

DairyNZ pasture renewal guide

*Your guide to the establishment and management
of productive and persistent new pastures*



This guide was an initiative of the Pasture Renewal Leadership Group; a DairyNZ-led industry group, including researchers, the seed industry, farmers and agricultural contractors, formed to develop better tools, resources and advice for farmers.

This guide is focused predominantly on a typical ryegrass-white clover pasture.

For more information on other species please refer to dairynz.co.nz/pasture-species



For more information visit

dairynz.co.nz

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Achieving successful pasture renewal

This guide focuses on evidence-based principles to help you get the best results from pasture renewal.

The following principles for successful pasture renewal apply:

1. Plan your pasture renewal programme 6-18 months before sowing.
2. Choose the appropriate method of renewal.
3. New pastures require special management in their first year compared to existing pastures.

Definitions

- Pasture renewal refers to any method of establishing new pasture plants.
- Pasture renewal may be achieved by going from grass-to-grass, from grass-to-crop-to-grass or undersowing.
- The first two methods involve destruction of the existing pasture either by spraying or cultivation before sowing the new pasture. Undersowing refers to drilling seed into existing pasture, usually in autumn. Oversowing refers to the broadcasting of seed onto the soil surface and is not considered as pasture renewal.
- Most dairy pastures are dominated by perennial ryegrass and white clover. The principles of pasture renewal have been well defined for these pastures and are summarised below.
- Refer to the DairyNZ website (dairynz.co.nz) for information on the ryegrass varieties, examples of current cultivars, endophyte selection and pasture pests, as well as information on other pasture species, such as kikuyu and plantain.

Common mistakes made when renewing pastures

1. Poor or no planning for pasture renewal.
2. Assuming establishment is complete by the spring immediately following autumn sowing, which may lead to unsuitable grazing management (see Principle 3, page 11).
3. Not using insecticide treated seed to control insect pests at sowing. While the endophyte in ryegrass seed protects against insect attack, it is not active in the seedling until about one month after sowing, leaving a gap when young seedlings are highly vulnerable.
4. Sowing ryegrass and clover seed in the same drill row, at the same sowing depth. This penalises clover, because its seedling vigour is less than ryegrass.
5. Expecting a long-term improvement in pasture production from undersowing into existing pastures (Table 2 on page 8).
6. Making silage or hay in the first spring (see Principle 3, page 11).
7. Sowing old ryegrass varieties or uncertified seed.

Principle 1: Plan your pasture renewal programme 6-18 months before sowing.

Prepare for sowing checklist

- ✓ Identify your lowest producing paddocks at least six months before sowing date.
Use information such as grazing records to identify the number of grazings per paddock or estimate dry matter yield in the last year, pasture walk notes, pasture condition score, and visual observations.
- ✓ Use the DairyNZ *Pasture Condition Scoring tool* (pages 4-5) to assess the status of each paddock.
- ✓ Identify why these paddocks are the lowest producing.
- ✓ Correct any non-species related deficiencies e.g. drainage, soil compaction.
Take a spade and do a visual soil assessment to evaluate any soil related issue that you might need to deal with.
- ✓ Arrange for a soil sample to be tested for nutrients and pH. Correct deficiencies by applying fertiliser and/or lime.
- ✓ Check insect populations and use seed which contains endophyte that will deter attack from the main insects present.
- ✓ Discuss your seed and seed treatment options with your merchant.

Remember: Introducing new plants will not increase production if you do not resolve the underlying causes of low pasture production.

Research shows that the worst paddocks on the farm can grow only half as much grass as the best paddocks.

Pasture condition score tool

The Pasture Condition Score Tool helps determine the most appropriate action to take to improve your pasture depending on its condition. The tool suggests suitable actions for each paddock based on its level of damage, allowing paddocks to be prioritised for renewal. The Pasture Condition Score Tool is also available at dairynz.co.nz

Rank 5

Description: Whole paddock has dense sward of desired grasses and clovers.

Suggested action: No action required. Would be happy if whole farm was in this state.



Rank 4

Description: Parts of the paddock show signs of low level damage, less vigorous grasses and some weeds.

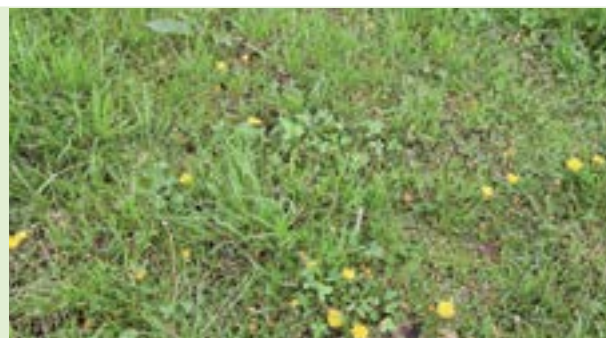
Suggested action: Check fertility. Apply summer N to encourage tillering. Paddock probably OK for coming season.



Rank 3

Description: Majority of paddock has low level damage, weeds, and less vigorous grasses.

Suggested action: Apply summer N. Undersow in the following autumn with perennial ryegrass containing appropriate endophyte.



Rank 2

Description: Parts of the paddock have severe damage, a lot of weeds and bare ground.

Suggested action: Sow into summer crop this spring, and plan to sow perennial pasture in the autumn.



Rank 1

Description: Entire paddock severely damaged.

Suggested action: Sow into summer crop this spring, and plan to sow in perennial pasture in the autumn, or direct drill ryegrass seed as soon as possible and when soil temperatures are 10°C and rising. If possible use the same cultivar and endophyte already established in the damaged paddock. A combination of these methods – but limit cropping to <10% of the farm area.



Pastures should be condition scored in spring to identify paddocks in need of remedial action following winter recovery of ryegrass populations. Pastures may require further assessment in early autumn where damage has occurred over summer e.g. through overgrazing, insect damage or weed ingress.



Having identified paddocks for renewal, consideration should then be given to the selection of the most suitable cultivar and endophyte combination for your region and farm system.

Endophyte

An endophyte is a naturally occurring fungus that is found in ryegrass and tall fescue pastures. Endophytes are essential for persistence in most New Zealand pastures as they protect the plant from insect attack.

Different endophytes provide varying levels of protection against pasture pests, it is important to identify which endophyte is best for your situation. AR37 and NEA2 are recommended in perennial ryegrass for the Upper North Island because of black beetle and argentine stem weevil.

Novel (or selected) endophytes provide a way of avoiding animal health problems associated with ryegrass infected with the standard (or Wild Type) endophyte (*Neotyphodium lolii*), while maintaining positive effects on plant persistence.

The decision of which endophyte to choose depends on your region and farm. See the endophyte tables at dairynz.co.nz/endophyte for the latest endophyte performance information.

Ploidy

Ploidy refers to the number of chromosomes per cell in a plant, a diploid ryegrass has two sets of chromosomes while a tetraploid ryegrass has four sets. These differences create differing plant characteristics with associated advantages and disadvantages for each type.

Tetraploids produce large, more upright plants, offering high palatability and animal performance but can be prone to overgrazing. Diploids are more prostrate and, in general, persist better than tetraploids.

Heading date

Ryegrass cultivars produce seed heads at slightly different times and this has an impact on pasture quality and growth rate. Heading date is defined as the date when 50% of plants have emerged seed heads.

Heading date is referenced to the old ryegrass cultivar Nui and reported as plus or minus days from Nui's heading date which is normally around October 20. So, if a cultivar has a heading date of +15 it would be expected to show 50% seed head emergence around November 4.

Ryegrass cultivars with late heading dates tend to maintain better quality going into summer. Earlier flowering cultivars (shown as 'mid-heading' in the FVI) tend to have superior early spring growth. Hence, there is a trade-off between early spring growth and summer feed quality.

Farmers could sow different parts of their farm with different heading date cultivars to 'even-out' pasture growth rates through spring and into early summer, especially if there is variation between paddocks in their ability to 'hold on' into summer. For example, paddocks that tend to dry out in the early summer should be sown with mid-heading cultivars while heavier soils are sown with late-heading cultivars.

Principle 2: Choose the appropriate method of renewal

Prepare for sowing checklist

Spraying out

- ✓ The paddock needs 5-10 cm of cover for effective glyphosate absorption and pasture kill.
- ✓ Add a broadleaf weed spray if required.
- ✓ For hard to kill weeds consider spraying twice with glyphosate (either before renewal or as part of a cropping rotation). Spraying twice also kills unwanted ryegrass seedlings containing standard endophyte, germinating from old pasture seed and other weed grasses.
- ✓ Seek advice from your chemical rep on the appropriate herbicide for your situation.

Seed

- ✓ Check the seed analysis certificate for germination, purity and endophyte levels.
- ✓ Use treated seed as endophyte does not protect establishing seedlings from insects and disease.
- ✓ Check recommended sowing rates.

Sowing

- ✓ Brief your contractor on requirements in advance.
- ✓ If your paddock needs levelling, allow enough time for the work to be completed before sowing.
- ✓ Plan for delays – allow 7-10 days before your sowing target date.
- ✓ Ensure the seed bed is fine and firm.
- ✓ Check drill depth; recommendations are 10 mm for ryegrass and 5 mm or less for white clover for best establishment.
- ✓ When direct drilling slug bait should be applied at sowing.

Methods of establishment

Table 1: Advantages and disadvantages of spraying before drilling into an existing pasture

Pros	Cons
Vigour of seedlings is not affected by competition from established plants	Adds \$80/ha to initial cost compared with undersowing
Greater plant density and survival (Table 2)	Two drill passes at half the seeding rate are desirable to achieve a dense pasture
Impact of new varieties is maximised	Immediate loss of pasture production for six to eight weeks after spraying
Improved control of insect pests (e.g. using treated seed with an appropriate endophyte)	
White clover establishment is possible (see below)	
Long-term solution	

White clover establishment (after killing existing pasture)

Drill ryegrass using the main-seed box. Drop white clover seed onto the soil surface from the small-seeds box in front of coulters sowing the ryegrass. Cover seed with a brush or bar harrow.

Sowing ryegrass and white clover seed in the same coulter results in poor white clover establishment because the clover is drilled too deep, and clover seedlings are forced to compete with the more vigorous ryegrass seedlings growing in the same drill row.

Table 2 shows the effect of spraying before drilling on ryegrass plant survival.

- Spraying improved new plant numbers by 74%.
- Large plant losses occurred over the first year, especially in summer.
- After five years, sufficient plants (250/m²) remained in the pastures established by spray and drill to maintain stability (L'Huillier 1987; Thom 1991).

Table 2: Effect of killing existing pasture by spraying with glyphosate before drilling on survival of new ryegrass plants over five years (Thom, E.R., D.D. Wildermoth, M.J. Taylor. 1993).

Time from sowing	Density (plants/m ²)		Significance
	Undersown	Spray and Drill	
54 days (15 May) ¹	452	788	★★
268 Days (15 Dec)	400	720	★★
1 year	175	400	★★
5 years	90	250	★★

¹ Date of maximum plant numbers; ** 99% chance that the differences were caused by spraying of existing pasture

Table 3: Advantages and disadvantages of undersowing into an existing pasture

Pros	Cons
Increases plant density in open pastures	New plants forced to compete with existing plants
Lower establishment costs, compared to spray and drill	Small plants result in more summer losses
	Not suitable for white clover establishment
	Not suitable when self-sown species (e.g. paspalum) are present or in dense pastures
	Short-term solution

Oversowing (broadcasting seed onto the soil surface)

Not recommended for improvement of lowland pastures due to high seedling mortality. Could be used on small areas (e.g. around pugged gateways) provided coverage of seed with soil is achieved.

Cultivation before drilling or after a crop

The most expensive option; however, it allows for incorporation of lime and provides better conditions for establishing white clover than spray and drill. Generally, cultivation also reduces soil compaction, allows paddock levelling to take place, disrupts insect populations and improves weed control.

Additionally, incorporating a summer crop as part of a renewal process may allow for better control of weeds such as yellow bristle grass and other summer active grasses.

Sowing rate for pasture persistence

Sowing rates of 18 kg seed/ha for diploid ryegrass and 25 kg seed/ha for tetraploids are enough to maintain a persistent and productive pasture.

Traditional recommendations for sowing rates of perennial ryegrass pastures were around 20-25 kg seed/ha for diploid cultivars and 25-30 kg seed/ha for tetraploid cultivars (due to the tetraploid's larger seed size). However, some schools of thought suggest sowing rates should be higher to ensure good establishment, or lower to prevent seedling competition that compromises their ability to survive in the first summer after sowing.

DairyNZ researchers compared the establishment and survival of seedlings from four perennial ryegrass cultivars sown in autumn 2011 (Lee, J.M et al. 2017). The cultivars were sown at five sowing rates (equivalent to 6, 12, 18, 24 and 30 kg diploid seed/ha) and three sites (Jordan Valley in Northland, Newstead in the Waikato, and Lincoln in Canterbury). Swards were monitored over five years.

- There was no evidence that sowing rate affected pasture persistence within the range of sowing rates commonly used on-farm.
- During their first year of establishment, swards sown at greater sowing rates generally had greater annual herbage accumulation, greater ryegrass tiller density and greater ryegrass content.
- Differences in tiller densities between treatments had largely dissipated by the start of the second or third year as a result of self-thinning.
- The initial positive effects of sowing rate on annual herbage accumulation had dissipated across all sites by the end of the third year (except at the Waikato site where there was no effect of sowing rate on annual accumulation).
- Sowing rate affected botanical composition with greater proportions of clover and weed species in the lower sowing rate treatment (6 kg seed/ha). As a result, in areas where there is greater potential for weed ingress (e.g. a known large weed seed bank), or where herbicide use is restricted (e.g. organic systems), greater sowing rates may be beneficial in limiting weed ingress.
- Although ryegrass persistence was unaffected by sowing rate, persistence was affected by experimental site. Ryegrass plant populations declined over time in all treatment groups at the Waikato site. There was evidence of less pronounced population decline in Northland (relative to Waikato) and stable populations in Canterbury under irrigation.

18 kg/ha of ryegrass seed is equivalent to 9 million seeds/ha for perennial ryegrasses (diploids). Assuming 90% germination this would result in 810 plants per m² for a perennial ryegrass pasture. 250-350 plants/m² are present in a stable, productive pasture. A sowing rate of 18 kg/ha for diploid ryegrasses and 25 kg seed/ha for tetraploids is sufficient to maintain a productive and persistent pasture.

Principle 3:

New pastures require special management in their first year compared to existing pastures.

After sowing checklist

- ✓ Do a pluck test before the first grazing (see page 12).
- ✓ First grazing – use the cows to nip off the top 2-3 cm to encourage ryegrass growth (new tillers).
- ✓ Have the animals on the new pasture for a short period to avoid pugging.
- ✓ Spray for weeds 6-8 weeks after sowing (see page 13).
- ✓ Apply two applications 20-30 kg N/ha when conditions allow (not water-logged and soil temperature 7°C or higher) between first grazing and spring.

Aim: to improve new plant size before summer

- New pastures take at least one year to establish and require special treatment during that year compared to existing pastures. The assumption that new ryegrass is established by the spring following sowing can lead to excessive damage and a less persistent pasture if treated like established pastures.
- Graze for the first time when new seedlings cannot be pulled out by hand-plucking, usually five to seven weeks after drilling (see page 12).
- Graze regularly during the winter/spring following drilling (i.e. between the 2 and 3 leaf stage and before canopy closure), leaving a 4 cm residual, this encourages growth of new ryegrass and white clover seedlings.
- Small applications of nitrogen fertiliser (e.g. 25 kg N/ha) six to eight weeks after drilling will encourage tillering, especially where the existing pasture was killed before drilling.
- Do not make hay or silage from new pastures in the first spring as this reduces tillering and root growth, increasing the chance of plant death during summer.
- Consider management options such as adjusting round length, utilising stand-off areas, or feeding supplements when grazing new pastures to ensure that target post-grazing residuals are met and to reduce pugging damage.
- Review the results of your pasture renewal after the first summer. Identify what went well and what did not and make necessary adjustments to improve results.

Remember: Strong seedling growth (prominent drill rows) going into winter/spring does NOT indicate success. The real test is how many of the new ryegrass plants survive their first summer (Table 5).

Pluck test

Use a pluck test to determine if newly sown grass is ready for the first grazing

How to do a pluck test

Grasp ryegrass seedling firmly between the thumb and forefinger, then tug in a single, quick movement (to mimic a cow biting).



Pass

Pass – if the leaves break off and the roots stay in the ground.



Fail

Fail – if the roots come out.



Control weeds early in a pasture's life

Weed control early in a pasture's life is preferable, as small weeds are easier to kill.

Emerging weeds in new pasture compete with establishing grass and clover plants and are generally less palatable. This leads to patchy grazing and lower pasture and animal production in the long-term.

Spraying new pastures is usually advantageous, even with few weeds, as most pastures benefit from the removal of troublesome weeds before they become established. Monitor your new pasture for emerging weeds. Seedling weeds can be sprayed before or after the first grazing.

Phenoxy butyric herbicides, namely 2,4-DB and MCPB, have traditionally been used against seedling broadleaf weeds such as docks and thistles. They have no effect on grasses and are relatively harmless to clovers when applied after seedling clovers have grown one to two trifoliolate leaves.

Spraying should also be delayed if there is more than 50 percent bare ground exposed, as excessive soil contact (with herbicide) may result in root uptake and damage to clovers.

Waiting for all clover plants to be big enough to spray with these herbicides (post first trifoliolate leaf), means that often weeds are too far advanced to control.

It's possible to use herbicides which are a low risk to clovers in early stages of development. This means earlier weed control, which is particularly effective where there is staggered clover germination and variable clover size.

Table 4: The type of weeds present can influence the need for herbicide control in their seedling stage. Consult with specialists through your local rural suppliers, as the choice of herbicides is subject to change.

Recommended to control with herbicide at seedling stage	Weeds that are possible to control by pasture competition and management during the seedling stage
Dock	Fat hen
Californian	Willow Weed
Scotch	Nightshade
Nodding & winged thistles	Redroot
Ragwort	Chickweeds
Buttercups	Wild turnip

Help in correctly identifying weeds in their seedling stage is often available through websites such as agpest.co.nz or weeds.massey.ac.nz

Strategic use of nitrogen applied at 25 kg N/ha can promote ryegrass to successfully compete against some weeds. This is particularly important in spring, so there are few gaps in the pasture to allow the establishment of summer active weeds such as yellow bristle grass.

To obtain the full benefit of herbicide application, careful attention should be given to calibration of equipment and application procedures. This includes checking spray volumes per hectare, boom height, nozzle pressures and nozzle output. Follow label instructions.

In this new pasture (Figure 3), a variety of weed seedlings are emerging which should be sprayed. Circled are buttercup (top left), broadleaf plantain (bottom) and dock (top and centre right).

Also circled (centre and lower right) are clover seedlings with trifoliate leaves, indicating they are less susceptible to damage from the preferred herbicides (*Phenoxy butyric*).



Photo supplied courtesy of Paul Addison: Nufarm

Figure 3: Weed seedlings establishing in a new pasture.

Survival of the first summer after pasture renewal is critical

The greater the number of tillers a ryegrass plant has at the beginning of its first summer, the more likely it is to survive into its second year.

Table 5 shows how competition for light can restrict plant tillering and summer survival:

- Plants with a greater number of tillers at the beginning of the first summer (December 14) had a greater chance of surviving the summer period.
- 75% of all plants monitored died over the first summer, emphasising how summer stresses affect ryegrass survival.
- Severe grazing (21%) and damage from dung and urine (22%) accounted for 43% of plant deaths over the summer.

Many of the recommendations with respect to management of establishing pastures are based around the principle of limiting competition for light between ryegrass plants to maximise tiller size and number. For example, grazing before canopy closure and not making silage or hay in a pasture's first year are practical methods to limit excessive competition for light and shading in the base of the sward.

Table 5: Ryegrass average plant size (tillers/plant) and summer deaths (% of marked plants) with and without competition for light from sowing (May). Beginning of summer (14 December) data in brackets (Thom et al. 1986).

Period	Average tillers per plant		Deaths (% of marked plants)	
	No competition ¹	Competition	No competition ¹	Competition
7 Aug – 14 Dec	17 (36)	6 (8)	1	4
15 Dec-15 May	29	6	13	45

¹ 30% more light penetration by clipping surrounding plants to 2 cm stubble

Seasonal management for ryegrass persistence

The seasonal breakdown on pages 17-21 defines current knowledge of seasonal grazing management impacts on ryegrass persistence, for dairy farms with perennial ryegrass and white clover pastures.

A tiller is a part of a ryegrass plant. Each tiller has a growing point from which new leaves grow. The growing point is found at the base of the tiller, close to the soil surface. This means it is rarely damaged during grazing, allowing the tiller to regrow after grazing. At any one time, each tiller has up to three live leaves and one or more dying leaves.

Grazing management impacts on ryegrass persistence by influencing the number and size of tillers in a pasture. The degree of influence grazing management has on persistence varies by season.

Persistence of pastures is strongly linked to how tillers respond to the frequency, severity and timing of grazing and the growing conditions (i.e. temperature and moisture) at the time.

Perennial ryegrasses mainly reproduce asexually through daughter tillers which become separated from the parent tiller and result in a new plant. Few new ryegrass plants emerge in established pasture through seed germination under existing management. Each tiller only lives for one year, so for a pasture to maintain plant population (persist) each tiller must leave behind at least one offspring.

The survival, size and number of tillers in a pasture depend on the rate of new tillers appearing and old tillers dying. Plants will respond to stress by stopping tiller production. Ryegrass pastures can change between having many small tillers per m², resulting from frequent intense grazing, to fewer larger tillers per m², resulting from less frequent grazing. The resulting dry matter (DM) production is similar in both pastures.

Grazing management also impacts on pasture production and quality. Understanding the principles of grazing management for optimal pasture growth and quality is required. These are briefly summarised as the following general rules.

- Graze between the two and three-leaf stage – at the three-leaf stage if wanting to build pasture cover and at the two-leaf stage if attempting to limit pasture cover.
- Graze to a consistent, even post-grazing residual of 3.5-4 cm height (1500-1600 kg DM/ha, 7-8 clicks using the rising platometer [RPM] winter formula) to maximise pasture yield and quality, and milk production. Lower residuals will reduce pasture regrowth (except in winter). Higher residuals reduce pasture quality for subsequent rotations.



Figure 4: A large ungrazed ryegrass plant with four live tillers. One of these tillers (inset) shows an elevated node. The growing point is now above this node, indicating seed head development. This growing point is normally close to ground level. Grazing or cutting below the node causes this tiller to die. A replacement tiller is required to keep tiller density.

Principles for increasing the persistence of new pastures

Spring – September to November

Seasonal response to management and environmental conditions

Frequent grazing favours ryegrass tiller initiation by:

- Preventing shading as light encourages initiation of tillers from buds at the base of the plant
- Preventing establishment of weeds
- Reducing stem elongation as some tillers become seed heads.

Good management: improved persistence

- Consistent post-grazing residuals, with grazing timed between the two to three leaf stage.

Bad management: reduced persistence

- Lax or under-grazing.
- Repeated grazing before the two-leaf stage.
- Pre-grazing levels regularly above 3000 kg DM/ha.
- For established pastures, silage and hay crops too long (more than 4000 kg DM/ha) or insufficient (less than 26 days) recovery time after cutting silage and hay.

Recommended rotation length

- 18-26 days.
- Graze closer to the three-leaf stage (26 days) if higher growth rates are required to meet cow demand.

Recommended grazing residuals

(grazing residuals are expressed as height in clicks, as measured by the rising plate meter, based on the winter formula)

- Target post-grazing residuals of seven to eight clicks (1500-1600 kg DM/ha)
- Achieve consistent grazing height at each grazing event.
- If fewer than seven clicks (1500 kg DM/ha), speed up rotation length if possible, to increase pasture allowance, or feed supplement to maintain herd intake.
- If more than nine clicks (1750 kg DM/ha) and currently feeding supplement, consider removing supplement, or if no supplement is being fed, consider reducing area allocation and conserving surplus pasture.

Transition spring to summer – November and December

Seasonal response to management and environmental conditions

- Development of reproductive tillers and flowering peaks (see page 16; figure 4).
- Rates of tiller death and replacement peaks.
- Soil seedbank: summer-active grass weed seeds germinate and establish in pastures.

Good management: improved persistence

- Nitrogen (N) fertiliser applied at 30 kg N/ha after each grazing (provided soil moisture isn't limiting). This helps development of new tillers and reduces tiller population decline during summer.
- Where a summer moisture deficit is likely, a lower grazing frequency is needed to allow for slower leaf development. A gradual reduction in grazing area per day is needed. Achieve this without lowering the grazing residual.
- If changing rotation lowers grazing residual below seven clicks, consider reducing animal demand through culling decisions, or increasing feed supply by offering supplementary feed or reducing stock numbers.

Bad management: reduced persistence

- Grazing residuals more than the consistent level previously determined in the spring. This can elevate growing points, potentially exposing them to grazing at the next grazing.
- Grazing to a lower residual than the previous grazing threatens the growing points of existing and developing tillers.

Recommended rotation length

- Shift from 20 towards 30 days.

Recommended grazing residuals

- Target post-grazing residuals of seven to eight clicks (1500-1600 kg DM/ha)
- Achieve consistent grazing height at each grazing event.
- If fewer than seven clicks (1500 kg DM/ha), consider rotation length and increase pasture allowance if possible, with consideration of leaf stage and future growth expectations. If rotation length cannot be sped up, consider feeding supplementary feed to maintain herd intake. Alternatively, stand cows off once the target post grazing residual has been met to prevent overgrazing damage.
- If more than nine clicks (1750 kg DM/ha) and currently feeding supplement, consider removing supplement, or if no supplement is being fed, consider reducing area allocation and conserving surplus pasture (silage, hay or deferred grazing).

Summer – December to February

Seasonal response to management and environmental conditions

- Increased temperature and lower soil moisture means new ryegrass leaves take longer to emerge after grazing.
- Plants respond by producing smaller and thinner leaves for moisture conservation.
- Some plant roots die after grazing. Grazing more often during droughts results in root death and less root replacement.

Good management: improved persistence

- Reduce grazing frequency allowing for slower leaf emergence.
- Prevent the herd grazing below the consistent grazing residual, determined at previous grazings.

Bad management: reduced persistence

- Repeated severe grazings, to residuals below target.
- Repeated grazing before the two-leaf stage.
- Long rotations that allow paspalum and kikuyu to dominate.

Recommended rotation length

- 25-32 days.
- Disadvantages of longer rotations are:
 - they can allow summer grasses to dominate.
 - inability to achieve target grazing residuals if moisture is not limiting.

Recommended grazing residuals

- Target post-grazing residuals of seven to eight clicks (1500-1600 kg DM/ha)
- Achieve consistent grazing height at each grazing event.
- If fewer than seven clicks (1500 kg DM/ha), increase feed supply by offering forage crops or supplementary feed, alternatively reduce herd demand by removing culls. If supplementary feed is not being offered, stand cows off once the target post grazing residual has been met to prevent overgrazing damage.

Autumn – March to May

Seasonal response to management and environmental conditions

With the removal of moisture stress, the autumn is often the first period where ryegrass pastures start recovering tiller density.

Good management: improved persistence

- Hold a long rotation following a dry period to allow pasture recovery.
- Rotation length remains similar to or longer than summer.

Bad management: reduced persistence

- Allocating too much pasture area (fast rotation) immediately after rain.
- Frequent intense grazing before plants reach the three-leaf stage reduces recovery of tiller numbers during autumn.

Recommended rotation length

- 30-40 days March-April.
- 50-60 days May.

Recommended grazing residuals

- Target post-grazing residuals of seven to eight clicks (1500-1600 kg DM/ha)
- Achieve consistent grazing height at each grazing event.
- If fewer than seven clicks (1500 kg DM/ha), consider rotation length and pasture availability, speed up rotation length, if possible, to increase pasture allowance provided ryegrass plants have reached the 2 to 3 leaf stage. If rotation length cannot be changed, increase feed supply by offering forage crops or supplementary feed. Alternatively reduce herd demand by removing culls or drying off cows based on body condition score. If supplementary feed is not being offered, stand cows off once the target post grazing residual has been met to prevent overgrazing damage.
- If more than nine clicks (1750 kg DM/ha) and currently feeding supplement, consider removing supplement, or if no supplement is being fed, consider reducing area allocation and pushing feed forward into winter.

Winter – June to August

Seasonal response to management and environmental conditions

- Moist cool conditions mean tiller death is low.
- Ryegrasses are forgiving of stress such as severe grazing except where high soil moisture leads to pugging damage.

Good management: improved persistence

- Reduce grazing frequency to allow pasture time to develop three leaves.
- Rotation lengths may need to be more than 60 days.
- Use spring rotation planners to manage the transition from winter to spring and ensure appropriate covers are reached for spring.

Bad management: reduced persistence

- Pugging.
- High farm covers in August, leads to base shading of plants and loss of tiller density.
- Grazing at high stock density on wet soils reduces subsequent pasture production by up to 45% over the following year, as shown in photo below.



Recommended rotation length

- A minimum of 60 days between grazings.

Recommended grazing residuals

- Winter is the time of the year where grazing below seven clicks does not appear to damage ryegrass regrowth, however, consider the effect of long rotations on pugging damage. During periods of greater risk for pugging damage, consider standing cows off once target post grazing residuals have been achieved.

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