophyte that will give you protection from insects while not causing animal health problems. There are few areas in NZ that do not have to consider damage from one or more insects. As new endophytes are being released annually contact your seed expert or refer to Farmfacts 1-22 and 1-24.

Heading dates

Do not mix cultivars with different heading dates in a paddock. If seeking greater early spring pasture performance the best way is to look at the performance values for seasonal dry matter production for the cultivars.

Aftermath heading

Aftermath heading refers to continued seed head production after the main spring heading. Choose cultivars that have reduced aftermath heading for improved summer pasture quality and animal productivity.

Tetraploids and diploids

Tetraploids are more upright clover-friendly plants. Tetraploid ryegrasses are highly palatable, have been shown to improve milk production, tend to be grazed lower reducing litter levels and hence accumulation of facial eczema spores. Diploids produce more tillers and consequently are more persistent and tolerant of overgrazing than are tetraploids.

Winter productivity

Generally annual and Italian ryegrasses produce more dry matter in the winter and early spring than other ryegrasses. Annuals persist for 6-8 months; Italians can persist for one year in summer dry areas and up to three years in summer wet conditions.

Refer Farmfact 1-23 for features and examples of types of ryegrass cultivars.

Forage Value Index/Cultivar Selector Tool

DairyNZ, in collaboration with the New Zealand Plant Breeding and Research Association (NZPBRA) developed an evaluation tool 'Forage Value Index' for New Zealand dairy farmers to estimate the profit of short term and perennial ryegrass cultivars for their region.

The Cultivar Selector Tool and more information on the FVI are available at **dairynz.co.nz/fvi.**

Quality seed – endophyte viability

Certified Seed is recommended – seed produced under the NZ Seed Certification scheme that meets quality standards and is free of weed seeds. Germination, purity and endophyte certificates should be available, to check seed quality. The germination should be 90%+, seed purity 99%+, and perennial ryegrass with endophyte should be 70%+ endophyte. Endophyte viability deteriorates over time with some endophytes less viable than other. Seed that is stored must be cool stored. Do not plant ryegrass seed that is left-over from last year's sowing; use seed harvested in the year of sowing for best endophyte viability. When sowing new ryegrass seed always use treated seed to control insect attack on seedlings.

Pasture sowing rates for mixed pastures

Ryegrass	Diploid	16-22 kg/ha	Rates are dependent on: • a good consolidated seedbed • seed is drilled evenly (tractor speed slow) • drill has good depth control • there is adequate moisture after sowing
	Tetraploid	20-30 kg/ha	
White clover	Bare	3-4 kg/ha	
	Coated	4-5 kg/ha	
Chicory – optional		1-2 kg/ha	
Red clover – optional	Bare	3-4 kg/ha	
	Coated	4-5 kg/ha	

Notes:

- Higher seeding rates are often recommended as a cover for poor seedbed preparation. High seeding rates do result in good coverage in early establishment and provide competition for weed species. However, high seeding rates also result in smaller, weaker individual plants that do not survive the first summer.
- Tetraploid ryegrass seed is significantly larger than diploid, so is sown at higher rates. Cultivars vary in seed size, so check with the seed company for recommended rate e.g. sowing rate for Bealey is 25-30 kg/ha as it twice the normal seed size.
- Coated clover seed generally has a 75% weight build-up of lime, so higher sowing rates are needed (coated clover seed costs less per kg).

Advantages of standard versus lower perennial ryegrass sowing rate

There is no 'correct' ryegrass seed sowing rate for New Zealand farms. Both a standard and lower perennial ryegrass sowing rate can work well, with the advantages of each outlined in the table below.

Standard sowing rate	Lower sowing rate
diploid 18-22 kg/ha; tetraploid 26-30 kg/ha (plus clover at 3-4 kg/ha)	diploid 12-16 kg/ha; tetraploid 20-24 kg/ha (plus clover at 3-4 kg/ha)
• Extra seed can help in adverse conditions (e.g. poor seed bed, poor drilling depth) • Usually higher DM yield over first 1-3 grazings • Lower weed content	• More space for clover establishment • Lower seed cost

Pasture: glossary of terms

Average pasture cover (APC)

Units are kg DM/ha. For most farms maintaining APC between 2000-2300 kg DM/ha is a good rule of thumb.Achieving the target average pasture cover (APC) on a farm at critical times is important for ensuring that the herd has sufficient high quality pasture to meet production targets. If APC is too low, cows will be underfed. If APC is too high, pasture quality and growth will decline and production will be reduced.

Balance date

Balance date is when pasture growth rate is expected to increase to meet pasture feed demand in early spring. Normally balance date is 50-60 days after the planned start of calving for spring calving herds.

Rotation length

Rotation length (days) = total farm area ÷ area grazed/day , area to graze = total area ÷ rotation length (days)

Feed wedge

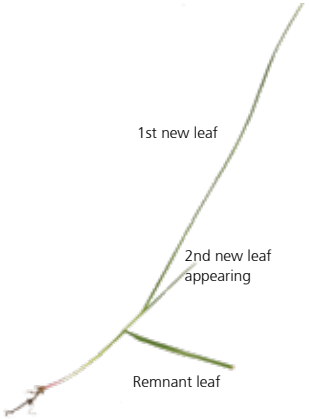
A pasture feed wedge gives a visual picture of the current pasture situation on a farm by ranking the paddocks based on average pasture cover in a graph. By drawing a line between pre and post grazing targets it becomes a simple tool to make proactive pasture management decisions.

Tiller

Ryegrass plants are made up of several parts called tillers. Each tiller has a growing point from which new leaves are produced. The growing point is found at the base of the tiller, very close to the soil surface. Because of this it is rarely damaged during grazing, which allows the tiller to keep growing after grazing. Each tiller will have three live leaves and one or more dying leaves at any one time (see diagram below).

Three leaf stage

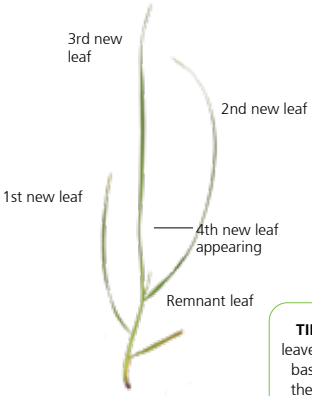
1 – leaf stage



2 – leaf stage

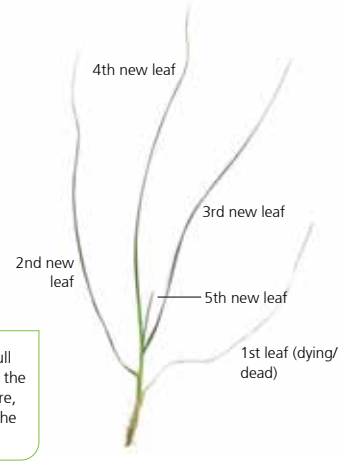
TIP: If blunt tips are visible across the paddock then not at 2-leaf stage.

3 – leaf stage

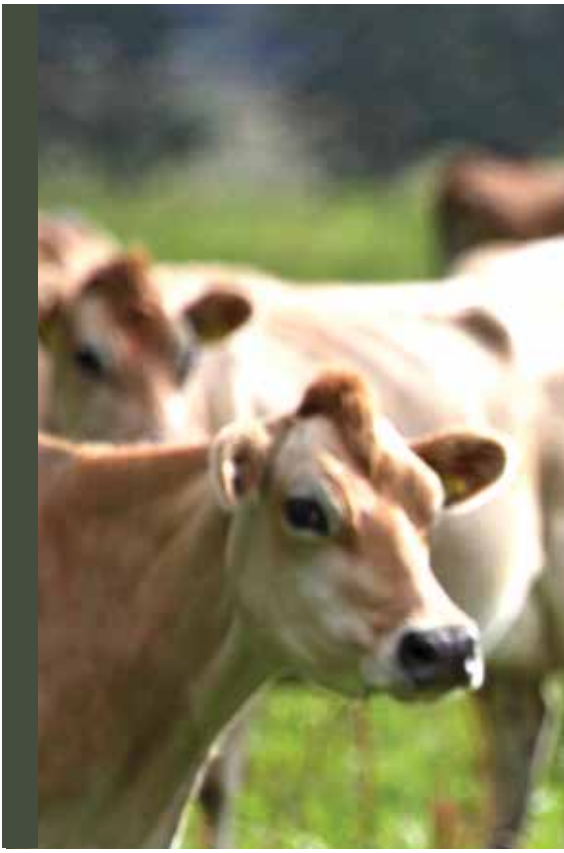


TIP: If decayed full leaves are visible in the base of the pasture, then it's beyond the 3-leaf stage.

4 – leaf stage



At the 4-leaf stage there is often no remnant leaf as it has decayed.



4.COW FEED REQUIREMENTS

Determine what energy is required for different scenarios. Allocate just enough feed, not too much or too little, from using information in the following pages.

4. COW FEED REQUIREMENTS

These feed requirement figures estimate the feed energy that must be eaten for a given level of milksolids production and cow liveweight. They do not allow for any feed offered that was not eaten (wastage). They do allow for energy used in grazing activity and up to 4km/day of walking on flat ground to and from milking. They also include the energy costs of losing and regaining body condition score throughout a lactation year.

Dairy cow annual dry matter requirements

Annual requirements tonnes DM/cow/year at 11.0 MJ ME/kg DM

Breed	kg Lwt	Milksolids production (kg MS/cow/year)							
		250	300	350	400	450	500	550	600
Jersey	375	3.5	3.8	4.2	4.5				
Jersey	400	3.6	3.9	4.3	4.6	4.9	5.3		
Jersey	425	3.7	4.0	4.4	4.7	5.0	5.4		
Kiwicross	450	3.8	4.2	4.5	4.8	5.2	5.5	5.9	
Kiwicross	475	3.9	4.3	4.6	4.9	5.3	5.6	6.0	
Friesian	500	4.1	4.4	4.7	5.1	5.4	5.8	6.1	
Friesian	525		4.5	4.8	5.2	5.5	5.9	6.2	
Friesian	550		4.6	4.9	5.3	5.6	6.0	6.3	6.7

The annual requirements include walking 4 km/day on flat ground for 270 days in milk per cow.

Note:

These requirements should be similar to those calculated by DairyBase,

- DM requirement with increasing feed quality: subtract 5% per MJ ME above 11.0 MJ ME/kg DM
- DM requirement with decreasing feed quality: add 5% per MJ ME below 11.0 MJ ME/kg DM.

Utilisation and wastage

The previous edition of this publication added 6% wastage to the feed requirements. This allowed for feed that was offered to cows under good grazing conditions but was not eaten by the cows. In research trials 6% of the feed offered to cows disappeared, but was not accounted for by milk production or liveweight change, so is assumed to be lost in the grazing process.

Farmers should be aware that cows are unlikely to eat all the feed they are offered. Wastage always occurs, the extent of wastage being dependent on grazing conditions and the type of feed being offered. To meet the expected energy requirements of cows, farmers should allow for some of the feed offered being wasted (not eaten by the cows).

Utilisation and wastage definitions:

Use of utilisation % changes depending on whether you are using it on an annual or daily basis. Utilisation % is an estimate as it is very difficult to measure under grazing conditions.

$$\text{Utilisation percent:} = \frac{\text{The estimated feed eaten (kg DM/ha)} \times 100}{\text{The estimated feed offered (kg DM/ha)} \times 1}$$

Annual pasture utilisation example:

Annual pasture eaten calculated =16 tonnes DM/ha (from table on page 46), 500 kg cows producing 400kg MS/cow=5.1t DM/cow x 3.13 cows/ha= 16 tonnes DM/ha)

Annual pasture growth = 20 tonnes DM/ha

Annual utilisation % = 16/20= 80% utilisation (assuming no feed other than pasture was used)

Exceptional utilisation:	80-85%
Average Pasture Utilisation	75-80%
Poor utilisation would be	<75%

Daily utilisation example:

Good grazing conditions: (free draining soil, no recent rain, fine weather)

1ha of pasture with 3000 kg DM/ha pre-grazing herbage mass is allocated to 100 cows for 24 hours. Grazing residual is 1500 kg DM/ha. 1500 kg DM/ha or 15 kg DM/cow has disappeared (assumed eaten). Under good grazing conditions its likely that the intake is about 6% less than 15 kg DM (14.1 kg DM/cow, 6% wastage)

Poor grazing conditions (poorly drained soils, is raining or soils are already saturated)

Using the same pre and post grazing levels under wet conditions pasture wastage of 25% could occur meaning that intake is likely to be 11.25 kg DM/cow. The uneaten (wasted pasture) was buried in the soil by trampling, or remained uneaten because of soiling.

Dry matter requirements for lactating cows

Daily energy requirements of lactating cows (MJ ME)

The requirements are calculated for pasture at 11.0 MJ ME/kg DM. For different pasture quality make the following adjustments to calculate ME requirements:

- ME requirements with increasing feed quality: subtract 5% per MJ ME above 11.0 MJ ME/kg DM
- ME requirements with decreasing feed quality: add 5% per MJ ME below 11.0 MJ ME/kg DM.

Maintenance MJ ME/day

Lwt (kg)					
375	**400**	**450**	**500**	**550**	**600**
46	50	54	59	63	68

Milksolids MJ ME/kg MS

MJ ME/kg DM	Breed		
	Jersey	**J x F**	**Friesian**
10	81	84	86
11	77	80	82
12	74	77	79

Walking MJ ME/km

Flat	Rolling	Hilly/steep
2.0	3.0	6.0

Pregnancy MJ ME/day

	Weeks before calving					Annual total
	Calf birth weight	12	8	4	2	
Jersey	25	11	18	32	42	1848
Kiwicross	30	12	21	37	48	2114
Kiwicross	35	13	23	41	54	2338
Friesian	40	14	24	44	57	2478

Liveweight MJME/kg Lwt change (diet ME required or saved)

Dry cows		Milking cows	
Lwt gain	Lwt loss	Lwt gain	Lwt loss
72	-30	50	-37

Example 1

CALCULATION EXAMPLE:

Daily requirements of a 450kg J x F cow, producing 2.0 kg MS/day and losing 0.5kg/day Lwt at 12.0 MJ ME/kg DM

Maintenance	54
Walking on flat (3km x 2 MJ ME/km)	6
Milksolids (2.0kg MS x 80 MJ)	160
Lwt loss (0.50kg LWT x -37 MJ)	-19
Total MJ ME at 11.0 ME	201
ME requirements reduced by 5% as 12.0 ME fed = 201 x 95%	191
Total kg DM Eaten (191 ÷ 12.0 ME)	15.9 kg DM

(Diet ME required reduced by 19 MJ ME from loss of Lwt).

Example 2:

CALCULATION EXAMPLE:

Daily requirements of a 450kg J x F dry cow (30kg calf birth weight), 12 weeks before calving and gaining 0.5kg/day Lwt (½ CS in 30 days) at 11.0 MJ ME/kg DM

Maintenance	54
Pregnancy	12
Lwt gain (0.50 kg Lwt x 72 MJ)	36
Total MJ ME	**102**
Total kg DM eaten (102÷ 11.0 ME)	**9.3kg DM**

(Diet ME required increased by 36 MJ ME from gain of Lwt).

Total daily dry matter requirements for lactating cows (kg DM/cow/day)

Daily pasture intakes by grazing cows (kg DM/cow/day) greater than 4% of cow liveweight are very unlikely to be achieved, e.g. 17 kg DM for a 400 kg cow = 4.25% of liveweight is very unlikely.

Daily milking cow requirements: kg DM/cow/day at 10.5 MJ ME/kg DM

Breed	kg Lwt	kg MS/cow/day						
		0.8	**1.0**	**1.2**	**1.4**	**1.6**	**1.8**	**2.0**
J	375	10.4	11.9	13.4	14.9			
J	400	10.9	12.4	13.9	15.4			
J x F	450	11.6	13.1	14.7	16.3	17.8		
Fr	500	12.1	13.7	15.3	17.0	18.6	20.0	
Fr	550	12.6	14.2	15.8	17.4	19.0	20.4	22.0

(No walking or Lwt loss or Lwt gain included).

Daily milking cow requirements: kg DM/cow/day at 11.0 MJ ME/kg DM

Breed	kg Lwt	kg MS/cow/day						
		1.0	1.2	1.4	1.6	1.8	2.0	2.2
J	375	11.2	12.6	14.0	15.4			
J	400	11.5	12.9	14.3	15.7			
J x F	450	12.2	13.7	15.2	16.6	18.1		
Fr	500	12.8	14.3	15.8	17.3	18.8	20	
Fr	550	13.3	14.8	16.3	17.8	19.3	20.6	22.0

(No walking or Lwt loss or Lwt gain included).

Daily milking cow requirements: kg DM/cow/day at 12.0 MJ ME/kg DM

Breed	kg Lwt	kg MS/cow/day						
		1.4	1.6	1.8	2.0	2.2	2.4	2.5
J	375	12.5	13.7	14.9				
J	400	12.6	13.9	15.1	16.3			
J x F	450	13.3	14.6	15.9	17.2	18.5		
Fr	500	13.9	15.2	16.5	17.8	19.1	20.7	
Fr	550	14.3	15.6	16.9	18.2	19.5	21.1	21.7

(No walking or Lwt loss or Lwt gain included).

Dry matter requirements for dry cows

Kg liveweight per body condition score (BCS)

kg Lwt/CS = 6.58% of cow Lwt					
Cow Lwt	**350**	**400**	**450**	**500**	**550**
kg/BCS	23	26	30	33	36

Approximate amounts (kg DM) of 'commonly used feeds' required to be eaten for a 1.0 unit increase in BCS.

Breed	kg Lwt[1]	kg Lwt/ BCS	Autumn Pasture	Pasture Silage	Maize Silage	PKE	Kale[2]	Swedes[3]	Fodder Beet[2]
					MJ ME/kg DM				
			11.5	**10.5**	**10.5**	**11**	**11**	**12**	**12.5**
J	350	23	145	110	115	85	150	125	110
J	400	26	165	130	130	100	175	145	125
J x F	450	30	185	145	145	110	195	160	140
Fr	500	33	205	160	160	125	215	180	155
Fr	550	36	225	180	180	135	235	195	170

[1] Live weights are for the cow only and exclude the weight of the foetus. [2] Requirements for kale and fodder beet were estimated relative to requirements for grass silage from Keogh et al. (2008). [3]Requirements for swedes were estimated as the average of kale and fodder beet.

Note:

- The reason different feeds have different effects on BCS gain is currently unknown, but the results are based on feeding studies in New Zealand
- The differences between maize silage, PKE and pasture silage are not statistically significant – this means that we cannot say with certainty that the numerical difference is real. However, this is the best information available for New Zealand farmers
- The figures presented are average feed requirements (feed eaten) for a 1.0 unit gain in BCS
- The amount of feed required to gain BCS increases later in pregnancy. Realistically, cows do not gain BCS during the last month before calving because of the energy demands of foetal growth

Maintenance and pregnancy requirements for no body condition score gain (kg/DM/cow/day) 11.0 MJ ME/kg DM autumn pasture

Breed	kg Lwt	Weeks pre-calving			
		12	8	4	2
J	350	5.0	5.7	6.8	7.7
J	400	5.5	6.3	7.6	8.5
J x F	450	6.0	6.8	8.3	9.3
Fr	500	6.5	7.4	9.0	10.1
Fr	550	7.0	8.0	9.6	10.8

Daily DM requirements for gaining 1 body condition score in 60 days (kg DM/cow/day), including maintenance and pregnancy requirements. 11.0 MJ ME/kg DM autumn pasture

Breed	kg Lwt	8 - 4 weeks pre-calving
Jersey	**350**	**7.5**
Jersey	**400**	**8.4**
Jersey friesian cross	**450**	**9.2**
Friesian	**500**	**10.1**
Friesian	**550**	**10.9**

No CS gain in last month of pregnancy

Estimating herd/cow liveweight

Average liveweight of mature cows can be determined by weighing a cross section of the mature cows in the herd. Weighing guidelines to establish an estimate are:

- 20–50 cows (the more you weigh the more accurate the result)
- 6-8 years of age
- 100-200 days in milk, making early December a good time to weigh a sample of cows.
- after the morning milking
- BCS 4.5 (add or subtract 14kg for Jerseys, 15 kg for Kiwicross, and 16kg for Holstein Friesian per 0.5 BCS if above or below score 4.5)

This information can be used to validate Lwt BVs and will be most accurate for herds with consistent breeding strategies and limited breed variation within the herd.

Where an estimate of the liveweight for all cows in the milking herd (including the immature 2 and 3 year olds) is required for estimating feed requirements and calculating liveweight/ha, then discount the mature weight by 5%, i.e. multiply the mature weight by 0.95, e.g 520 kg mature weight x 0.95 =500 kg average herd weight allowing for 40% of the herd to be 2 and 3 year olds.

Estimating expected mature liveweight for a group of heifers

Estimating mature liveweight for a group of replacement heifers enables a check on the adequacy of their growth rates for acheiving their mature liveweight. All methods require an estimate of the mature LW of that group first, then estimating their target weight depending on their age.

1. Using average liveweight breeding value (Lwt BV) of the group of heifers.

Breeding values for liveweight are genetic predictions of an animals' mature weight as a 4 year old or older based on parent genetics.

Lwt BV can be used to estimate the target mature liveweight for a group of heifers using the equation:

Mature liveweight (kg) = 500 kg + Average Lwt BV for the group of heifers

Examples:

If the average BV is +20, then the predicted mature target liveweight for that group of animals will be 500 + 20 = 520kg

If the average BV is -15, then the predicted mature liveweight for that group of animals will be 500 + -15 = 485 kg.

Applying this method to individual animals is not recommended.

2. Using the average weight of the mature herd (as above)

This information can be used to validate Lwt BVs and will be most accurate for herds with consistent breeding strategies and limited breed variation within the herd.

3. Typing animals and assigning a breed average

The most effective use of this method is for each animal to be sighted and scored based on coat colour and frame structure to breed. Once breed is selected assign the animal a mature liveweight target based on the breed.

	Average mature cow liveweight kg (New Zealand National Dairy Statistics 2020/21)*	Estimated range in mature cow herd average liveweight
Jersey	435	415 – 465
J x F	485	430 – 550
Friesian	535	510 – 600

** Weighted average liveweight of 6-8 year olds from the NZ Dairy Statistics 2020/21 page 32 Table 4.7.*

Heifer feed requirements

Heifer liveweights

Heifer recommended liveweights – kg LWT

	Age in months					
	3	6	9	15	19	22
	Target % of mature liveweight					
Mature Lwt kg	20%	30%	40%	60%	80%	90%
425	85	128	170	255	340	383
450	90	135	180	270	360	405
475	95	143	190	285	380	428
500	100	150	200	300	400	450
525	105	158	210	315	420	473
550	110	165	220	330	440	495

Annual feed requirements

Heifer total kg DM requirements – kg DM/head at 11.0 MJ ME/kg DM

	Total kg DM		
	Age in months		
Mature Lwt kg	3-10	11-22	3-22
425	891	2455	3346
450	953	2535	3488
475	996	2707	3703
500	1011	2727	3738
525	1048	2839	3887
550	1117	2995	4112

Daily heifer requirements – kg DM/head/day at 11.0 MJ ME/kg DM (including pregnancy)

		Age in months (% of mature liveweight)					
Mature Lwt kg target	Lwt gain kg/day	3 (20%)	6 (30%)	9 (40%)	15 (60%)	19 (80%)	22 (90%)
425	0.54	2.3	3.5	4.6	5.9	7.6	9.2
450	0.56	2.6	3.8	4.9	6.1	7.9	9.4
475	0.60	2.6	3.9	5.1	6.5	8.4	10.1
500	0.62	2.7	4.1	5.4	6.7	8.6	10.3
525	0.63	2.8	4.1	5.4	6.8	9.3	10.6
550	0.67	2.9	4.3	5.7	7.2	9.8	11.1

Heifer intake requirements

- Heifers require energy for maintenance and energy to put on weight.
- Animals become less efficient at using energy for growth as they get heavier.
- Protein requirements are highest from weaning to nine months of age.
- If heifers are on rolling to steep country increase energy requirements by 10%.
- Add or subtract 5% per MJ ME for diets below/above 11 MJ ME/kgDM.
- Heifers should be fed diets of 10.5 MJ ME or higher to achieve target liveweights.

Energy and protein required for maintenance and growth (0.6kg/day) in heifer diets for animals of different weights. Energy for pregnancy is not included.

BW	Maintenance	Growth	Protein
Kg	MJ ME/day	MJ ME/day	%
100	19	17	17
150	26	24	17
200	32	28	17
250	37	29	15
300	42	31	15
350	47	39	14
400	51	40	14
450	55	40	14
500	62	40	14
550	69	40	14

Water requirements

Access to clean fresh water is important for heifer growth and health. Make sure heifers have sufficient access to water.

Water intake of heifers during low day temperatures and high day temperatures

	Litres per day	
Bodyweight (kg)	**4° C (air temp)**	**27° C (air temp)**
45	2.6	4.2
90	8	13
180	14	23
270	19	32
360	24	40
455	28	47

Animal health requirements

Trace elements

Copper and selenium deficiency will decrease growth rates in young stock but only if they are deficient in their diet, or in the case of copper, there are other minerals in the diet that are affecting absorption of copper (molybdenum, iron, sulphur, zinc). Cobalt (VitB12) deficiency can affect growth rates, but this is rare in cattle.

Testing: Every farm's mineral status is different due to differences in soil, topography, fertilisers and the history of the animals arriving on farm. Testing the animals first is crucial to ensure that they are not deficient in minerals and that your supplementation programme is working. Preferably use liver samples to test for copper and cobalt and blood samples to test for selenium.

Supplementation: There are a large range of products to supplement trace elements and some are better than others. Always test your stock to ensure that your supplementation is needed and/or working.

Parasites

Obvious weight-loss, diarrhoea and deaths are the visible signs of worms but are just the tip of the iceberg. Reduced weight gain will occur long before any signs of worms are evident. Parasites need to be managed effectively by:

a. reducing larval intake (prevent infection)

b. helping the animal cope with worms (healthy cattle)

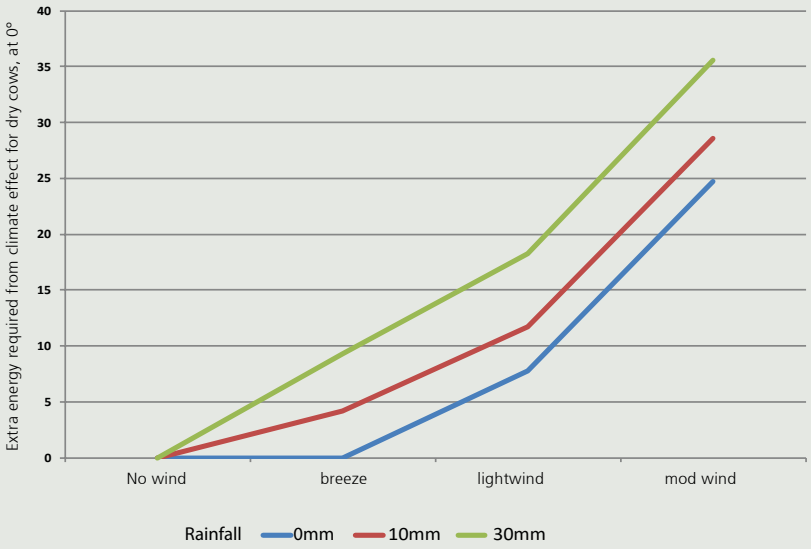
c. killing the adult worms inside the animal (effective drench)

For calves and heifers an effective drench should be a combination drench containing levamisole to target Cooperia worms.

For more information see **www.wormwise.co.nz**

How feed requirements are altered by weather

Cold stress: non-lactating cows.



Temperature thresholds for cold stress (dry cows) °C	
Strong wind and rain	+7.5
Strong wind and no rain	+4
Rain and no wind	0
No wind or rain	-13

Heat stress:

When air temperature is greater than about 21°C and relative humidity is greater than 70% cows begin to experience heat-induced depression of feed intake and lower productivity. Visit **dairynz.co.nz/heatstress** for more on the impact of heat stress on cow productivity in your region, and ways to reduce impact.

5. NUTRITION

The nutritional characteristics of pasture and other commonly used feeds and the advantages and disadvantages of their use.

5. NUTRITION

General nutrition

Energy and protein

Energy is the key driver of milk production. In practice high protein pastures meet the protein requirements for high milksolids production. The table below shows levels of production when protein may limit production for cows fed high quality pasture.

Nutrients first – limiting milk production on high quality pasture diets

kg milk/cow/day	Approx. kg MS cow	Nutrient first limiting milk production
20	1.6	Energy (if protein in pasture >18%)
25	2.0	Energy (if protein in pasture > 21%)
30	2.4	Energy and protein
35	2.8	Protein

Fibre

Fibre is the primary source of energy for grazing animals, but is also required to stimulate chewing and saliva production.

Neutral Detergent Fibre (NDF) is the most common measure of fibre used for animal feed analysis. It measures more than 90% of the structural components in plant cells (i.e. lignin, hemicellulose and cellulose).

For cows grazing only high quality pasture the minimum NDF requirements are 27-33%.

Nutritional guidelines for all pasture, pasture + supplement, and total mixed ration (TMR) diets

Protein Good quality all-pasture diets		Protein content of diet required % DM
litres/cow/day	**kg MS/cow/day**	
20	1.6	18
30	2.4	24
Pasture + supplement, TMR		
kg milk/cow/day	**kg MS/cow/day**	
20	1.6	16 (65% degradable, 35% bypass, 32% soluble)
30	2.4	18 (65% degradable, 35% bypass, 32% soluble)

As a general rule for all diets	**Protein content of diet required % DM**
Early lactation	18
Mid lactation	16
Late lactation	14
Dry cow	12

Fibre	(% diet DM)
As a general rule for pasture diets	
Minimum NDF	35
Minimum effective fibre (eNDF)	17
Pasture + supplement, TMR	
Minimum NDF	27-33
Minimum effective fibre (eNDF)	20
Minimum ADF	19-21
Soluble carbohydrate	(% diet DM)
Pasture + supplement, TMR	
Maximum total soluble carbohydrate	38
Maximum starch	25-28
Fat	(% diet DM)
Pasture + supplement, TMR	
Maximum additional unprotected fat	3
Maximum additional protected fat	3
Macro minerals	**Mineral content of diet required (%DM)**
All diets for high production (2 kg MS/cow/day)	
Calcium	0.6-0.8
Phosphorus	0.3-0.35
Magnesium	0.22-0.28
Potassium	1.0+
Sulphur	0.23
Sodium	0.20
Chlorine	0.25

Pasture composition and value

The nutritional value of ryegrass-based pastures as a feed for dairy cows varies seasonally.

Table 1. Effect of season on pasture composition

Season	Pasture composition						
	DM (%)	ME (MJ/kg)	CP (% DM)	NDF (% DM)	SSS (% DM)	Starch (% SSS)	Fat (% DM)
Spring	12-18	11.5-12.5	18-35	35-45	7-25	2-4	3-6
Summer leafy	15-20	10.5-11.5	14-22	42-52	7-25	4-8	4
Summer dry	20-30	9.0-10.0	10-15	50-65	7-10	2-4	2-4
Autumn/winter	13-18	11.0-11.5	15-20	40-47	7-25	2-4	3-5

Grazing management can also influence the nutritional value of pasture.

Table 2. Typical digestibility and ME of pasture.

Component	Green leaf	Soft stem	Hard mature stem	Dead material
Digestibility (%)	70-85	65-75	40-50	40-50
Energy (MJ ME/kg DM)	10.5-12.5	10-11	6.5	6.5

Feed composition

The following definitions apply to the tables on pages 66-71.

DM, dry matter

ME, metabolisable energy

CP, crude protein

NDF, neutral detergent fibre

SSS, soluble sugars and starch

Ca, calcium

P, phosphorus

Mg, magnesium

K, potassium

S, sulphur

Na, sodium

Cl, chloride

FEEDSTUFF	DM (%)	ME (MJ/kg)	CP (% DM)	NDF (% DM)	SSS (% DM)	Starch (% of SSS)	Fat (% DM)
PASTURE							
Spring	12-18	11.5-12.5	18-35	35-45	7-25	2-4	3-6
Summer leafy	15-20	10.5-11.5	14-22	42-52	7-25	4-8	4
Summer dry	20-30	9.0-10.0	10-15	50-65	7-10	2-4	2-4
Autumn/winter	13-18	11.0-11.5	15-20	40-47	7-25	2-4	3-5
SILAGE							
Pasture, good	23-28	10-11	17-18	45	22.0	7	3.0
Pasture, poor	38	9.0	15.0	55	15.0	8	3.1
Barley	33	9.8	11.9	57	19.9	100	2.9
Lucerne	30-40	9.5	20.0	51	16.7	45	3.5
Maize	32-38	10.5-11.5	8.0	32-45	35-47	85	3.1
Pea	33	8.8	13.1	59	18.3	100	3.3
Wheat/oat	36	10.5	13.0	59	16.1	100	3.6
HAY							
Pasture, good	85	9.7	17.0	54	17.7	44	2.6
Pasture, poor	85	7.3	7.0	66	14.6	45	2.6
Barley straw	87	6.5	4.3	80	6.7	100	1.9
Pea straw	85	6.7	6.3-8.0	59	-	-	-
Wheat straw	89	6.3	3.6	79	7.8	100	1.8
CONCENTRATE							
Barley	89	13.0	11.0	21	61.4	90	2.0
Bran	85	9.8	17.1	51	20.6	95	4.4
Canola meal	90	11.5	38	30	-	1.5	3.5
Lupin	89	12.0	34.2	33	22.0	90	5.5
Maize grain	89	13.6	8.0	9	75.1	99	4.3
Oats	89	11.5	13.0	31	47.5	90	4.9

Ash (% DM)	Ca (% DM)	P (% DM)	Mg (% DM)	K (% DM)	S (% DM)	Na (% DM)	Cl (% DM)
10-12	0.2-1.5	0.2-0.6	0.1-0.4	1.5-4.5	0.1-0.6	0.03-0.6	0.03-0.6
7-25	0.2-1.5	0.2-0.6	0.1-0.4	1.5-4.5	0.1-0.6	0.03-0.6	0.1-1.5
8-10	0.2-1.5	0.2-0.6	0.1-0.4	1.5-4.5	0.1-0.6	0.03-0.6	0.1-1.5
-	0.2-1.5	0.2-0.6	0.1-0.4	1.5-4.5	0.1-0.6	0.03-0.6	0.1-1.5
10.0	0.80	0.30	0.21	2.30	0.24	0.10	0.20
9.5	0.55	0.28	0.14	2.0	0.20	0.16	0.19
8.3	0.52	0.29	0.19	2.57	0.24	0.12	0.00
9.5	1.29	0.29	0.25	2.84	0.29	0.05	0.34
4.0	0.25	0.23	0.18	1.20	0.13	0.01	0.00
9.0	0.87	0.34	0.23	3.08	0.25	-	-
8.3	0.57	0.32	0.20	2.85	0.25	0.07	0.07
9.0	0.80	0.40	0.20	2.32	0.26	0.20	0.62
6.3	0.40	0.30	0.18	1.67	0.20	0.15	0.60
7.1	0.30	0.07	0.23	2.37	0.17	0.14	0.67
-	1.60	0.12	0.39	1.40	0.25	0.01	0.67
7.8	0.18	0.05	0.12	1.42	0.19	0.14	0.32
2.8	0.06	0.44	0.18	0.57	0.17	0.03	0.18
6.9	0.13	1.31	0.60	1.50	0.25	0.04	0.05
7.4	0.75	1.10	0.53	1.41	0.73	0.07	0.04
5.1	0.26	0.44	0.00	0.91	0.00	0.00	0.00
1.6	0.02	0.31	0.12	0.40	0.12	0.003	0.05
3.6	0.10	0.41	0.15	0.53	0.19	0.01	0.11

FEEDSTUFF	DM (%)	ME (MJ/kg)	CP (% DM)	NDF (% DM)	SSS (% DM)	Starch (% of SSS)	Fat (% DM)
Peas	87	13.0	24.0	23	46.2	-	1.8
Soya bean meal	90	12.9	50.0	14	27.3	90	1.4
Soya bean hulls	91	11	11.4	61-67	14.0	1.4	2.5
Tapioca pellets	88	12.5-12.8	3	12	50-65	100	2
Wheat	89	12.6	11.3	14	70.2	90	1.9
Whole cotton seed	88	16.0	23.0	44	3.7	90	18.0
Cotton seed meal	89	12	Min 43	20-23	-	1.5	0.05
CROPS/ROOTS							
Chicory	8-19	12.5-13.0	20-26	30-38	4-9	-	-
Fodder beet	14-20	12.0-12.5	9-14	11-16	60-65	5	-
Kale	11-15	11.0-13.5	12-18	20-35	35-40	-	2.1
Lucerne	24	11.0	30.0	30	-	-	2.5
Oats	11-20	11.5	13.2	30	48	90	4.9
Swedes	9-12	11-13	12-20	16-30	45-50	0.1	-
Triticale	32		13.8	59.7	68	67	-
Turnips	9-11	12.0	12-18	27	17	10	2.0
Plantain	10-20	10-12.5	16-28	30-38	6-17	5-15	2.4-3.8
BY PRODUCTS							
Apple pomace	22	10.4	5.4	41	44.0	100	4.7
Bread	63	14.0	13.0	18	65	90	5.7
Brewers grains	24	10.0	23.0	49	11.2	100	7.3
Cabbage	8	13.2	19.0	29	60.4	-	3.4
Carrots	12	13.2	9.9	9	59.4	-	1.4
Condensed distillers syrup	42-45	15-17	15-17	1	-	-	4-8
Dried distillers grains	90	12-13	25-33	30	7.0	55	3.5
Fishmeal	92	11.7	66.7	1.47	2.0	90	10.5
Kiwifruit (ripe)	14	12-12.5	12-17	20	50	2-4	3
Kiwifruit (hard)	20	12-12.5	6-10	25	30	2	3

Ash (% DM)	Ca (% DM)	P (% DM)	Mg (% DM)	K (% DM)	S (% DM)	Na (% DM)	Cl (% DM)
5.0	0.14	0.43	0.17	1.80	-	0.01	-
7.3	0.30	0.68	0.30	2.12	0.37	0.01	0.08
4.8	0.6	0.18	0.25	1.5	0.12	0.01	0.05
6.2	0.2	-	0.15	1.10	-	-	-
2.6	0.07	0.36	0.13	0.46	0.16	0.01	0.08
4.5	0.16	0.60	0.37	1.20	0.26	0.01	-
6.7	0.20	1.15	0.61	1.64	0.40	0.03	0.03
-	1.49	0.34	0.28	3.64	-	0.21	-
-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-
11.0	1.60	0.30	0.25	2.50	0.30	0.06	0.35
3.3	0.11	0.40	0.16	0.52	0.19	0.03	-
6.0	0.4	-	0.10	0.50		0.20	0.20
9.7	0.57	0.33	0.19	3.01	0.21	0.05	-
-	1.75	0.37	0.23	3.00	0.33	0.28	1.45
10-18	-	-	-	-	-	-	-
5.0	0.23	0.11	0.00	0.53	0.11	0.00	0.00
3.0	0.17	0.15	0.40	0.19	-	0.80	-
4.4	0.30	0.60	0.10	0.10	0.36	0.20	0.17
9.0	0.60	0.30	0.19	3.13	-	0.23	-
8.2	0.40	0.35	0.20	2.80	0.17	1.04	0.50
-	-	-	-	-	-	-	-
4.5	0.18	0.83	0.33	0.10	0.44	0.30	0.26
20.8	5.65	3.16	0.16	0.76	0.49	0.43	0.60
0.64	0.03	0.04	0.03	0.33	0.00	0.05	
-	-	-	-	-	-	-	-

FEEDSTUFF	DM	ME	CP	NDF	SSS	Starch	Fat
	(%)	(MJ/kg)	(% DM)	(% DM)	(% DM)	(% of SSS)	(% DM)
Molasses	75	12.0	4.0	0	82.8	0	0.1
Onion	10	13.0	11.6	18	65.1	100	1.6
Palm kernel extract	90	11	14	70		5	8.0
Potato	23	13.0	10.0	7.6	77.2	100	0.4
Pumpkin	8.4	12.9	16.0	5.9	67.4	100	1.2
Tallow	99	31.0	0.0	0	0.0	0	99.0
Urea	99	0.0	281	0	0	0	0.0

Ash	Ca	P	Mg	K	S	Na	Cl
(% DM)	(% DM)	(% DM)	(% DM)	(% DM)	(% DM)	(% DM)	(% DM)
13.1	1.10	0.09	0.43	3.30	0.47	0.15	3.10
3.7	0.20	0.33	0.10	1.57	0.10	0.03	0.20
6.0	0.25	0.65	0.30	0.80	-	0.02	0.50
4.8	0.04	0.24	0.14	2.17	0.09	0.09	0.28
9.5	0.25	0.52	0.14	4.0	-	0.01	-
1.0	0.57	0.06	0.06	0.32	0.00	0.01	0.00
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Feed characteristics and uses

Feed	Type	Considerations
Apple pomace	By-product	A good source of digestible fibre but low in protein. As a moist product it is around 20% DM, with moderate energy levels. It is highly palatable, but is a low mineral product. Consistency may be variable with different batches.
Barley	Concentrate	High starch and risk of acidosis at high feeding rates and/or quick introduction into the diet. High energy and low protein. Palatable and digestible. Best fed through an in-shed feed system or mixed in a ration on a feed pad.
Barley silage	Silage	
Barley straw	Straw/Hay	Low in energy and protein, high in effective fibre. Not suitable as a milking cow feed unless the diet is short of effective fibre. Can be used as part of a dry cow ration.
Bran	Concentrate	Moderate energy and protein levels. Not recommended to feed ad-lib due to the high palatability.
Bread	By-product	High energy, low protein feed and high starch. Risk of acidosis at high feeding rates and/or quick introduction into the diet. Soft oils in the bread can oxidise, so does not store well and goes off quickly.
Cotton seed meal	Concentrate	Very high levels of by-pass protein, excellent digestible fibre and good energy levels. It has a poorer amino acid profile than soya bean meal.
Dried distillers grain	By-product	High energy, moderate protein, high oil which can affect milk fat if the percentage of total unprotected fat in the diet exceeds 6%. Low in starch from extraction process.

Feed	Type	Considerations
Brewers grains	By-product	Rich in protein with moderate energy levels. High in digestible fibre and low in starch. Nutritional value can vary from source to source with a range in dry matters.
Cabbage	By-product	High energy, moderate protein and high SSS. Low proportion of stem to leaf compared to kale means they are less fibrous. Eaten readily and usually needs feeding immediately after delivery.
Canola meal	Concentrate	Highly digestible, high quality protein source with excellent levels of bypass protein. Best fed through an in-shed feed system or mixed in a ration on a feed pad.
Carrots	By-product	High energy, moderate protein, high SSS feed with risk of acidosis at high feeding rates and/or quick introduction into the diet. They are a good source of beta-carotene; however, prolonged use at high levels can colour milk fat.
Chicory	Crop	Management is similar to turnips with time required to adjust to crop. Ready to graze at 25-35 cm height; graze down to 5-10 cm. Do not graze lower than 5 cm. For more information, refer to DairyNZ Farmfact 1-72 – Chicory.
Condensed distillers syrup	By-product	High energy, and a good source of available crude protein. Very low fibre content and can contain high levels of fat.
Lucerne	Crop	Perennial legume, long tap root making it tolerant to dry conditions. Highly nutritive feed – leaf can contain around 12 MJME, however overall value declines as the season progresses (8.5 MJME) and stem component becomes greater. Sodium levels are low. Should be introduced gradually to avoid bloat.
Lucerne silage	Silage	Lucerne taken for silage should be wilted to 25-30% dry matter. It has higher protein content than grass silage and also results in higher intake levels due to lower cell wall content. High fibre levels may reduce nutrient levels in high yielding rations.

Feed	Type	Considerations
Fish meal	By-product	Quality will vary. Excellent protein source, rich in lysine, sulphur, minerals and vitamins.
Fodder beet	Crop	A potentially high yield of digestible nutrients compared to other forage crops. Cows need to be transitioned carefully over a 10 - 14 day period. Graze roots and crop together. Crop DM measurements need to be accurate. Dry cows are commonly put on fodder beet. It should not exceed 2/3 diet. Transition cows off crop 2-3 weeks prior to calving and supplement with magnesium. Refer to Farmfact 1-73.
Kale	Crop	High protein and calcium levels, good water soluble carbohydrates. Can be ensiled. Need to manage effluent loss. Utilisation 75-80% in ideal conditions; 50-60% in the wet. Can provide 100% of diet but better feed usage if less than 65% with high quality baleage, hay or pasture as the other 35%. SMCO: greatest risk in mature kale crops; use little to no sulphate fertiliser. Nitrate poisoning: excessive fertiliser use and exacerbated by certain weather conditions. High Ca/P ratio can cause milk fever at calving.
Kiwifruit	By-product	Good quality milking feed with high energy content but relatively low protein. Needs to be introduced slowly with controlled intake to individual animals. Ripe fruit contain more soluble sugars and increase acidosis risk. Refer to Farmfact 1-61.
Oats	Concentrate	Poorer energy value than wheat and barley but higher in unsaturated oil. High fibre content.
Oats	Silage	Oats can be used for spring-harvested silage and also following winter grazed kale to reduce N leaching. Quality changes with maturation: protein declines, soluble carbohydrate increases. Requires top management, can get high wastage if poor quality. Oats can be used as a single graze feed for dry cows (usually in the South Island).
Onions	By-product	May cause anaemia, also a choke hazard, and there is a risk of milk taint.

Feed	Type	Considerations
Pasture hay, good	Hay	Suitable feed for dry cows, or to reduce risk of acidosis.
Pasture hay, poor	Hay	Poor quality hay can be 7-8 MJME. Not suitable as milking cow feed.
Lupin	Concentrate	Fresh forage or ensiled with maize/cereals. The thick, juicy stem makes them unsuitable for hay. Seeds can be the concentrated protein feed in the diet. Lupin meal or flakes are the seeds processed to remove the fibrous coat.
Maize grain	Concentrate	High energy and starch but slowly digestible, risk of acidosis less than barley or wheat. The seed is high in starch but low in protein, fibre, and minerals.
Maize silage	Silage	High in starch, low in protein, good dry matter levels. Can feed up to 40% of diet to milking cows and 50% of diet for dry cows if the pasture is 25% crude protein. For short periods (up to a month) can feed up to 80% of diet for dry cows. At high intakes require supplementation with Ca, Mg and Na.
Molasses	By-product	High risk of acidosis. Max intake 1.0-1.5 kg DM/ cow/day (i.e. 2 l /cow). Introduce gradually. High in potassium and salt, known to be a laxative. Stores well for up to a year.
Palm kernel extract	By-product	Can sometimes be an issue with palatability. Ideally no more than 30% of the diet; during severe feed deficits max intake 50% of diet, balanced with forage. Cows need water all day at high intakes and a source of long chopped fibre. No major animal health risks. At high intakes review copper supplementation and limit feeding to springing cows.
Peas	Concentrate	Dried peas usually added to animal feed mixes to improve digestibility. Similar to field beans with marginally lower protein. Can be used to replace soya and other protein sources but slightly lower energy. Peas are high in sugar and starch.

Feed	Type	Considerations
Pea silage	Silage	Whole-crop to provide starch and protein in the diet. Peas are sometimes wilted in the field to 25-30% DM. Delaying harvesting beyond flat pod stage results in reduced digestibility and overall feeding value.
Pea straw	Hay	Not suitable for milking cow feed, low energy 7-8 MJME. Pea straw is usually crop residuals from harvesting field peas; this contains dry stem and leaves.
Potato	By-product	High risk of acidosis. Can be reduced by spreading over paddock. Need to restrict to 3 kg DM/cow/day if fed in bins as risk of acidosis from cows gorging. Limited supply. Need to know ration's ingredients.
Pasture silage, good	Silage	Silage and baleage often not greater than 10.5 MJME and therefore not suitable as milking feed. Suitable feed for dry cows, or if no long-chop feed available for milking cows (to reduce risk of acidosis). Cost varies depending on size of bale, wastage and ME.
Pasture silage, poor	Silage	Silage and baleage closer to 9 MJME.
Soya bean hulls	By-product	Good source of digestible fibre, moderate energy content, and average protein. Suitable supplement with grass.
Soya bean meal	Concentrate	The best quality protein feed, high in by-pass protein. Has a good amino acid profile. High in energy.
Swedes	Crop	Low DM% (11-12) which can limit intake. Good palatability and a high energy value. Cows need to be transitioned well. Bolting or maturing swede crops, e.g. elongated necks or flowering heads, increase the risk of ill- health. Swede crops need to be monitored including the proportion of swede in the diet.

Feed	Type	Considerations
Tapioca	Concentrate	Tapioca is a high energy supplement, with similar starch content to maize grain, but is low in protein and not as palatable. Ideal for cows as starch is slowly degraded and has good energy levels.
Triticale	Crop	High energy, moderate protein grain. Some autumn sown varieties can only be grazed once; others may be grazed twice and cut for silage.
Triticale silage	Silage	High production within a short period compared to other crops grown for silage. Can be harvested at an earlier stage before seed head is present (green chop) giving a silage value similar to high quality grass silage.
Turnips	Crop	Use long narrow breaks. Introduce cows gradually to adjust to crop; offer a maximum of 2 kg DM/cow (approx. 2-3 m2/cow/day) in first five days, increasing over next five days, up to 5 kg DM/cow/day; no more than a third of the daily ration. For more information refer to DairyNZ Farmfact 1-67 – Barkant turnips.
Urea	By-product	Urea is the most concentrated non-protein nitrogen source available at 50% nitrogen. Care should be taken to provide urea in small quantities (< 150g/day) in a safe form as it can produce ammonia toxicity if introduced too quickly or larger amounts are fed.
Wheat	Concentrate	Very high energy with average protein. High in starch, low in fibre, but tends to be low in vitamins. Is useful for increasing milk protein yield and for growth. Approximately 10% of starch is rumen unfermented. The readily fermentable carbohydrates present can cause acidosis when fed at high levels. Higher risk of acidosis than with barley or maize.
Wheat straw	Hay	Lowest quality hay at 6-7 MJME.

Feed	Type	Considerations
Wheat silage	Silage	Like maize, not all regions in NZ are suited to growing quality cereal silage with high ME. Requires top management (small harvesting window). Can get high wastage if poor quality.
Whole cotton seed	Concentrate	Whole cotton seed is high in energy, protein, and fibre. When feeding cotton seed the amount that can be fed will be limited due to: chemical residuals from growing the crop, oil intake and effect on the rumen, and the risks of gossypol toxicity.
Whole crop silage mixes and green - chop silage	Silage	Whole crop silage refers to a number of silages already mentioned: oats, barley, triticale, peas. Whole crop silage cereals are harvested when the grain has reached full size but is still soft. Green-chop cereal silage is harvested at the boot stage and wilted. It has similar properties to pasture silage.

Feeding forage crops: factors to consider

Forage crops	Factors to consider
Cereals	Flexible as can be grazed or ensiled (whole crop silage) Silage quality general lower ME than good quality maize silage but is less risky in cooler regions or exposed locations. In North Island difficult to get good grain fill reducing silage quality.
Triticale	Range of cultivars from single to multiple grazings.
Oats	Best suited to single grazing; or multiple cut and carry where height controlled. Quality changes with maturation, protein declining, soluble carbohydrate increasing. Good catch crop following winter fodder beet or brassicas

Forage crops	Factors to consider
Multiple-graze cereals	Sown in autumn; grazing time in winter not as flexible as Italian ryegrass. e.g. triticale, rye corn, oats
Brassicas	Fall into 2 categories – summer feed or winter feed. All provide high quality feed and bulbing brassicas a source of carbohydrate (stored starch and soluble sugars). Dangers of feeding can be avoided by careful transitioning between diets (at least 10 days) and supplementing with straw and silage to increase gut fill and reduce rate of intake and offering 2-3 smaller breaks during the day. High sugar and low fibre: rumen acidosis. Toxic components SMCO, glucosinolates and high nitrate. SMCO1 – reduced performance 'red water' disease; highest risk mature kale, flowering brassicas and secondary re-growth. Rape scold in second-growth Pasja.
Swedes (approx 12.0 ME)	Low DM% 11-12% which can limit intake.
Kale (approx 12.5 ME)	Medium to high in protein (dependent of N fertiliser input), good levels of soluble carbohydrate and high levels of calcium (7-8 g/kg DM compared to pasture 2-2.4 g/kg DM). Can be ensiled; need to manage effluent loss. Utilisation 75-85% ideal conditions; 50-60% in the wet. Can provide 100% of diet but better feed usage if less than 70% with high quality baleage, hay or pasture as the other 30%. SMCO – greatest risk in mature kale crops; use little to no sulphate fertiliser. Nitrate poisoning: excessive fertiliser use and exacerbated by certain weather conditions. High Ca/P ratio can cause milk fever at calving.

[1] SMCO = amino acid S-methylcysteine sulphoxide

Forage crops	Factors to consider
Turnips	Use long and narrow breaks. Introduce cows gradually to adjust to crop; offer a maximum of 2 kg DM/cow (approximately 2-3 m2/cow/day) in first five days increasing over next five days, up to 5 kg DM/cow/day; no more than a third of the daily ration. For more information refer to DairyNZ Farmfact 1-67 – Barkant turnips: feeding the crop.
Chicory	Management is similar to turnips with time required to adjust to crop. Pre-graze at 25-35 cm height; graze to 5-10 cm. Do not graze lower than 5 cm. For more information refer to DairyNZ Farmfact 1-72b – Chicory.
Fodder Beet	Not the same management as kale and swedes. Need to transition cows onto crop over 10-14 day period. Graze leaf and bulb together. Low phosphorus content. Seek veterinary advice about mineral supplement as cows transition off crop at calving. For more information refer to DairyNZ Farmfact 1-73 – Fodder beet: feeding dairy cows.

Crop area required to feed 100 cows: see www.dairynz.co.nz/feed/crops/

	Daily intake (kg DM/cow)			
Crop Yield	**3.0**	**4.0**	**5.0**	**6.0**
8 t DM/ha	375m²	500m²	625m²	750m²
10 t DM/ha	300m²	400m²	500m²	600m²
12 t DM/ha	250m²	333m²	420m²	500m²
14 t DM/ha	215m²	280m²	360m²	430m²
16 t DM/ha	188m²	250m²	313m²	375m²
18t DM/ha	167m²	222m²	278m²	333m²
20 t DM/ha	150m²	200m²	250m²	300m²
25 t DM/ha	120m²	160m²	200m²	240m²
30 t DM/ha	100m²	133m²	167m²	200m²

Estimating chicory crop yield

The DM% of chicory ranges from 10-15% and therefore yields can vary by up to 50% if DM is over or under estimated. The following outlines the best practise method. For more information refer to DairyNZ Farmfact 1-72 – Chicory.

- Make a 0.25m² quadrant by bending wire into a square 0.5 m x 0.5m
- Take cuttings from 4 randomly chosen sites, cut to grazing height (5cm recommended)
- Bulk the 4 samples together and weigh
- Multiply by 10,000 to get fresh weight (kg/ha)
- Take 200g sample of fresh chicory after thoroughly mixing the sample
- Dry in microwave or oven until the weight doesn't change, re-weigh and record the dry weight OR send sample away for DM analysis in a sealed plastic bag
- Calculate DM% (dry weight / fresh weight)
- Calculate DM/ha (fresh weight/ha x DM%).
- Similar to pasture, the Rising Plate Metre can be used to estimate the yield of first year chicory crops when there is no stem present. Take at least 40-50 readings in a 'W' shape across the paddock and calculate yield using the equation:

Yield (kg DM/ha) = RPM height (clicks) x 86 + 235.

Estimating brassica crop yield

- Collect at least 6-8 quadrat samples that are representative of the paddock. Recommendation of 1 quadrat/ha of crop but the more samples the better
- Sample size minimum of 1m² use a 1m x 1m square quadrant or a circle made with a 3.55 m length of alkathene; or for a 2m² sample use 5.1m length of alkathene to make the circle)
- Harvest all the material within each quadrat and measure its fresh weight after removing any excess soil, especially from the bulbs of swedes and turnips
- For bulb crops weigh the leaf and bulbs separately
- Determine the DM content – take a sub-sample of plants/plant parts (swedes, turnips) and send to the lab for DM analysis. As DM% varies greatly between cultivars and paddocks estimating the DM% will result in under or overestimating the yield
- Average the DM yield for the quadrat samples (fresh weight x DM%) and multiply by 10,000 for a 1m² sample or by 5,000 for a 2m² sample (e.g. 1.44kg DM from a 1m² sample equates to 14,400kg DM/ha or 14.4 tonnes DM/ha).

NB. If swedes are ridged, follow the fodder beet method (refer to page 82)

Estimating fodder beet crop yield

- Determine the row spacing of the crop by measuring across 10 rows of crop from the centre of the first row; divide the distance by 10.
- Collect at least 5 yield samples that are representative of the paddock
- From each yield sample remove all the plants from 4 lineal m of a row (50cm row spacings) or 4.44 lineal m (45cm row spacings). This length provides 2m² of sample.
  (2 and 2.22 m lengths = 1m²)
- Remove any excess soil from the bulbs by scraping with a blade, separate the leaf and bulb by cutting as close to the crown of the bulb as possible and measure the wet weight of leaf and bulb separately.
- Select approximately 300g of leaf from multiple plants and 3-5 bulbs for DM determination. Cut the bulbs in quarters lengthways and place one quarter of each bulb into a plastic bag, seal and send with the leaf to the lab for DM determination. As DM% varies greatly between cultivars and paddocks estimating the DM% will result in under or overestimating the yield

Calculate the DM yield for each sample and plant part (fresh weight x DM%; 30kg bulb x 0.14 DM = 4.2 kg DM; 6 kg leaf x 0.09 DM = 0.54kg DM) and average. Add the average bulb and leaf DM yield together ((4.2+ 0.54) = 4.74kg DM/2m²) and multiply by 5000 to determine the kg DM/ha yield (4.74kg DM/2m2 x 5000 = 23700kg DM/ha or 23.7t DM/ha).

Silage

Area of farm to close for silage or baleage during a pasture surplus

Example calculation:

500 cows on 160ha, stocking rate =3.1 cows/ha, 25 day rotation=160/25=6.4 ha/day

Estimated Pasture intake = 18 Kg DM/cow/day

Feed demand = 3.1 x 18 =56 Kg DM/ha/day

Pasture Growth = 65 Kg DM/ha/day

Area to be in grazing rotation = 56/65 = 86% or 138ha of the farm

Close up 14% of the farm or 22ha.

Check that new rotation length is suitable; 138 ha/6.4ha=21.6 days new rotation length.

Density and storage of silage

Density and DM% of silage and hay

Silage type	DM %	Wet weight silage kg/m³ in stack or hay in bale	DM silage kg/m³ in stack/bale
Direct cut grass	13-18	700-900	120-160
Wilted grass	20-30	600-800	160-180
Baleage	35-40	500	200-220
Hay – small bales	85	18-25	15-20
Hay – round bales	85	180-300	150-250
Maize stack	30-40	500-760	170-250 (average 200)
Maize bunker	30-40	600-900	200-300 (average 220)
Typical density in forage wagons is around 80kg DM/m³ for a range of forages			

Estimate of DM % grass silage

Squeeze test: Break up silage 2-3 cm length and roll into ball size of tennis ball, squeeze in fist for 30 seconds	DM %
Hands dry, sample does not stay in tight ball when stop squeezing	Over 30
Sample stays in ball when stop squeezing, no juice, hands moist	26-30
A little juice runs out with difficulty	21-25
Juice runs out easily	18-20

Storage space required for grass and maize silage

Silage storage	Tonnes DM multiplied by	Example
Maize stack	5.0	e.g. 50 t DM x 5.0 = 250m^3
Maize bunker	4.4*	e.g. 50 t DM x 4.4 = 222m^3
Grass silage	5.7	e.g. 50 t DM x 5.7 = 285m^3

** This figure is used to determine weight of maize silage in the example on page 85*

How much silage is in my stack?

To calculate the weight of silage in storage you need to know (or estimate):

a) storage volume (capacity) in cubic metres (m^3)

b) silage density in kg DM/m^3

c) dry matter %.

The weight of silage in storage is then calculated using the following equation:

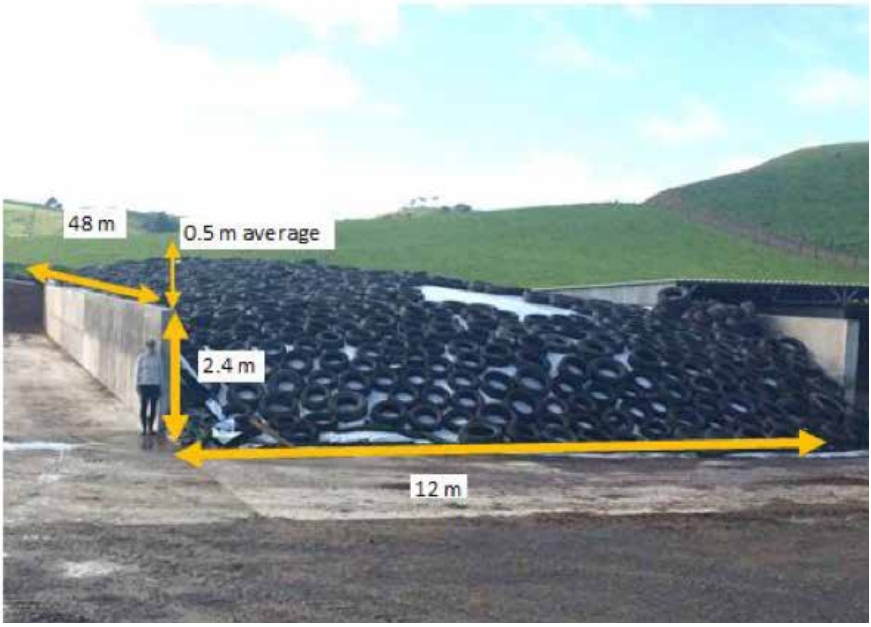
Silage weight (kg DM) = volume of stack or pit (m^3) x silage density (kg wet weight/m^3) x DM %

Estimating stack volume

Volume of the storage can be estimated by multiplying the width by the length by the approximate height of the silage.

In the photo, the dimensions have been estimated at a length of 48 metres, width of 12 metres and height of 2.9 metres (the height at the highest point is about 1 metre above the top of the wall, so about 0.5m on average). The volume of the silage in the bunker is therefore:

48 x 12 x 2.9 = 1670m^3



Using the table on page 84 for storage space for silage as a guide for our example bunker storage in the photo:

Maize silage weight = 1670m^3 ÷ 4.4 = 380 tonne DM*

Density and storage of other feeds

	Density (kg/m³)	Storage (m³/tonne)
Grains – Barley	630	1.6
Grains – Wheat	760	1.3
PKE	630-750	1.35-1.6
Carrots	630	1.6
Onions (dry)	630-725	1.4-1.6
Potatoes	660	1.5

Maximum silage face area (m²) to achieve min. silage feed out rates

On average a 20cm daily progression of the silage face is required across the whole silage face for better silage stability (preventing heating). A slow rate of silage feedout increases losses.

Silage feed out t DM/day	Silage density kg DM/m³	Max. silage face area (m²)	Silage face dimension Example height x width
1	200	5	e.g. 1.5 x 3.3m =5m²
2	200	10	e.g. 1.8 x 5.5m = 9.9m²
3	200	15	e.g. 2 x 7.5m = 15m²
4	200	20	e.g. 2.5 x 8.0m =20m²

Interpreting pasture silage analysis

Factors measured	Typical range	Interpretation
pH	4.3-4.7	A low pH prevents unwanted butyric fermentation. Higher pH (>5.0) may be due to butyric fermentation or to silage being high in DM (>45%) restricting fermentation
Ammonia N (% of total N)	8-12	Low values indicate minimal breakdown of protein in silage usually due to rapid fall in pH to a low level in the silage.
Lactic acid (% of DM)	6-10	High concentrations indicate well preserved silage.
Butyric acid (%of DM)	0.1-0.5	High concentrations indicate poorly preserved silage.

Interpreting maize silage analysis

Factors	Quality of fermentation typical range	Interpretation
pH	3.7-4.2	pH higher than 4.0 may be due to the silage being very high DM (>42%) or the silage has had considerable aerobic exposure.
Ammonia N (% total N)	5-7	High value (>12%) is the result of high protein breakdown. Note: maize silage has low crude protein (8%) i.e. less crude protein available to be degraded.
Lactic acid (% DM)	4-7	High concentrations indicate well preserved silage. Low values may indicate restricted fermentation due to high DM or after considerable aerobic exposure lactic acid was degraded.
Acetic acid (% DM)	1-3	High concentrations are often found with very wet silage (<25% DM) or due to loose packing. Silage treated with inoculant containing L. buchneri show higher levels of acetic acid; this should not be mistaken for a poorly preserved silage.

Time to ensile

Time to ensile (days to when silage can be fed out)

		Days to ensile	
Silage type	**% DM**	**with inoculant**	**without inoculant**
Grass	20	4-7	8-14
	30	4-10	14-21
	40	4-10	20+
	50	Up to 14	Up to 30+
Whole crop cereal	32-45	3-4	7
Maize	30-40	3-4	7

Note: Need to use proven inoculant. The lower the DM the quicker to ensile but more risk of low quality silage (butyric i.e. bad smell). The higher the sugar content the quicker to ensile.

Mineral additives to maize silage

Mineral additives to maize silage (when maize silage 25-40% of DM intake). Contact an animal nutritionist to get recommendations when maize is more than 40% of the diet. Amount of each mineral supplement (g/cow/day) to include when feeding different amounts of maize silage.

Maize eaten – kg DM	**Limeflour**	**Magnesium Oxide**	**AgSalt**	**Dicalcium Phosphate**
	g/cow/day			
Lactating cow				
Less than 3kg	60	40	15	20
3-5kg	70	45	25	35
5-8kg	80	45	40	55
Dry cow (last 3 weeks)				
Less than 3kg	0	60	0	0
3-5kg	0	60	15	0

For more information refer to DairyNZ Farmfact 1-60 – Mineral supplementation for maize silage.

Costing feeds:

Costing per kg DM eaten and per MJ ME eaten

Dry Matter (DM)	= wet weight x DM%
Cost/kg DM eaten	= price per tonne feed ÷ kg DM ÷ Utilisation
Cost/MJ ME eaten	= cents/kg DM eaten ÷ MJ ME/kg DM
Example: Grass silage costs $80/tonne; 35% DM; 10 MJ ME/kg DM Utilisation of 80% (10% wastage storage + 10% wastage feeding out)	
DM	= 1000kg x 35% DM = 350 kg DM
Cost/kg DM eaten	$= \frac{\$80/\text{tonne}}{350\text{kg DM/tonne}}$ x 100 = 23 cents/kg DM offered $= \frac{23 \text{ cents}}{0.80}$ = 29 cents/kg DM eaten
Cost/MJ ME eaten	$= \frac{29 \text{ cents/kg DM}}{10 \text{ MJ ME/kg DM}}$ = 2.9 cents/MJ ME eaten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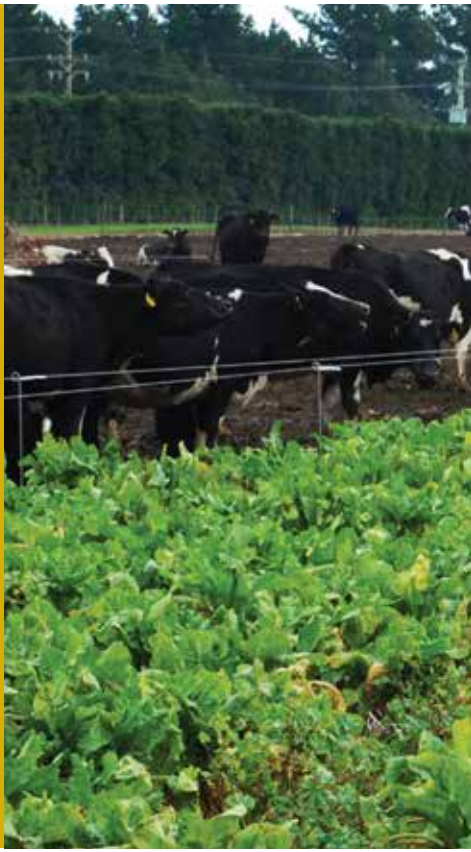


6. USING SUPPLEMENTARY FEEDS PROFITABLY

Determine whether supplements other than pasture can be used to improve profitability.

6. USING SUPPLEMENTS

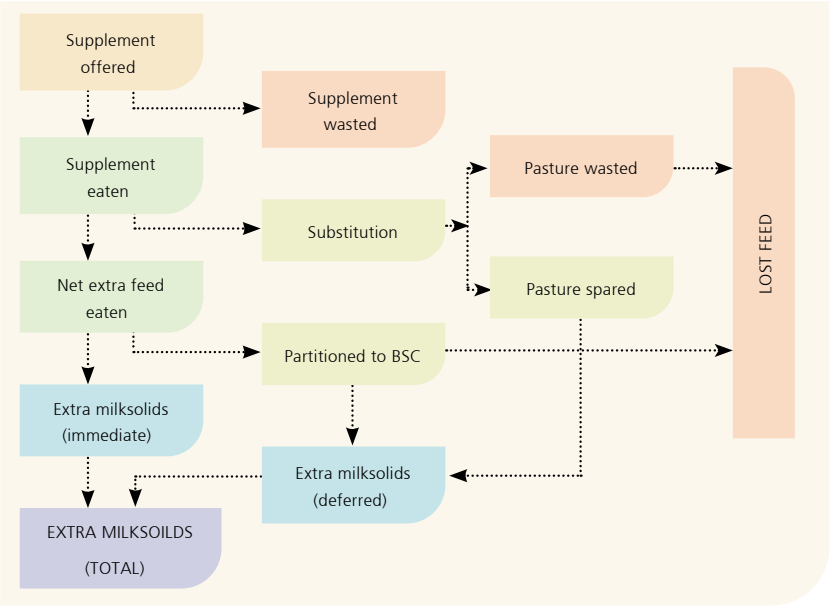
- In pasture-based systems, supplementary feeds should be used to fill a feed deficit
- The milksolids response to supplementary feeds depends on animal and feed factors
- Pasture substitution is a key determinant of the milksolids response when supplementary feeds are incorporated into a pasture-based system
- Financial implications of feeding supplements depend on the milksolids response and increase in revenue, and the costs of feeding the supplement

What is the milksolids response to supplement?

Under ideal research conditions, supplementary feeds return approximately 70 – 80g MS/kg DM fed. This is approximately 7.5 g MS/MJ ME offered, and in this situation, herd sizes are small, loss of supplements is limited and pastures are intensively managed to avoid wastage and maintain quality. Analyses from commercial farms report an average MS response to supplement of 55g MS/kg DM.

Although adding supplements into a pasture-based system has the potential to increase total intake and production, the actual MS response is often variable and less than expected. There are several factors that affect the MS response to supplement.

Factors that affect the milksolids response to supplements



Determine the amount of supplement required

Supplementary feeds should only be used when there is an energy deficit, and not to balance or improve the nutritive value of the cows' diet.

Therefore, supplements can be used:

- when pasture growth does not equal herd feed demand,
- to achieve pasture management targets (e.g. pre-grazing leaf stage/round length and/or pasture residuals),
- if the weather does not permit good pasture utilisation.

If supplements are bought in to fill a feed deficit, they should be purchased based on cost (c/MJ ME), how easily they can be fed to reduce wastage, and the milksolids response that will be achieved.

COST OF SUPPLEMENT c/kg DM feed c/MJ ME fed:

For example: PKE delivered for $245/tonne, fed in trailers and 11 MJME/kg DM

$/tonne wet weight	÷	DM%	÷	1000	=	$/kg DM fed		
$245	÷	0.90 (90%)	÷	1000	=	$0.27		
c/kg DM	**+**	**associated costs**	**=**	**c/kg DM fed**	**÷**	**MJ ME/kg DM**	**=**	**c/MJ ME fed**
27	+	2.7	=	30	÷	11	=	2.7

**Associated feeding costs: associated feeding costs are approximately 10% of actual feed cost and are included when making tactical decisions on supplement use. They include repairs, maintenance, depreciation and tractor running costs.*

The amount of wastage varies depending on the feed, feeding method, infrastructure, and management practices of the operator(s).

Some good rules of thumb for wastage are:

- 5% for in-shed feeding
- 10% for feed offered on a feed pad
- 15% for feed offered in trailers in the paddock
- 20% for feed fed out in the paddock in good (dry) conditions
- 40% for feed fed out in the paddock in poor (wet) conditions.

Feed wastage or feed utilisation needs to be taken into account when calculating the amount of supplementary feed that the cow has eaten.

kg DM fed/cow and kg DM eaten/cow

For example: 0.8 tonne wet weight PKE fed in trailers to a herd of 360 cows

$/tonne wet weight fed to herd	x	DM%	x	1000	=	kg DM fed/herd
$245	÷	0.90 (90%)	÷	1000	=	$0.27

kg DM fed/herd	÷	number of cows	=	kg DM fed/cow
720	+	360	=	2

kg DM fed/cow	x	utilisation*	=	kg DM eaten/cow
2	x	0.85 (85%)	=	1.7

**typical utilisation*

in paddock in wet conditions	in paddock in dry conditions	trailers in paddock	feed pad	in-shed
60%	80%	85%	90%	95%

**Utilisation (%) = 100 – wastage (%)*

Estimates of % wastage rates in storage and feeding out

Supplement	Storage			Feeding out paddock[2]			Feeding out bins[3]	
	Excellent	Average	Poor	Excellent	Average	Poor	Very good	Poor
Grass silage (%)	5	10-15	20-40	10	20	40	5-10	25
Maize & cereal silage (%)	6	10-15	20-40	15	25	40	5-10	25
Palm kernel (%)	<2	10-15	20	25	30	50	10	25
Concentrates (%) [5]	<2	5	15				5	25

[1] As research on wastage of supplements is limited, the above are based on best estimates from scientists and industry experts

[2] Includes losses at the stack face and when loading the wagon

[3] Bins = Feed trough for PKE fed in the paddock or feed pad for forages or in-shed feeding for concentrates

[4] Excludes refusal in the bin for rotten silage

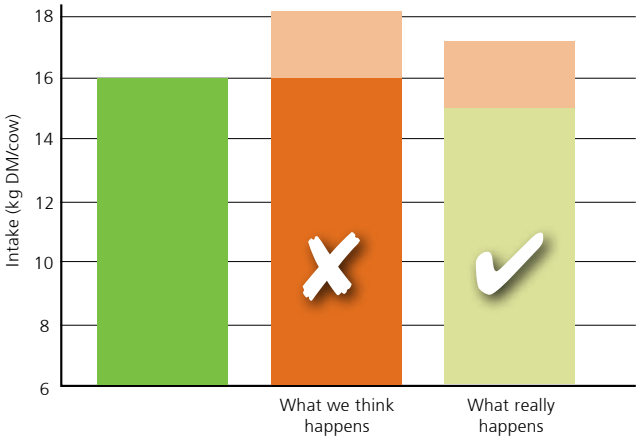
[5] There are additional losses feeding concentrates e.g. small grain losses up to 40% as grains are undigested by the cow. There are also losses when grains are digested whole.

Substitution

Typically, the factor that has the greatest impact on the milksolids response is the reduction in pasture intake when supplementary feeds are eaten: this is known as substitution.

There is always some substitution when grazing cows eat supplementary feeds, and on average, cows will graze for 12 minutes less for every 1kg DM of supplementary feed that is introduced into the system.

Substitution simply means that when supplements are fed, the increase in total DM intake is less than the amount of supplement offered.



Determine the economics of feeding supplements

Decisions on purchasing and feeding supplements can be made at both a strategic and tactical level.

Tactical

DairyNZ's Supplement Price calculator can help you answer: 'Should supplements be fed today and if so, how much should be fed?'. Visit **dairynz.co.nz/supplementcalc** for information.

Also helpful is DairyNZ's Spring/Summer Feeding Check, which is based on estimates from the Supplement Price Calculator and encourages the use of a weekly feed management check to monitor feed management both in the paddock and the use of supplements at various times of the season.

Strategic

The decision to incorporate supplements into a system should involve an annual feed budget and is based on many factors.

When making strategic decisions, key components are that the system is resilient to outside influences where possible and to remember that the average annual response to supplementary feeds on-farm is between 55 g – 70 g MS/kg DM.

7. ANIMALS

Important information for managing a herd. Body condition score targets, breeding dates, calf rearing, animal health and welfare requirements.

7. ANIMALS

Body condition score recommendations

Body condition score (BCS)		
BCS	3.0	BCS less than 3.0 is emaciated
BCS	4.0	Minimum at mating
BCS	5.0	Calve at 5.0 for mature cows
BCS	5.5	Calve at 5.5 for first and second calvers
BCS	6.0	Feeding cows to achieve BCS above 6.0 is not efficient

Cows calving 1 BCS lower than target will:

- take 8-10 days longer to start cycling
- result in a later calving date next year
- produce approximately 15 kg milksolids less in the following lactation.

Cows calving at BCS 6.0 (fat) rather than BCS 5.0 will:

- have lower intakes than thinner cows post-calving
- mobilise more BCS post-calving and are more prone to metabolic diseases.

Realistically dry cows only gain ½ BCS in 30 days unless very well fed with high quality supplement. Do not expect cows to gain BCS during their final month of pregnancy.

Reproduction and milksolids benefits associated with body condition score for a 500kg Lwt cow

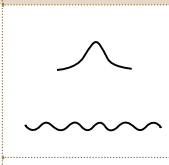
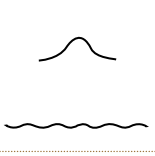
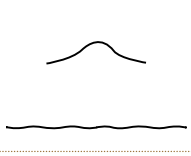
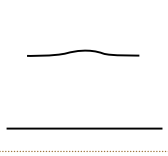
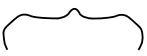
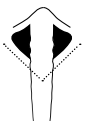
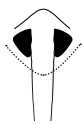
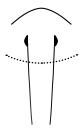
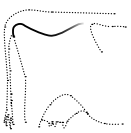
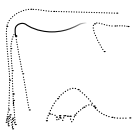
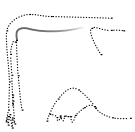
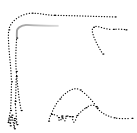
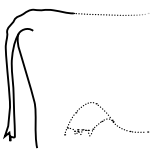
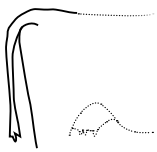
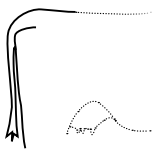
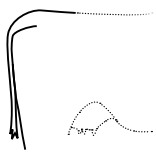
BCS change	MS response kg MS	$5.50/kgMS	**Repro benefits** (over two seasons)	Total $/BCS
From 3.0-4.0	18.0	$99	$40	$139
From 3.5-4.5	12.5	$69	$40	$109
Rule of thumb	15.0	$83	$40	$123

Drying off time (days from calving) based on cow body condition score and feed type

Body condition score		Days from Calving	
Cow	Rising 3-year old	Autumn pasture only	Well-fed with high quality supplement
3.0	3.5	160	120
3.5	4.0	130	100
4.0	4.5	100	80
4.5	5.0	70	60

Includes 10 days when cows are being dried off and not gaining weight and 30 days when cows do not gain weight before calving

What to look for when body condition scoring

BCS	3.0	4.0	5.0	6.0
Backbone - Rear view - Side profile				
Long Ribs				
Short Ribs				
Hips				
Pins				
Tailhead				
Rump				
Thigh				

Gestation length (term of pregnancy)

		Average period (days)	Range (days)
Cow	(9 months plus 9 days)	282	279-289

Breeding dates and periods

Conception date		Expected calving date	
July	9	April	17
July	23	May	1
August	6	May	15
August	20	May	29
September	3	June	12
September	17	June	26
October	1	July	10
October	15	July	24
October	29	August	7
November	12	August	21
November	26	September	4
December	10	September	18
December	24	October	2
January	8	October	17
January	22	October	31
February	5	November	14
February	19	November	28
March	5	December	12
March	19	December	26
April	2	January	9
April	16	January	23
April	30	February	6
May	14	February	20
May	28	March	6
June	11	March	20
June	25	April	3

Note:

1. Proven sires with short gestation length genetics are used in herds to calve some cows earlier than 282 day's term, to compact the calving pattern and give these cows more days to recover before next mating.
2. Expected calving reports now adjust for gestation length Breeding Values (BV) for individual cows using a formula

e.g. Conception date +282 days + BV gestation length = expected calving date.

That explains why some cows have due to calve dates on the expected calving report prior to the herds planned start of calving date, which is based on the standard 282 days.

InCalf herd reproduction targets – calving and mating

Measure	Target	Seek professional advice if
% calved by week 3	67%	<60%
% calved by week 6	88%	<75%
% calved by week 9	98%	<92%
3-week submission rate	90%	<81%
Conception rate	60%	<53%
6-week in-calf rate	78%	<68%
Not-in-calf rate (6 weeks)	22%	>25%
Not-in-calf rate (9 weeks)	13%	>17%
Not-in-calf rate (10 weeks)	12%	>16%
Not-in-calf rate (11 weeks)	11%	>15%
Not-in-calf rate (12 weeks)	10%	>14%
Not in-calf rate (15 weeks)	8%	>12%
Length of total mating	<12 weeks	>12 weeks

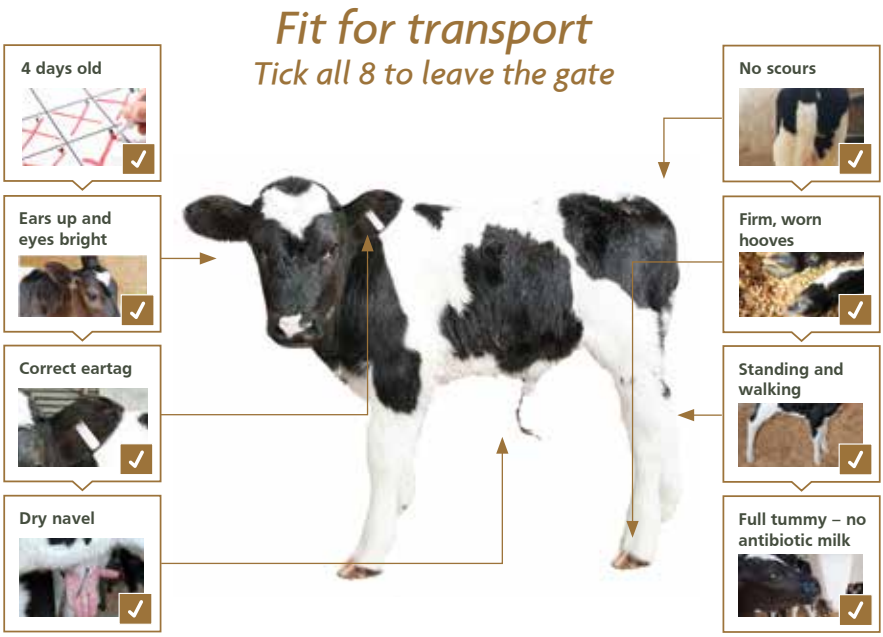
Note:

1. InCalf is an integrated approach to improving herd reproductive management, by setting one's own targets and striving for incremental gains in performance, year-by-year, through a 4-step continuous improvement programme. For more information go to **dairynz.co.nz/incalf**.
2. The InCalf Fertility Focus report available through licensed providers CRV, LIC and Infovet, automatically calculates the above measures and compares your herd's results with target.

Bobby calves

Regulations governing the selection, transportation and processing of young calves were introduced in 2016/17. Failure to meet the requirements of the regulations may result in an infringement and fine.

Fit for transport



The owner or person in charge must make sure that all calves are healthy, strong and have been recently fed to be considered fit for transport. Prior to transport, young calves must receive sufficient milk to ensure that their needs are met during the total length of the journey that they will take. For calves destined for slaughter, this also includes the time that they will spend in holding pens before they are slaughtered.

Any calf considered for transport off farm must:

- be at least 4 days (96hrs) of age
- be alert and able to stand and bear weight evenly on all 4 limbs
- move freely and protect itself from being trampled or injured by other calves. The calf's hooves are firm and worn flat, not bulbous with soft unworn tissue.
- have a shrivelled navel.

Transport times

Young calves under the age of 14 days must not be transported on journeys that take longer than 12 hours, nor can they be transported across Cook Straight.

Loading facilities

The farm must provide a facility, or make available other means, to allow calves to walk safely onto a stock truck. Examples of this include a raised platform, a loading ramp, an embankment or lowering the height of the vehicle track relative to the calf shed.

A stock truck is defined as having a loading height of 90 centimetres or more. Loading facilities are not required for vehicles with a loading height of less than 90cm such as utes or farm trailers.

Shelter

All calves awaiting transportation must have access to shelter that provides protection from the weather and keeps them warm/cool and dry. The shelter must be well ventilated and constructed so that calves can stand up and lie down in a natural posture. The facility must be kept clean and be safe to use

Maximum time off feed

Maximum time off feed before slaughter requires that a young calf must be slaughtered as soon as possible after arrival at the slaughter premises, and within 24 hours of the last feed on farm. If the calf is unable to be killed within the 24 hours calves can be fed at the slaughter premises. To allow the processors to meet their obligations a declaration stating the time of last feed on-farm must accompany each consignment of calves when they leave the farm.

Heifer calf rearing

Colostrum

- Colostrum for new born calves should be first milking (gold colostrum) ONLY. All other milkings are classified as transition milk and are suitable for calves over 24 hours.
- The calf should drink 4 to 6 litres of fresh gold colostrum during the first six to twelve hours of life in two separate feeds to get an adequate supply of immuno-globulins (antibodies).
- To check your system, your vet can take blood samples of 12 healthy calves, between one and seven days of age, for estimating antibody levels. This is the best way to know if your calves are getting enough antibodies from colostrum
- Consider measuring the quality of your colostrum with a Brix refractometer as it cannot be assumed that the colostrum you are providing is of good quality. Brix higher than 22% are best for newborns.
- Store colostrum in lidded drums, in a cool place, or a refrigerated vat. Ensure it is stirred twice a day with a stirrer ONLY used for colostrum and hung up to avoid touching the ground.
- If refrigeration or freezing is not possible, a preservative, such as potassium sorbate, can be added to stop the rapid decline of antibodies. Yoghurt does not preserve colostrum quality. Colostrum can be stored frozen for up to six months. Thaw in hot water, do not microwave.
- Bacteria in colostrum can decrease its quality and prevent calves from absorbing antibodies. Wash any buckets, storage containers, and feeders after every use with hot water, detergent and scrubbing.

Calf rearing rations

Feed comparisons

All of the following quantities of different feeds can supply about 3 MJ ME to the calf:

- 1 litre of whole Friesian milk (fresh, acidified or stored colostrum)
- or 0.9 litres of whole Jersey milk
- or 0.14 kg of whole milk powder
- or 0.16 kg fat fortified milk powder.

Calf rearing key points

- Calves need to be fed milk for at least the first four to six weeks. Some systems extend milk feeding up to 10 weeks
- Sufficient milk to meet all their needs must be fed for the first two to three weeks as their digestive system will not be sufficiently developed to deal with "hard feeds"
- Calves can be fed alternatives to milk (or milk replacer), from week two to three onwards, and milk reduced after week three
- Meal can be offered from week one onward. Meal needs to be high quality, fed fresh every day and kept clean and dry
- Calves need access to clean water at all times.

Daily intakes (litres) of milk (5.0% fat and 3.7% protein) for calves to gain weight to weaning

Liveweight of calf (kg)	Daily Lwt gain (kg Lwt/day)				
	0.63	0.71	0.83	1.00	1.25
	Litres of milk				
40	5.8	6.4	7.3	8.5	10.4
60	6.2	6.8	7.7	8.9	10.8
80	6.5	7.2	8.2	9.3	11.2

Low volume milk systems

- Calves are fed ten percent of their body weight (i.e., starting from 4-5 L/day) for up to 10 weeks of age.
- Restricting the volume of milk fed encourages the calf to eat more meal and leafy pasture, which promotes earlier rumen development
- Free access to good quality meal and fibrous feeds (good quality hay, leafy pasture) from first week
- Continue to feed meal until eating 1.0-1.5 kg/day and hold at this level
- Calves may lack energy in the first 2-4 weeks, which can increase risk of disease and slow growth
- Economics depends on relative cost of milk and meal, with best approach involving early weaning at 4-6 weeks of age

High volume milk systems

- Calves are fed 20 percent of their body weight (i.e., starting from 8-12 L/day) until a stepwise weaning process needs to occur to encourage meal intake, and rumen development.
- Calves tend to be more satisfied and exhibit more natural behaviours
- Calves tend to be less susceptible to disease during the pre-weaning period and reach higher weaning weights
- High quality concentrate meal needs to be fed for two to three weeks after milk feeding ceases.

Weaned calf

- Requires at least 16% crude protein (CP); but ideally 20% CP
- Most if not all commercial supplements should supply 16-20% CP
- Homemade mixes (plus fresh pasture and minerals, vitamins and a coccidiostat (e.g. Bovatech or Rumensin). Soya is the best source of protein, due to the amino acid profile. Other protein resources can be used:
  - 80% kibbled maize; 20% soybean
  - 60% barley or maize; 30% PKE; 10% soybean.
- PKE is a suitable feed for weaned calves providing it does not make up more than 10-15% of diet.

Treatment of diarrhoea in calves

Calf scours is a broad, descriptive term referring to diarrhoea in calves. Calf scours is not a specific disease but the clinical sign of a disease complex with many possible causes. Scours occurs when normal movement of water into and out of the digestive tract is disrupted, resulting in water loss and dehydration. Loss of body fluids through diarrhoea is accompanied by loss of body salts which can lead to severe depression in the calf and eventual death.

Non-infectious diarrhoea (nutritional scours)	Caused by changes to the feeding program. Not usually severe enough to cause death, non-infectious diarrhoea can weaken the calf and make it more susceptible to infectious diarrhoea. Temperature: normal – 38-39.5°C.
Infectious diarrhoea	Caused primarily by viruses, bacteria and protozoa. Identifying the infectious agent causing diarrhoea is an important part of developing a sound prevention program. Temperature: fever 39.5-42°C.
Mild to moderate diarrhoea	Continue milk feed and add electrolyte directly to milk diet, plus water ad lib.
Moderate/severe diarrhoea	Day 1: Electrolyte AM, milk lunch time electrolyte PM Day 2: Milk AM, electrolyte lunchtime, milk PM Day 3: as above or back to milk.

- Isolate to sick bay immediately
- For infectious diarrhoea consult your vet
- Oral electrolyte is easy to feed and successful in treating diarrhoea
- All calves (even those being treated) need to have clean, fresh ad-lib access to water
- Home brew mixes: rarely are home brew electrolyte mixes effective, as most lack enough of the vital ingredients of salts and energy
- Clean bedding area regularly.

Electrolyte Solution

- Feed electrolyte solution at least 2 hours before or after a milk feed but a milk feed should be given every day.
- Talk to your vet about a suggested electrolyte regime for your calves.

Herd replacement rate

New Zealand dairy cows have an average productive life of 4.5 lactations, thus requiring a replacement rate of 22% of heifers entering the herd.

The optimal replacement rate for maximising profit has been estimated at 18%. This considers the trade-off between the costs of younger animals (including reduced production until they reach maturity) versus the increased lifetime profitability of higher genetic merit animals. The replacement rate is expected to cover the final not in-calf rate, culls, all deaths on farm, and any planned herd growth.

Optimal target age structure for a herd

(% of herd for each age group)

Age (years)	2	3	4	5	6	7	8	9	10+
% Dairy Herd	18	16	13	12	11	9	8	7	6

Breeding

Animal evaluation and selection indexes

Breeding decisions have a permanent and compounding effect on a dairy herd. The New Zealand dairy industry's breeding objective is to identify animals whose progeny will be the most efficient converters of feed into farmer profit.

For more information, visit the DairyNZ website: **dairynz.co.nz/animalevaluation**

Breeding Values: the estimated genetic merit of a cow or bull

- New Zealand Animal Evaluation limited (NZAEL) produce breeding values for a wide range of individual traits. These include milkfat (kg), protein (kg), volume (litres), liveweight (kg), fertility (%), somatic cell (score), body condition score (score), residual survival (days), as well as udder and conformation traits.
- The estimated breeding values represent the genetic merit of an animal, compared to an average 2005 born cow (the genetic base).
- An estimated breeding value of +10kg protein indicates a bull will transmit 5 kg more protein per lactation to his daughters than a bull with a protein breeding value of zero (a daughter inherits half of her genetics from her father).

Breeding Worth (BW): The ability for a cow or bull to breed profitable and efficient replacement heifers

- BW is calculated by combining breeding values with the appropriate economic values.
- The economic value which is applied to each trait represents the net income from one additional unit of the trait.
- The base unit of feed is 5.0 tonnes of DM of average quality pasture
- BW can be used to decide which bulls to use during Artificial Breeding (AB), and which cows to keep heifers from.
- BW becomes more accurate as herd test records are accumulated. In the case of bulls this herd test information comes from daughters.
- Refer to the website to get current economic values for the BW traits. dairynz.co.nz/animalevaluation

Production Worth (PW): A cow's own productive ability

- This index measures the ability of the cow to convert feed into profit over her lifetime.
- The main use for the PW is in making purchasing and culling decisions.
- The reliability of PW indicates how much information is known about the cow i.e. how many herd tests records she has.
- A well-recorded heifer typically starts her life with a PW reliability of about 20%; by the time she has five recorded lactations, and some liveweight recording, the reliability will be about 85%.
- A PW of 72/56 indicates that the cow is expected to generate an extra $72 profit per year (per 5 tonnes of feed on a dry matter basis) compared to a typical cow born in 2005. The '56' represents the reliability.

Animal health

Magnesium and milk fever

Magnesium plays an important role in milk fever prevention (calcium deficiency). Magnesium is required for the production of hormones that are important for the absorption of calcium (Ca) from the gut and the mobilisation of Ca from bones. Supplementing with magnesium daily for two to three weeks pre-calving will reduce the risk of milk fever. However it does not build up a store of magnesium in the cow.

Magnesium and grass staggers (grass tetany)

The cow is dependent on what magnesium is supplied in her daily diet. The initial symptoms of magnesium deficiency are nervousness, ears pricked, nostrils flaring, eyes alert and head held high. Movement is stiff, like walking on stilts, and cows stagger when forced to move quickly. Cows suffer loss of appetite and reduced milk production. Death results from a "tetany" where the muscles contract uncontrollably, including the heart.

Dietary magnesium concentrations and quantity of supplementary magnesium required (g/cow/day)

Mg requirement (% of diet)		Supplementary Mg (g/cow/day)		
		Jersey	J x F	Friesian
Dry	0.35%	12	16	20
Lactating	0.28%	15	17	20

Quantities of magnesium sources to supply the required amounts of pure magnesium (down the throat).

Magnesium source (% Mg)	Example product	Magnesium required (g/cow/day)				
		12 g	14 g	16 g	18 g	20 g
Mg Oxide (55%)	CausMag	22	25	29	33	36
Mg Sulphate (10%)	Epsom salts	122	142	162	182	202
Mg Chloride (12%)	Mag chloride	100	117	134	151	167

- If dusting Magnesium Oxide on pasture, need to at least double possibly triple the above to allow for field losses. When mixing with feed, double the rates above.

Amount of magnesium oxide dusted (g/cow/day)

	Magnesium Oxide	Rate of Mg Oxide required (g/cow/day)				
		12 g	14 g	16 g	18 g	20 g
Mg Oxide (55%)	Double rate	44	50	60	66	72
	Triple rate	66	78	90	100	108

Magnesium supplementation

- Supplementing with magnesium sulphate or magnesium chloride before calving is more likely to prevent milk fever than using magnesium oxide.
- However, it can be difficult to supply cows with enough magnesium when using either magnesium sulphate or magnesium chloride. Therefore dust pastures with magnesium oxide as well, to ensure the cows receive enough magnesium, not just the correct type.
- One way to achieve the required dietary magnesium concentration pre-calving is to add 60 grams of magnesium chloride or magnesium sulphate into the water trough and dust pastures with 50-70 grams of magnesium oxide per cow per day as well. For more information refer to DairyNZ Farmfact 3-1 – magnesium supplementation.
- Supplement with magnesium until after spring pasture growth rates have slowed (December). Use blood tests to determine if continued supplementation is required from December onward.
- Magnesium requirements are also affected by the levels of potash and calcium in the diet. Some farms with very high potash levels in pasture will require high rates of magnesium supplementation.
- Applying potassium fertiliser or lime within three months of calving can affect cow magnesium levels at calving. Where magnesium is added to water and the dosage is not accurate there is a risk of the water becoming toxic and stock refusing to drink.

Facial Eczema prevention

Facial Eczema (FE) is a disease of the liver that significantly impacts on the health and productivity of cattle and presents significant welfare concerns for the industry. For more information on facial eczema visit **dairynz.co.nz/facial-eczema**.

Symptoms:

- Drop in milk production
- Cows are restless
- Cows seek shade
- Cows lick their udder
- Exposed unpigmented or thin skin thickens and peels

Most animals affected by facial eczema will not show any clinical signs but their liver is damaged. It is estimated that for every 3 in 100 cows showing clinical FE, about 70% of the herd may have subclinical FE.

Prevention: Breeding for FE Tolerance

Breeding cows that are more tolerant to facial eczema is a solution to reduce the impact of facial eczema in the long term.

In the interim the following preventative measures should be applied.

Pasture spore counts

Pasture spore counting is an excellent tool to visualise pasture spore count trends. However, variability between farms is very large because every farm, paddock and even sections of paddocks contain a slightly different micro-climate for the fungus.

It is therefore important that when regional spore counts start trending upwards to reach 20,000, it is important to gather a picture of your own farm.

Spore count	Risk
0-20,000	Low
20,000-30,000	Slight
30,000-60,000	Moderate
>60,000	High

Long term intake of low numbers of spores can cause just as much damage as short term intake at high numbers.

Zinc oxide drenching

Drenching should start when spore counts start to rise on your farm. Daily individual cow drenching at full dose is optimal for protection against facial eczema.

Drench recipes and dose rates

Using a stabilised drench will allow a higher concentration of Zn and therefore lower volume of drench.

Each brand of zinc will have a slightly different dose rate that will need to be checked on the bag. The following relates to Global Supa Zinc Oxide.

Stabilised drench	
Long term dosing rates are 2.5g ZnO/100kg Lwt/day. Mix 1kg of Global Supa Zinc to 1L of water. Stir to get a smooth lump free solution. Makes 1.2L of drench that contains 80% elemental zinc.	
Long term daily dosing	3mls/100kg Lwt
Crisis daily dosing (emergency only)	4.5mls/100kg Lwt
3 day to weekly intervals long term dosing (dry stock only, not recommended)	4.5mls/100kg Lwt x No. of days between drenching

Zinc sulphate water treatment

For all water treatment you will need to calculate the requirements for ALL stock on the farm.

Water treatment at a half dose should begin 3-4 weeks before the FE season starts to prime troughs and get cows used to the water taste.

Full dose rates should be dispensed when spore counts start to rise on your farm.

Weight of animal (kg)	MONO ZINC (grams/head/day)	HEPTA ZINC (grams/head/day)
30kg	1.7	2.4
60kg	3.4	4.8
100kg	5.5	8
150kg	8.3	12
200kg	11	16
250kg	14	20
300kg	16	24
350kg	19	28
400kg	22	32
450kg	25	36
500kg	28	40

Floating in-trough dispensers

Calculate amount of zinc sulphate to be added to the trough daily for all animals using that trough (use above table) e.g. 100 cows (at 450kg) x 36 grams/day = 3,600 grams of heptahydrate/day.

Refill the dispenser twice daily with half the daily amount (ie 1,800 grams or 1.8kg) at each visit to the trough.

In-line dispensers

Use the above table to calculate daily dispenser requirements for ALL stock on the farm and then set the dispenser to deliver that amount.

Hepta zinc	
200 cows (450kg) x 36 grams/day	= 7,200
50 heifers (300kg) x 24grams/day	= 1,200
55 calves (150kg) x 8grams/day	= 440
TOTAL	= 7,740g = 7.74 kg heptahydrate/day

Direct addition to the supply tank

Do not use this method if the supply tank also supplies the house water.

Calculate the daily requirements for all stock on the farm (see In-line dispenser example).

Add the daily zinc sulphate requirement to the supply tank at the same time each day. Dissolve the zinc sulphate in water before adding to the tank. If the supply tank is regularly re-filled e.g by pump on time switch, add zinc just after filling.

Where zinc is added to the water and the dosage is not accurate there is a risk of the water becoming toxic and stock refusing to drink it.

Zinc in feed

Zinc oxide can be added to feed for in shed feeders or added to feed on the feed pad. Zinc for in shed feeders is often put in by the feed company. Zinc administration onto pasture is not recommended. Pelletized feed or a mixer wagon will give a more constant distribution of zinc in the feed in comparison to un-pelletized feed and feed out wagons.

Administer full dose rates of zinc oxide in the feed when spore counts start to rise on your farm.

- If there are cattle that eat more than others they may be at risk for zinc toxicity.
- If zinc is not properly mixed into the feed in a silo, or wagon, cattle may be at risk of toxicity or have inadequate protection against FE.
- Consider independently testing zinc in feed.

Intraruminal bolus

An intraruminal bolus (capsule) slowly releases zinc into the rumen over a period of 4-6 weeks.

There are two brands of capsule, Face-Guard™ and Time Capsule®.

Both are extremely consistent and effective at managing FE as long as it is administered before the FE challenge and is administered at the correct dosing intervals (4 weeks for FaceGuard™, 4-6 weeks for Time Capsule® depending on challenge).

The Time Capsule® bolus provides protection against FE in animals from 90-600kg.

- Check the liveweight of your cattle to avoid under or over dosing
- Capsules must be administered with correct applicator
- Do not use damaged capsules

Follow the label instructions of the product.

Fungicide spray

Fungicides are used to slow the development and spore production of the fungus that causes facial eczema. This is an effective way of managing facial eczema without the use of zinc but only if:

- pasture has confirmed spore counts below 20,000 spores/gram pasture
- pasture is green and growing (in dry conditions the grass will not uptake the fungicide)
- spraying should cover all areas including fence lines, under hedges and under trees
- spraying should reduce spore growth for 4-6 weeks. After this pasture should either be immediately re-sprayed or monitored with spore counting.

Trace element supplementation

Consult with your veterinarian to determine if cows are deficient in trace elements before supplementation.

- Of the 7 macro minerals (i.e. required in large amounts), only two (magnesium and calcium) are deficient when the majority of the diet is pasture.
- Sodium can be deficient when more than one third of the diet is a low sodium feed (e.g. cereal grains) and dietary phosphorus can become inadequate in cows grazing fodder beet.
- Of the 18 trace elements (i.e. required in very small amounts), only five are likely to be deficient in pasture-based systems (i.e. cobalt, copper, iodine, selenium, zinc).
- Magnesium and the five scarce trace elements should be supplemented during the 2-4 weeks before calving and for four months after calving.
- Calcium should be provided to cows in the colostrum herd, and to cows before transport. There is unlikely to be a benefit of continued supplementation to milking cows unless the herd is experiencing downer cows.
- All sources of trace elements (i.e. pasture, supplementary feeds, water, fertiliser, and mineral supplements) need to be accounted for in dietary plans to avoid the risk of over-supply of any trace element.

Cobalt

Required for production of Vitamin B12, energy metabolism in the rumen and in the cow, fibre digestion and immunity. High manganese in soil reduces cobalt uptake by the plant. Therefore, as pasture is generally high in manganese it is usually low in cobalt.

Copper

Copper deficiency is common in grazing dairy cows because copper concentrations are generally low in pasture (6-10 mg/kg DM), the absorption of available copper is low (3-5%), and concentrations of sulphur and iron are high, particularly in spring with soil contamination of the pasture/crop; furthermore, the concentration of molybdenum can also be high. These three elements form insoluble complexes with copper in the rumen and render it unavailable for absorption.

Of all the trace elements provided, copper is the most likely to become toxic, particularly in Jersey cows or crossbred cows with a high proportion of Jersey genetics. It is important to account for all sources of copper before deciding on the most effective supplementary feeding strategy.

Warning: Some feeds (e.g. PKE) contain copper, so use great caution if feeding PKE and providing additional copper supplementation.

Iodine

Required for intake, energy metabolism and milk production, protein synthesis, reproduction, and heat detection. Uptake of iodine by pasture can be low. Additionally, iodine is easily leached during wet weather in winter and spring. Requirements for iodine increase during cold wet weather. One of the most important times for iodine supplementation in the South Island is during winter, when the cows are grazing brassica crops, so supplementation with iodine is recommended through the dry period and for approximately four months post-calving. Brassica crops contain compounds that render dietary iodine unavailable to the cow and because they are high in water, fortification of the water with iodine is an ineffective way of supplying iodine to cows.

Selenium

Required for disease resistance (e.g. mastitis), placental shedding (post-calving cleaning), milk production, reproduction, calf viability and immunity. There are regions that will have high selenium levels in pasture, particularly if they have been fertilised with selenium fertiliser. In such areas supplementation should be avoided. If in doubt, consult with your vet or farm consultant.

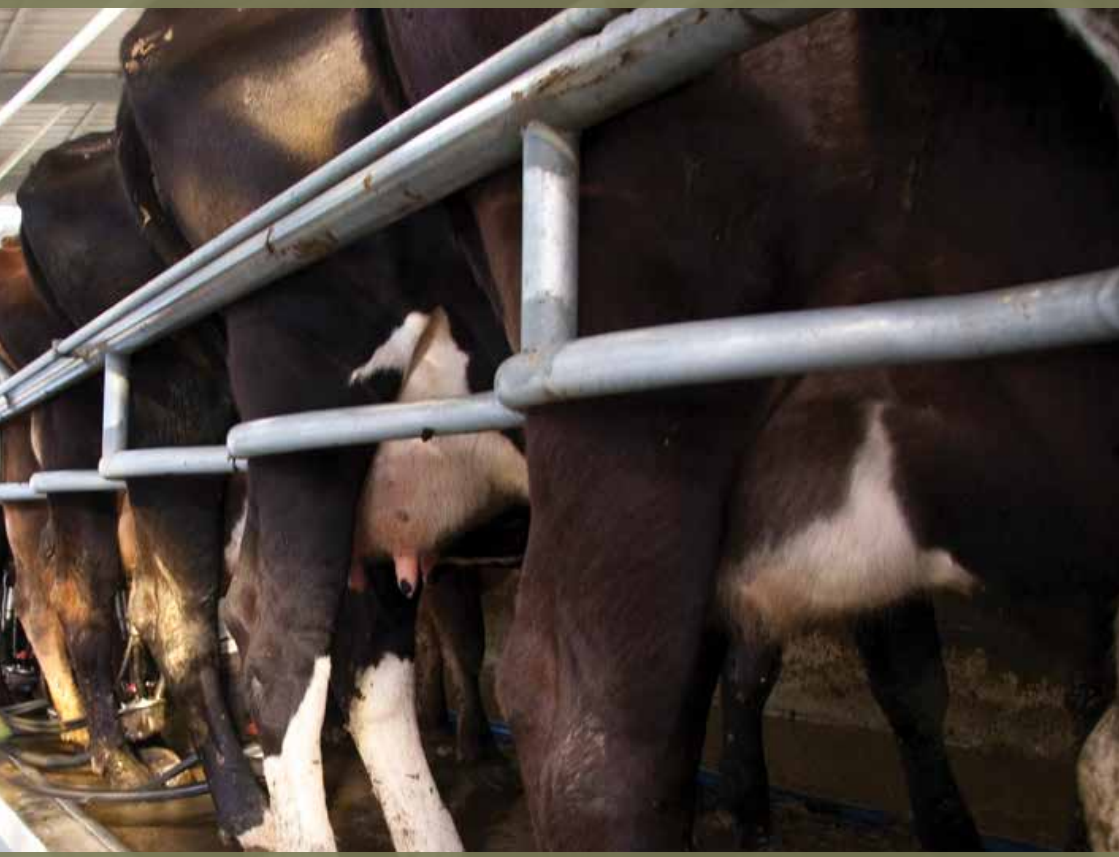
Zinc

Required for growth and production, reproduction, hoof strength, and immune system. The need for zinc supplementation will vary from farm to farm. Farms using zinc in summer for facial eczema may still require zinc supplementation in the spring. Pasture analysis should determine the need for supplementation. Excess zinc intake will increase the risk of milk fever and copper deficiency, and may depress appetite.

Nutrient	Requirements mg/cow/day	Sources
Cobalt	1-10	Cobalt sulphate orally, commercial cobalt sources, cobalt sulphate fertiliser, strategic use of Vitamin B12 injections. Can be added to spring fertiliser.
Copper	200-300	Copper sulphate orally, copper bullet, copper capsule (needles), copper injection (not recommended for cows during the breeding season), commercial copper sources, copper sulphate fertiliser (not recommended in secondary deficiencies).
Iodine	10	"Stock iodine" (3ml of 2% or 0.5ml of 10% per cow orally), 8 ml of 5% teat spray on flank weekly, commercial iodine sources, oil-based slow release injections.
Selenium	5	Oral or injection products, commercial selenium sources, and slow release injections. Can be added to fertiliser.
Zinc *other than for facial eczema	400-750	Zinc sulphate, zinc oxide, and commercial zinc sources.

Trace element requirements vary a lot and depend on many inter-related factors so get professional advice for your individual situation.

8. MILK



Udder health and milk quality is important to farm productivity and profitability. Every farm stands to gain from less mastitis.

8. MILK

Milk composition

Average milk composition (2020/2021 lactation)

	Holstein Friesian	Holstein Friesian/Jersey Crossbred	Jersey	Ayrshire
Milk fat (%)	4.5	5.0	5.6	4.4
Protein (%)	3.8	4.0	4.2	3.6
Milksolids (%)	8.3	8.9	9.8	7.9

Milk quality tests

These are the types of tests conducted on bulk tank milk, and the minimum standard required.

Each dairy company operates a milk quality assurance scheme to relate payment for the milk to the quality supplied. Refer to a dairy company's supply agreement for more detail.

Test	Description	Minimum Freq	Minimum Standard
Bactoscan (BScan)	Test number of bacteria. Gradings due to poor hygiene and plant washing.	3 per month	less than 100,000 cfu/ml
Thermoduric Plate Count (Therm)	Test the number of bacteria that survive pasteurisation at 72°C for 15 mins. Grading indicates hygiene problem.	As required	less than 1,500 cfu/ml
Coliform Plate Count (Coli)	Measure of coliform bacteria in milk. Associated with dung and contaminated water.	As required	less than 500 cfu/ml
Organoleptic Assessment (Senses)	Milk is smelled and looked at to identify contaminants such as blood, chemical and feed taints.	As required	See company terms of supply.
Sediment (Sed)	Amount of sediment in milk from soli, dung, hair and skin.	As required	See company terms of supply

Test	Description	Minimum Freq	Standards
Colostrum	To ensure milk does not contain milk from cows that have recently calved.	As required	1.35 g IgG/l or less
Inhibitory Substance (IS or Inhibs)	Test ability of milk to prevent growth of standard bacteria i.e., presence of antibiotics	3 per month	less than 0.003 IU/ml
Freezing Point (Fr. Pt)	Indicates if water has been added to milk to increase volume.	Per consignment	-0.513°C or lower
Somatic Cell Count (SCC)	Measure of white blood cells in the milk. High levels indicate inflammation (i.e. mastitis) in the udder.	Per consignment	less than 400,000 cells/ml
Collection Temperature (Temp)	Measure of the milk temperature upon collection	Per consignment	Milk must be at or below 10°C within 4 hours of commencement of milking, or at or below 6°C within 6 hours of commencement of milking, or 2 hours from completion of milking, whichever is soonest.

Milking plant

Milkings before rubberware changed

Material	Estimated lifespan
Nitrile rubber or natural/nitrile blends	2,500 cow-milkings
Silicone rubber	3,000-5,000 cow-milkings or 4-6 months, whichever comes first

Note: See manufacturer's recommendations for liner products.

Recommended vacuum levels

Vacuum level versus milkline height based on recommendations by the NZ Milking and Pumping Trade Association

Milkline height in metres above cow platform	Vacuum in kilopascals
1.8	48
1.6	46-48
1.4	44-46
1.2	42-44
Lowline	40-42

Notes:

Use the lower vacuum levels listed with large bore long milk tubes or in wet, windy weather e.g. at the start of spring calving. With automatic cluster removers, depending on their internal head loss, the higher level is acceptable after spring. (In practice, it is wise to start the season off with the vacuum level low rather than high, i.e. never start spring calving with a vacuum higher than 46 kPa regardless of the milkline height). Increase to around 48 kPa for herd testing to compensate for the head losses in current milk meters.

Pulsation ratio: 60:40 to 70:30 is the typical range.

Pulsation rates: 50-65 pulsations per minute are typical.

Mastitis

Udder health targets

Industry benchmarks are linked to the performance achieved by herds in the top 10% and 50% (median) of herds.

Key measure of performance (2013/14 BMSCC data)	Top performing herds	
	10%	50%
Average BMSCC (x1,000 cells/ml)	<100	<165
Number of consignments >400,000	0	0
Case rate of clinical mastitis	8%	15%
Culls/deaths due to mastitis	1-2%	3%
Benefit of "closing the gap" from 50% (median) to top 10% performance (for a 400 cow herd, at $6.00/kg MS)	$19,900	

BMSCC and cost of mastitis

Estimated BMSCC (bulk milk SCC calculated from herd test data) is associated with different levels of subclinical mastitis in the herd:

- At 100,000 cells/ml, approximately 20% of cows have subclinical mastitis
- At 200,000 cells/ml, approximately 30% of cows have subclinical mastitis
- At 300,000 cells/ml, approximately 36% of cows have subclinical mastitis
- At 400,000 cells/ml, approximately 40% of cows have subclinical mastitis.

Milk yield losses are associated with mastitis

Subclinical mastitis:	• 2.1% reduction in milk yield per doubling of individual cow SCC above 100,000 cells/ml. • 6.0 kg solids reduction per doubling of individual cow SCC above 100,000 cells/ml.
Clinical mastitis:	• 3.3% milksolids loss associated with clinical mastitis.

- Each case of mastitis costs approximately $150 per case due to costs of drugs and discarded milk, labour and short term production losses.
- Use SmartSAMM Gap Calculator **(dairynz.co.nz/mastitis-gap)** to calculate the benefit of closing the gap between current and target performance for your herd's udder health.

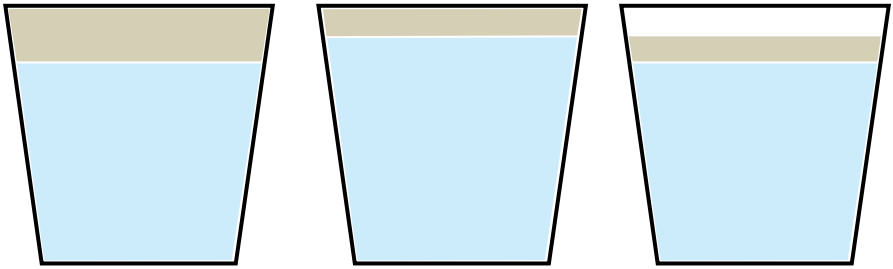
Teat spray

Make up teat spray correctly

1. Use a registered product – check registration with New Zealand Food Safety Authority (ACVM Act) at **https://eatsafe.nzfsa.govt.nz/web/public/acvm-register**
2. Mix a fresh batch regularly – every 2-3 days is recommended
3. Use potable (drinking quality) water – cooled water from hot water tank is an option.
4. Mix according to label – dilution rates may change as mastitis risk changes.
5. Use extra emollient if required – emollient (glycerine or sorbitol) are skin conditioners. Use when teat condition is likely to be poor (e.g. in spring or wet muddy conditions). Replace some of the water volume with emollient.

Check your mix

Not all products are the same. Some are registered for different dilutions. Incorrect mixing can lead to problems with residues or outbreaks of mastitis. Check with supplier for appropriate mix before changing mix.



1:4	**1:9**	**1:9**
20 l teat spray	20 l teat spray	20 l teat spray
= 4 l concentrate +	= 2 l concentrate +	= 2 l concentrate +
16 l water	18 l water	2 l emollient +
		16 l water

1:4 means:

- 1 part to 4 parts (1 to 4)
- 1 in 5
- 20% by volume

1:9 means:

- 1 part to 9 parts (1 to 9)
- 1 in 10
- 10% by volume

See DairyNZ Healthy Udder and **dairynz.co.nz/mastitis** for more on making up teat sprays.

9. FERTILISER

Good knowledge of your farm's soils and intelligent use of fertilisers can save valuable dollars.

9. FERTILISER

Applying nitrogen fertiliser

N fertiliser is a growth multiplier; when pasture growth rates are high the response to N will be higher, with greatest response rates achieved in spring.

Response rates in autumn are lower but fertiliser N may still provide the lowest cost feed source at this time. However, the risk of N leaching is medium in autumn, for moderate to free-draining soils.

Early winter applications give the lowest growth responses and are most likely to lead to direct leaching of fertiliser N.

Avoid application to waterlogged soils or before heavy rainfall. Ensure adequate soil moisture and soil temperatures (10cm) are greater than 7°C and rising.

It is best not to apply more than 50 kg N/ha in one application. Rates of 20-40 kg N/ha are recommended for pasture. All other nutrients need to be at optimum levels to allow optimal pasture growth and therefore response rates.

Avoid grazing between 4 and 14 days post application as this leads to high N intake and excretion by grazing animals.

When using N, canopy closure will typically occur at a lower leaf stage. Ideal pre-gazing yields of 2600-3200 are recommended with grazing residuals of 7-8 clicks on a rising plate meter.

Pasture growth rate	Pasture growth (kg DM/ha/day)	Response (kg DM/kg N)	Time for full response (weeks)
Slow	10	5	10-14
Moderate	20-40	10	6-8
Fast	50-70	15	5-6
Rapid	80	20	3-4

A summary of N responses over 40 days across 400 trials was 4, 9, and 15 kg DM/kg N for N applied in winter, early spring or late spring.

Common nitrogen fertilisers

Fertiliser	%N	%P	%K	%S	Kg/ha needed to apply
					30kg N/ha
Urea	46.0	0	0	0	65
Sulphate of Ammonia (SOA)	20.5	0	0	24	150
Nrich Ammo 30N	30.4	0	0	14	100
Di-ammonium Phosphate (DAP)	18	20	0	1	170
PhasedN	25.3			28.5	118
SustaiN/ N protect	45.9	0	0	0	65

Lime requirements for common N fertilisers

Fertiliser	Lime needed for each 100kg N/ha	N applied before 1 tonne of lime/ha is needed
Urea	180kg/ha	550kg N/ha
Sulphate of Ammonia (SOA)	540kg/ha	175kg N/ha
Di-Ammonium Phosphate (DAP)	360kg/ha	275kg N/ha

Rule of thumb: 1.0t lime/ha will increase pH by 0.1 unit (e.g. from 5.5 – 5.6)

Increasing soil P levels

Amount of P (kg/ha) to raise Olsen P by1 unit		
Soil	**Average**	**Range**
Ash	11 (122)*	7-18
Pumice	7 (78)	4-15
Sedimentary	5 (57)	4-7
Peat	**	6-9

* superphosphate equivalent ** depends on ASC

Herbage tests

Guidelines for interpreting mixed pasture chemical analysis for pasture growth				
			Concentrations	
Nutrient (% of DM)	**Deficient**	**Low**	**Optimum**	**High**
N	<4.00	4.00-4.70	**4.70-5.50**	>5.50
P	<0.30	0.30-0.34	**0.35-0.40**	>0.40
K	<2.00	2.00-2.40	**2.50-3.00**	>3.00
S	<0.25	0.25-0.27	**0.28-0.35**	>0.35
Mg	<0.15	0.15-0.17	**0.18-0.22**	>0.22
Ca	<0.25	0.35-0.29	**0.30-0.50**	>0.50
ppm				
Fe	<45	45-49	**50-65**	>5.50
Mn	<20	20-24	**25-30**	>0.40
Zn	<12	12-15	**16-19**	>3.00
Cu	<5	5	**6-7**	>0.35
B[1]	<13	13-14	**15-16**	>0.22
Mo[1]	<0.10	0.10-0.14	**0.15-0.20**	>0.50

[1]Clovers only, NOT mixed pastures samples. For a Mo deficiency, clover N must also be below 4.5%

Guidelines for critical mineral concentrations

(where levels should be above in pasture for adequate nutrition of a lactating cow)

Nutrient	Pasture Concentration
Na	0.11%
Cu[1]	10ppm
Co	0.06ppm
Se	0.03ppm
I[2]	0.25ppm

[1]Depends on Mo and Fe concentrations

[2]2 ppmI recommended if feed contains goitrogens (e.g. forage kales, other brassicas). (Source: The Mineral Requirements of Grazing Ruminants, 1983)

10. EFFLUENT

Dairy effluent is a valuable resource which, when managed well, increases pasture production, and reduces fertiliser costs.

10. EFFLUENT

Nutrients in the effluent from 100 cows under different scenarios

	Nutrients in effluent from 100 cows (kg/yr)			Effluent area needed to apply 150 kgN/ha*	
No feed pad – farm dairy effluent					
	N	P	K	% of farm	ha /100 cows
All grass system (milking 270 days, twice a day)	590	70	540	11	4
Feeding 2tDM/ha of maize silage in paddock	668	80	668	12	4.4
Using a feed pad – farm dairy effluent plus feed pad effluent (Feeding 2tDM/ha of maize silage)					
Time on the pad	N	P	K	% of farm	ha /100 cows
½ hour per day on pad	838	100	868	14	5.6
1 hour per day on pad	1008	120	1044	17	6.8
2 hours per day on pad	1348	160	1396	22	8.8
Feed comparisons (2 hours/day on pad)					
4tDM/ha/yr maize silage	1360	164	1460	25	8.8
4tDM/ha/yr grass silage	1588	184	1668	29	10.4

Table adapted from B. Longhurst, AgResearch 2004 – Adding Environmental and Economic Value to Dairy Effluent

*** Overseer should be used to determine effluent block size**

Note that, at minimum nitrogen loading (i.e., 4ha effluent area/100 cows for an all-grass system) potassium (K) loading may become an issue for metabolic problems.

The average dairy cow produces about $25 worth of nutrients annually as farm dairy effluent (FDE). For a 400 cow dairy herd this represents about $10,000 of nutrients annually.

Typical nutrient concentrations (kg/m3) of different effluent sources

Source	%DM	N	P	K	Spreader type
Liquid – farm dairy (fresh or sump)	< 1.0	0.45	0.06	0.35	Irrigator
Liquid – storage pond	< 0.5	0.25	0.03	0.30	Irrigator
Feed pad – slurry	4	1.5	0.3	1.0	Slurry tanker
Feed pad – liquid (post separation)	0.3	0.25	0.03	0.3	Irrigator
Feed pad – solids (post separation)	20	4.5	0.8	2	Muck spreader
Stand-off pad solids	25	2.0	1.5	2.0	Muck spreader
Wintering pad scrapings	15	2.0	0.3	0.75	Muck spreader
Wintering shed bunker	20	5.0	2.0	7.5	Muck spreader

Effluent spreading rates and depths for different effluent sources

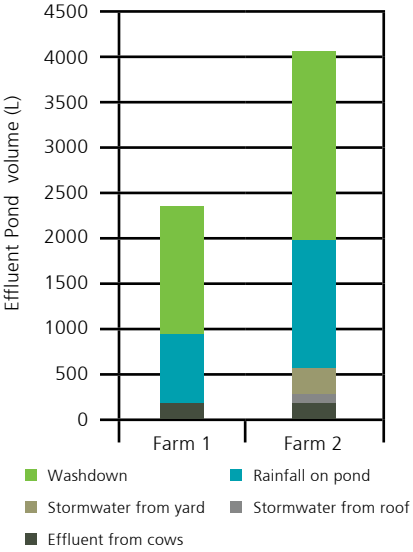
Use the Farm Dairy Effluent Spreading Calculator to determine nutrient loading based on effluent source and the effluent irrigation depth applied. Download at **www.dairynz.co.nz/effluent.**

Effluent storage requirements

There is no fixed number of days of required Farm Dairy Effluent storage on dairy farms. Each individual farm has its own unique storage requirements. The graph shows how water use in different parts of the farm dairy can affect dairy effluent pond volumes.

In this example, both farms milk 300 cows, but the effluent volume on Farm 1 is almost half that of Farm 2. This is because:

- Farm 1 uses less washdown water per cow per day than Farm 2 (50 L/cow/d vs. 80 L/cow/d).
- Farm 1 has guttering on the farm dairy roof and diverts stormwater from the yard.
- Farm 1 collects less rainwater as the pond is smaller, due to the lower storage requirements.



Storage requirements should be determined by the Dairy Effluent Storage Calculator (DESC). This can be downloaded from **www.dairynz.co.nz/desc**.

This uses a combination of local climate, soil types and your farm information to determine the volume of storage required by a farm.

We recommend working with a **Dairy Effluent WOF assessor** or **Accredited Effluent System Designer** to use this Calculator and identify the most appropriate storage requirements for your farm.

Soil risk framework for effluent application

Category	A	B	C	D	E
Soil and landscape feature	Artificial drainage or coarse soil structure	Impeded drainage or low infiltration rate	Sloping land (>7°) or land with hump & hollow drainage	Well drained flat land (<7°)	Other well drained but very light flat land (<7°)
Risk	High	High	High	Low	Low
Application depth (mm)	< SWD[1]	< SWD	< SWD	< 50% of PAW[2]	≤ 10 mm & < 50% of PAW[2]
Storage requirement	Apply only when SWD exists	Apply only when SWD exists	Apply only when SWD exists	24 hours drainage post saturation	24 hours drainage post saturation
Max depth: High rate tool	10 mm	10 mm	10 mm[3]	25 mm[4] (10 mm at field capacity)	10 mm
Max depth: Low rate tool	25 mm	25 mm	10 mm	25 mm	10 mm

[1] SWD is the soil water deficit

[2] PAW is the plant available water in the top 300 mm of soil

[3] Only applicable when instantaneous application rate from the irrigator is less than the infiltration rate

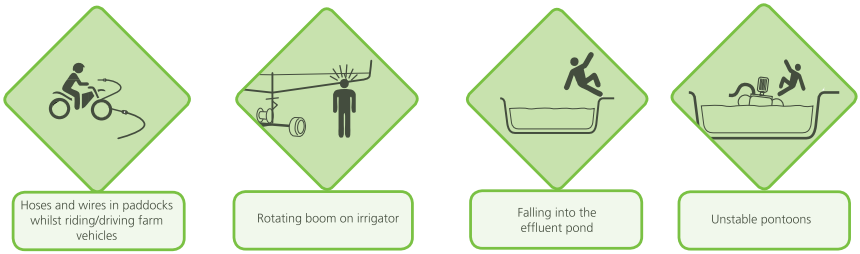
[4] Suggested maximum application depth when a suitable SWD exists (≥ 15 mm)

For all the risk categories the application rate should always be less than the soil infiltration rate otherwise you will get ponding (on sloping land the instantaneous application rate needs to be less than the soil infiltration rate or you will get run-off).

For more information, refer to the *Pocket guide to detemine soil risk for FDE application*

Common hazards of effluent irrigation

Ensure the maintenance and operation of all areas related to your effluent system are included in your farm Health and Safety plan.



11.FARM INFRASTRUCTURE

Well planned, managed and maintained farm infrastructure can make a big difference to the day-to-day running of a farm. See this section for recommended dimensions and management tips for farm infrastructure such as feed and stand-off pads, tracks, water supply, milking sheds, and yards.

11. FARM INFRASTRUCTURE

Buildings and yard sizes

Dairy cow yard	1.3m^2 / cow Jersey 1.5m^2 /cow Friesian
Calf pen	Allow 1.1 -1.4m^2 per calf
Haysheds	Allow 2m^3 per large round bale
Fertiliser Bins	Allow 0.9m^3 per tonne

Feed pads

Dimensions	• 4.5 – 6.0m wide feed lanes • 4.0- 4.5m wide single cow lane • >7.0m wide double cow lane • 0.7m/cow – length of feed face /bin when all cows feed at once • 0.3m/cow length of feed face when cow feeding adlib • Entry and exit points – 8.0-10.0m wide • A feed pad where cows are kept for short periods of time should allow a minimum of 3.5m^2 /cow with 0.7m feed bin length per cow.
Slope	• 2° - 4° • 2° – is a rise of 35mm per 1m along or 3.5m fall over 100m • 4° – is a raise of 75mm per 1m along or 7m fall over 100m
Concrete	• Feed lanes 25-30 mpa • Cow lanes 20 mpa

Stand-off pad

Short term		**Long term**		**Permanently**
+ 12 hrs / day (up to 2 days in a row)		+ 12hrs / day, (3 or more days in a row)		No on-off grazing
Surface type	Area per cow	Surface type	Area per cow	Area per cow
Woodchip	3.5m^2	Woodchip	6-8m^2	9-11m^2 including a comfortable lying area plus 1m^2 feeding area. Length of the feed face: 0.7m/cow feed all at once,0.3m/cow feed ad-lib
Sand	3.5m^2	Sand	6-8m^2	
Concrete	3.5m^2	Concrete	Not recommended	

*These figures are based on a standard cross-bred size cow. Add an extra 1m^2 per cow if you have large Friesians.

Track/race

Width

www.dairynz.co.nz/efficient-tracks

Herd size	Race width
<120	5.0
120-150	5.5
250-350	6.0
350-450	6.5
>450	Varies with split of herd

Camber

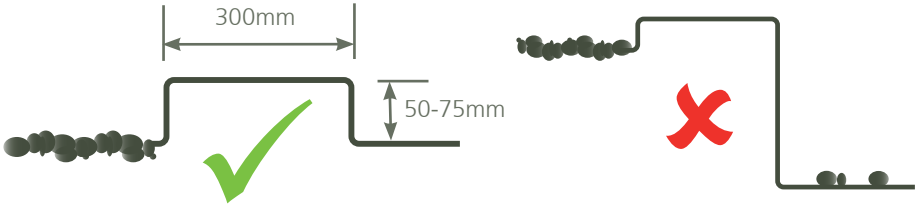
www.dairynz.co.nz/track-building

Measure using a 1m spirit level.

Yard intersection

www.dairynz.co.nz/yard-intersection

- Advantageous for track to widen by 2m as it enters the yard to avoid congestion
- Nib should be square not rounded, without a change in level
- Nib should be 500mm back from the end of the concrete to avoid forming a pot-hole



Dairy design

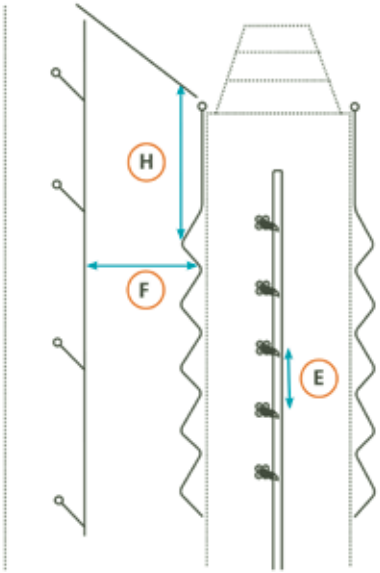
Collecting yard design – **www.dairynz.co.nz/yard-design**

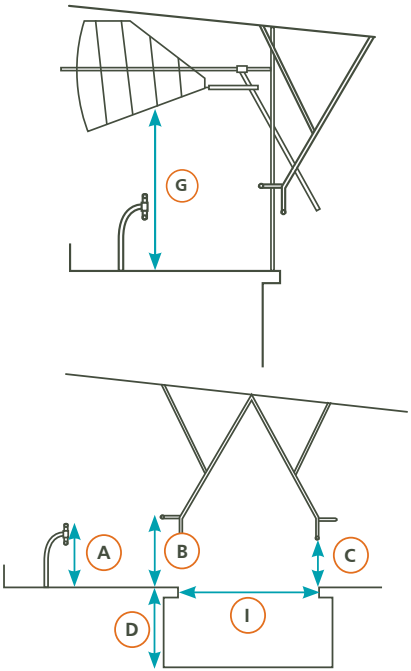
Yard size	1.3m²/Jersey cow 1.5m²/Friesian cow
Backing gate speed	0.5m per 5 sec for rectangular yards 1m per 5 sec for circular yards
Recommended maximum backing gate length	12m for rectangular yards 12m for circular yards with a herringbone 15m for circular yards with a rotary

Herringbone design

www.dairynz.co.nz/herringbone-design

Bail lead-in	900-1000mm
Breast rail height (A)	700mm Jersey 760mm Friesian
Rump rail height (B)	Approx. 900mm
Kick rail height (C)	Approx. 200mm below the rump rail
Depth of pit (D)	850-950mm
Cluster spacing (E)	Wider gives better cow flow, guide 700mm
Bail width (F)	Depends on cluster spacing 1450mm for 600mm cluster spacing 1050mm for 900mm cluster spacing
Head gate clearance (G)	At least 1400mm
Width of first bail in zig-zag (H)	Cluster spacing + 200mm

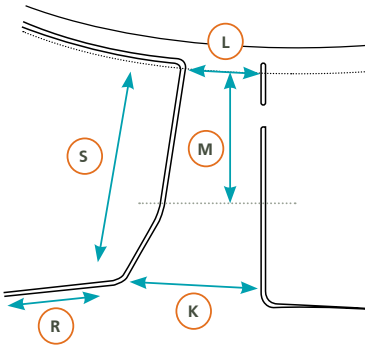


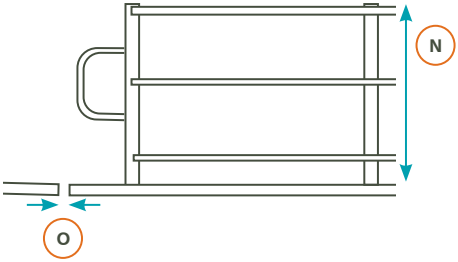


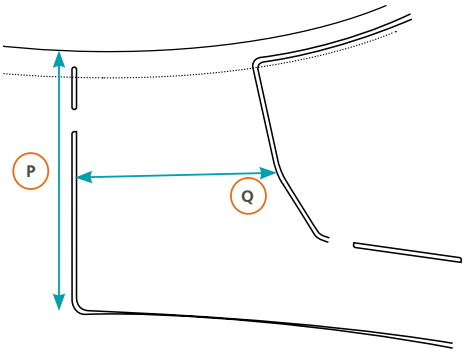
Rotary design

www.dairynz.co.nz/rotary-design

Width of entrance at yard (K)	Approx. 1200mm
Width of entrance at platform (L)	Approx. 900mm
Length of entrance race (M)	Minimum 2500mm
Height of entrance fence (N)	Approx. 1200mm
Gap between bridge and platform (O)	Not more than 40mm
Ability for cup-on person to step back (R)	Must be able to step back 2m unobstructed
Distance from entrance to yard man-gap (S)	At least 2m from bridge entrance
Depth of exit turning area (P)	Not less than 3m
Width of exit turning area (Q)	At least 2.5m when measured 1.5m from the platform edge








DANGER

Herringbone efficiency

www.dairynz.co.nz/herringbone-principles

The expected number of cows milked per hour for various row time/herringbone size combinations are shown in the table below.

The amount of time available for milkers to perform their work routine (e.g. attaching/removing clusters, teat spraying, loading row etc) is also shown. This number should be multiplied by the planned number of milkers in the pit to calculate the amount of time each milker will have available to achieve that row time.

Go to **www.dairynz.co.nz/herringbone-calculator to test a specific scenario.**

Number of clusters

Row time in minutes	12	14	16	18	20	22	24	26	28
6	120 30	140 26	160 23	180 20	200 18	220 16	240 15	260 14	280 13
7	100 35	120 30	140 26	150 23	170 21	190 19	210 18	220 16	240 15
8	90 40	110 34	120 30	140 27	150 24	170 22	180 20	200 18	210 17
9	80 45	90 39	110 34	120 30	130 27	150 25	160 23	170 21	190 19
10	70 50	80 43	100 38	110 33	120 30	130 27	140 25	160 23	170 21
11	70 55	80 47	90 41	100 37	110 33	120 30	130 28	140 25	150 24
12	60 60	70 51	80 45	80 45	100 36	110 33	120 30	130 28	140 26
13	60 65	60 56	70 49	80 43	90 39	100 35	110 33	120 30	130 28
14	50 70	60 60	70 53	80 47	90 42	90 38	100 35	110 32	120 30

30	32	34	36	38	40	44	
300	320	340	360	380	400	440	cows/hour
12	11	11	10	9	9	8	seconds/cow
260	270	290	310	330	340	380	cows/hour
14	13	12	12	11	11	10	seconds/cow
230	240	260	270	290	300	330	cows/hour
16	15	14	13	13	12	11	seconds/cow
200	210	230	240	250	270	290	cows/hour
18	17	16	15	14	14	12	seconds/cow
180	190	200	220	230	240	260	cows/hour
20	19	18	17	16	15	14	seconds/cow
160	170	190	200	210	220	240	cows/hour
22	21	19	18	17	17	15	seconds/cow
150	160	170	180	190	200	220	cows/hour
24	23	21	20	19	18	16	seconds/cow
140	150	160	170	180	180	200	cows/hour
26	24	23	22	21	20	18	seconds/cow
130	140	150	150	160	170	190	cows/hour
28	26	25	23	22	21	19	seconds/cow

Rotary efficiency

www.dairynz.co.nz/rotation-time

The expected number of cows milked per hour for various rotation time/rotary size combinations are shown in the table below. Note these figures assume no empty bails but make allowances for cows going-around on a second rotation. The number of go-around cows was estimated for this table using a milk yield of 12 L/cow (i.e. equivalent to the morning milking for a herd averaging 20 L/cow/day).

Go to **www.dairynz.co.nz/rotary-calculator** to estimate a different milk volume.

Rotation time in minutes

	30 Bail	34 Bail	40 Bail	44 Bail	50 Bail	54 Bail	60 Bail
6.0	170 12 21	200 11 18	240 9 15	260 8 14	300 7 12	330 7 11	370 6 10
7.0	170 14 21	190 12 19	240 11 15	260 10 14	300 8 12	330 8 11	370 7 10
8.0	170 16 21	200 14 18	240 12 15	260 11 14	300 10 12	330 9 11	370 8 10
9.0	170 18 21	190 16 19	230 14 16	260 12 14	300 11 12	320 10 11	360 9 10
10.0	160 20 23	190 18 19	220 15 16	250 14 14	280 12 13	310 11 12	340 10 11
11.0	160 22 23	180 19 20	210 17 17	230 15 16	270 13 13	290 12 12	320 11 11
12.0	150 24 24	170 21 21	200 18 18	220 16 16	250 14 14	270 13 13	300 12 12
13.0	140 26 26	160 23 23	180 20 20	200 18 18	230 16 16	250 14 14	280 13 13
14.0	130 28 28	150 25 24	170 21 21	190 19 19	210 17 17	230 16 16	260 14 14

The amount of time available for a cow to walk on to the rotating platform is also shown. The milker can have more time available to attach clusters as not every cow in a rotation needs their clusters attached (because cows can be going-around on a second rotation).

64 Bail	70 Bail	80 Bail	
400 6 9	440 5 8	500 5 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
400 7 9	440 6 8	510 5 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
400 8 9	440 7 8	500 6 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
390 8 9	430 8 8	490 7 7	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
370 9 10	400 9 9	460 8 8	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
340 10 11	370 9 10	430 8 8	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
320 11 11	350 10 10	400 9 9	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
290 12 12	320 11 11	370 10 10	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster
270 13 13	300 12 12	340 11 11	1. cows/hour 2. seconds for cow to load 3. seconds for milker to attach cluster

Water supply

Peak drinking water daily requirements

Category	Non-irrigated pasture		Irrigated pasture	
	At trough	At pump[1]	At trough	At pump[1]
Lactating cow average annual	35 litres/head	60 litres/head	25 litres/head	28 litres/head
Lactating cow peak	72 litres/head	105 litres/head	61 litres/head	68 litres/head
Lactating cow average milking period (Sep – Feb)	44 litres/head	70 litres/head	35 litres/head	39 litres/head
Dry cow	45 litres/head		45 litres/head	
Calves	25 litres/head		25 litres/head	

[1]Leakage has been found to be highly variable between farms, and was 29-47% of the water use at the pump on non-irrigation farms, and 13% of the water use at the pump on irrigated farms.

Peak drinking water flows required at trough

Lactating cow – non-irrigated pasture	15 litres/head/hr
Lactating cow – irrigated pasture	12 litres/head/hr
Dry cow	8-10 litres/head/hr

Water supply

Herd size	Trough flow (1 per sec)	Trough size (litres)
100	0.33	600
200	0.67	1200
300	1.00	1800
400	1.33	2 @ 1200
500	1.67	2 @ 1500

Flow rate = 12 litres/cow/hr at trough

1 litre = 0.26 gallons

Dairy shed water requirements

Category	Non-irrigated	Irrigated
Dairy shed water annual average	49 litres /head	64 litres /head
Dairy shed water peak	82 litres /head	118 litres /head
Dairy shed water average milking period (Sep – Feb)	63 litres /head	90 litres /head

Irrigation

Five tips for good irrigation management

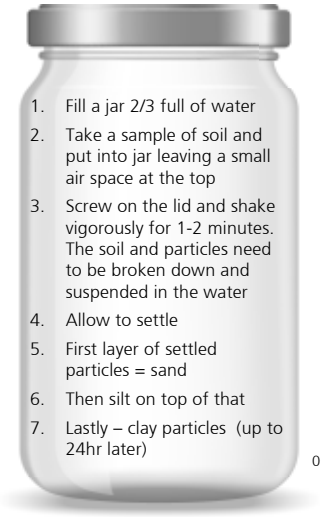
1) How much productive water can our soil hold?

a. Identify your soil type by:

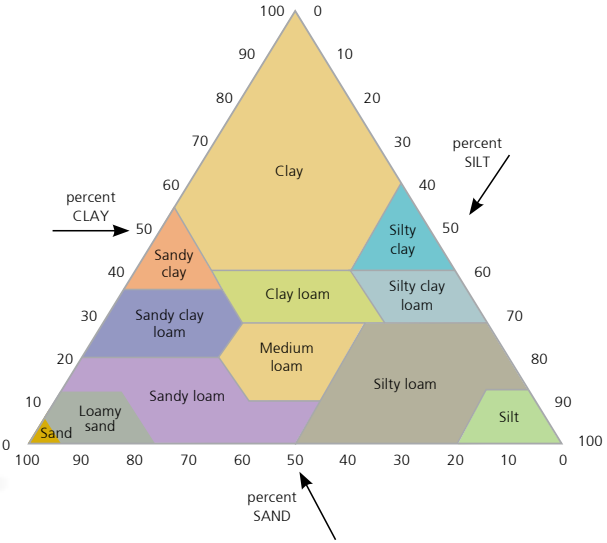
i. Referring to SMAPs **https://smap.landcareresearch.co.nz**

ii. Or carry out a "jar test" (see next page)

Jar test



1. Fill a jar 2/3 full of water
2. Take a sample of soil and put into jar leaving a small air space at the top
3. Screw on the lid and shake vigorously for 1-2 minutes. The soil and particles need to be broken down and suspended in the water
4. Allow to settle
5. First layer of settled particles = sand
6. Then silt on top of that
7. Lastly – clay particles (up to 24hr later)



To interpret the jar test use the 'soil triangle' above:

2) Measure the total volume of sample*

e.g. 4cm *that is the distance from the top of the clay layer to the bottom of the jar

3) Measure each sample layer individually

Sample divided by total x 100 = %

Therefore:

i. Clay – 0.4cm/4cm x100 = 10%

ii. Silt – 0.6cm/4cm x 100 = 15%

iii. Sand – 3cm/4cm x 100 = 75%

Using the triangle, we identify our soil as "sandy loam"

a. Compare soil type with potential "soil water holding capacity chart" to determine your soils' capacity to hold water

Example of test jar

Soil class	WHC (mm/100mm)
Clay loam	17.5-19.0
Silt loam no stones or gravel	15.5-16.5
Silt loam, approx 30% gravel	11.0-12.0
Sandy loam	0.5-11.0
Sand	4.5-5.5

b. Dig a hole to identify the depth of the plant's active root zone
i.e pasture is no greater than 400mm

c. Calculate:

Water holding capacity x rooting depth = plant available water divided by 2 = readily available water (total amount of production water, rest is survival water)

e.g. 8mm x 4 = 32/2 = 16mm readily available water (RAW) the size of your bucket

Applying any more than the plant available water e.g 32mm will cause drainage and runoff which is a major contributor to nitrogen leaching

2) How fast is my pasture going to use this moisture?

a. Identify your daily evapotranspiration (ET) which are often published in the local newspaper.

b. Identify your crop factor using the table provided: (pasture = 1.0)

Pasture	1.0
Clover	1.0
Lucerne	1.2
Maize	1.1
Fodder beet	1.0
Kale	1.1

c. Calculate:

Potential ET x crop factor of pasture

e.g. 4.5 x 1.0 = 4.5

Therefore our pasture uses 4.5mm/day

3) What amount of irrigation does my system need to supply?

a. Information from 1)

b. Information from 2)

= System requirements

That is:16mm (RAW) divided by 4.5mm (crop use per day) = 4 days return interval

Therefore, our system must be capable of applying 16mm of irrigation every 4 days – if not the system needs to be modified.

4) How do I justify my irrigation events?

a. Calculate a water budget at **www.dairynz.co.nz/environment/water-use/irrigation/**

b. Interpret your soil moisture trace. Visit **dairynz.co.nz** for more information.

For further information on soil moisture monitoring refer to **http://irrigationnz.co.nz**

5) How do I measure the amount of irrigation that my system applies?

a. Perform a bucket test to measure application depth and distribution uniformity – a bucket test is a very simple way of understanding if you have a problem or not and showing you are being efficient with your water

www.dairynz.co.nz/environment/water-use/irrigation/ or search the app store for the "check it" bucket test app

b. Carry out pressure and flow verification

DairyNZ