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.

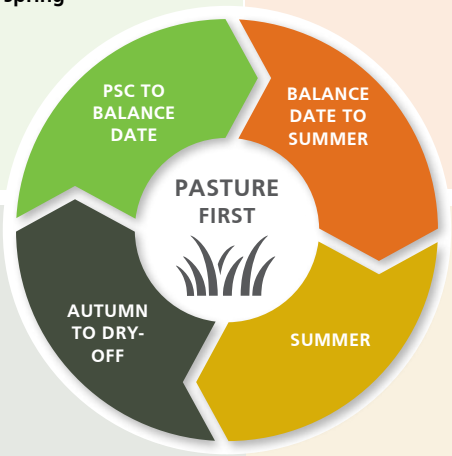
Visit **dairynz.co.nz/spring**

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:

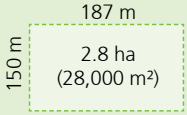
M² PER COW TO COWS PER HA *A stride is approx. 1 m.*

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

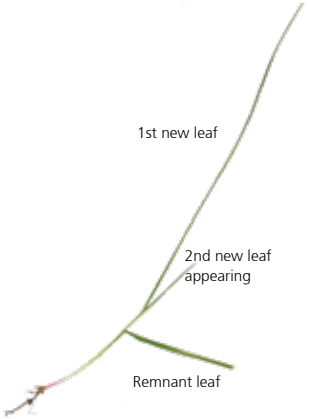
A pasture feed wedge gives a visual picture of the current pasture situation on a farm by ranking the paddocks based on average pasture cover in a graph. By drawing a line between pre and post grazing targets it becomes a simple tool to make proactive pasture management decisions.

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

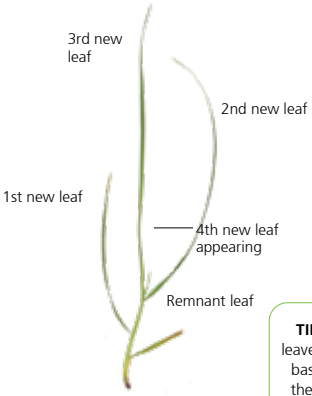
1 – leaf stage



2 – leaf stage

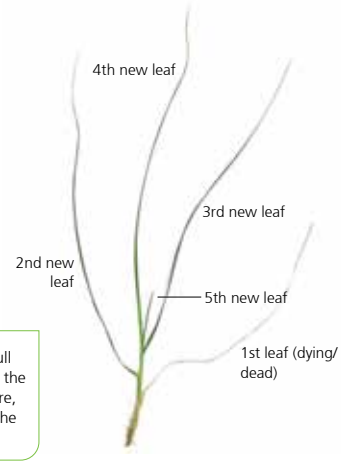
TIP: If blunt tips are visible across the paddock then not at 2-leaf stage.

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.