DairyNZ pasture renewal guide

Your guide to the management of persistent, productive pastures

0800 4 DairyNZ (0800 4 324 7969)
dairynz.co.nz
This guide is 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.

If you would like to receive the regular update from the Pasture Renewal Leadership Group register on-line at dairynz.co.nz/PRLGupdate or call the DairyNZ Farmer Information Service on 0800 4 DairyNZ (0800 4 324 7969).
Pasture renewal checklist

For further information refer to the commentary section – pages 4-7

Before sowing

Paddock selection

☐ Identify your lowest producing paddocks at least six months before sowing date.
  Use information such as grazing records, pasture walk notes, pasture condition score, and visual observations

☐ Identify why these paddocks are the lowest producing

☐ Correct any non-species related deficiencies e.g. drainage

☐ Arrange for a soil sample to be tested for nutrients and pH. Correct deficiencies by applying fertiliser and/or lime

☐ Discuss your seed and seed treatment options with your merchant.

Endophyte and ryegrass cultivar selection

☐ Fill out the table below

  • First decide what endophyte you require based on the insect protection and animal health ratings (Tables 2 and 3 on page 4)

  • Then decide on cultivar options based on whether you want an early or late heading ryegrass that is a diploid or tetraploid (Table 1).

Table 1: Cultivar/endophyte combinations

<table>
<thead>
<tr>
<th>Endophyte</th>
<th>Heading date</th>
<th>Ploidy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early/Mid</td>
<td>Late</td>
</tr>
<tr>
<td>AR1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEA2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endo 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NIL (NE)*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wild (WE)*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Not recommended
Prepare for sowing

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. Spraying twice also kills unwanted ryegrass seedlings, containing standard endophyte, germinating from old pasture seed
☐ Seek advice from your chemical rep on the appropriate herbicide for your situation.

Seed

☐ Check seed analysis certificate for germination, purity and endophyte levels
☐ Use treated seed – endophyte does not protect establishing seedlings from insects and disease
☐ Check recommended sowing rates – avoid higher than recommended rates.

Sowing after cultivation or by direct drilling

☐ Brief your contractor on requirements
☐ 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 seed bed is fine and firm
☐ Check drill depth; less than 20mm for ryegrass, less than 10mm for white clover
☐ When direct drilling slug bait should be applied at sowing.

After sowing

☐ Do a pluck test before the first grazing (see page 20)
☐ 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 28)
☐ 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.
Endophyte and cultivar selection

**Endophyte:** The most appropriate endophyte for your situation depends on the level of insect challenge. Tables 2 and 3 provide a summary of the expected insect protection from the range of endophytes available in ryegrass.

**Key to tables**

- No control
- Low level control: Endophyte may provide a measurable effect, but is unlikely to give any practical control.
- Moderate control: Endophyte may provide some practical protection, with a low to moderate reduction in insect population.
- Good control: Endophyte markedly reduces insect damage under low to moderate insect pressure. Damage may still occur when insect pressure is high.
- Very good control: Endophyte consistently reduces insect populations and keeps pasture damage to low levels, even under high insect pressure.

( ) Provisional result: Further results needed to support the rating. Testing is ongoing.

**Table 2:** Diploid ryegrasses (e.g. Alto, Commando)

<table>
<thead>
<tr>
<th>Insect</th>
<th>AR1</th>
<th>AR37</th>
<th>Standard endophyte</th>
<th>Without endophyte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentine stem weevil</td>
<td>★★★★</td>
<td>★★★</td>
<td>★★★★</td>
<td>—</td>
</tr>
<tr>
<td>Pasture mealybug</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★★</td>
<td>—</td>
</tr>
<tr>
<td>Black beetle</td>
<td>★</td>
<td>★★★</td>
<td>★★★</td>
<td>—</td>
</tr>
<tr>
<td>Root aphid</td>
<td>—</td>
<td>★★★</td>
<td>★★★</td>
<td>—</td>
</tr>
<tr>
<td>Porina</td>
<td>—</td>
<td>(★★★)³</td>
<td>★³</td>
<td>—</td>
</tr>
</tbody>
</table>

*(NEA2 endophyte is not included because incomplete data are available)*

**Table 3:** Tetraploid ryegrasses (e.g. Halo, Bealey)⁴

<table>
<thead>
<tr>
<th>Insect</th>
<th>AR1</th>
<th>NEA2</th>
<th>AR37</th>
<th>Endo5</th>
<th>Without endophyte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentine stem weevil</td>
<td>★★★</td>
<td>★★¹</td>
<td>★★★¹</td>
<td>★★★¹</td>
<td>—</td>
</tr>
<tr>
<td>Pasture mealybug</td>
<td>★★★</td>
<td>(★★★)</td>
<td>★★★</td>
<td>★★★</td>
<td>—</td>
</tr>
<tr>
<td>Black beetle</td>
<td>★</td>
<td>★★★</td>
<td>★★★</td>
<td>★★★</td>
<td>—</td>
</tr>
<tr>
<td>Root aphid</td>
<td>—</td>
<td>(★)</td>
<td>★★★</td>
<td>(★★)⁵</td>
<td>—</td>
</tr>
<tr>
<td>Porina</td>
<td>—</td>
<td>Not tested</td>
<td>Not tested</td>
<td>(★)³</td>
<td>—</td>
</tr>
</tbody>
</table>
Notes of explanation

1. These endophytes control Argentine stem weevil larvae, but not adults. While larvae cause most damage to pastures, adults can damage emerging grass seedlings, so use an appropriate seed treatment to control them.

2. AR1 plants are more susceptible to root aphid than plants without endophyte.

3. Control of porina in pastures only applies to the ryegrass component. Other species that are palatable to porina (such as white clover) will still be damaged.

4. There is much less information on the effect of endophyte in tetraploid ryegrasses on insects than for diploids. Tetraploids are generally more susceptible to Argentine stem weevil and the insect resistance provided by endophyte may not be as strong, although this may vary between cultivars. These ratings are based on available data but require further confirmation.

5. Control of root aphid by Endo5 in tetraploid cultivars is variable. Banquet II Endo5 has moderate control (★★), whereas Quartet II Endo5 has no control.

6. See the DairyNZ FarmFact 1-29 – Black Beetle for more information on black beetle.

Ploidy

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 seedheads 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 the plants have emerged seedheads. The 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 this means 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 the summer. Early heading cultivars tend to have superior early spring growth. Hence, there is a trade-off between early spring growth and summer feed quality. Farmers should sow different parts of their farm with different heading date cultivars. For example, paddocks that tend to dry out in the early summer should be sown with early heading cultivars while heavier soils are sown with late heading cultivars.

Spraying out

Glyphosate is the most common chemical used to spray out pastures. For effective absorption of the active ingredient plants need to have sufficient leaf area for good contact. Spraying before grazing can be an effective method of getting good leaf contact. If other chemicals are added to glyphosate withholding periods from grazing must be adhered to.

Glyphosate will not kill some hardy broadleaf weeds (e.g. docks) and a broadleaf spray should be added in these situations.

For really hard to remove species such as couch or browntop consider double spraying. This requires a six week gap between sprays to allow weed seeds to germinate.

When direct drilling slug bait should be applied at sowing.
Seed

Use certified seed. All certified seed is tested for germination and purity. Always request a copy of the seed analysis certificate from your merchant when purchasing seed. Ryegrass seed infected with a particular endophyte will also have an endophyte viability test. The endophyte level must be 70% or greater, meaning 70% of the seeds contain endophyte. This information is printed near the bottom of the seed analysis certificate.

The endophyte protection described above is only expressed in established ryegrass plants. Establishing seedlings have no endophyte protection against insects. Therefore, it is essential that only treated seed is sown. Seed treatments normally include an insecticide and fungicide to protect establishing plants.

Increasing the seeding rate to compensate for poor seed bed preparation is not recommended.

Sowing

Where paddocks are uneven it is difficult to get a consistent sowing depth and cultivation is normally preferred over direct drilling.

Delays due to weather or contractor availability are common and it is best to allow 7-10 days for this type of disruption.

Good seed bed preparation is essential for good seedling growth. A fine, moist and firm seedbed is required after cultivation. Consolidation is very important and if in doubt an additional pass with a roller is recommended.

Sowing depth is also very important. Clover should be sown at a shallower depth than ryegrass. Most drills have a small seeds box which can be used to sow clover at the correct depth (less than 10mm).

After sowing

Management of new pastures in the first 12 months will have a huge impact on their long term performance and persistence.

New pastures should be first grazed when plants break off rather than pull out when ‘plucked’ by hand (refer to page 20). This first grazing should be a quick nip off (top 2-3 cm) with young stock or 2-3 hours of grazing with milking cows.

During cultivation, soil mineralisation occurs releasing nitrogen. The new plants use this nitrogen during early growth when young clovers are unable to replenish the nitrogen supply. Thus, new grass often becomes nitrogen deficient 2-3 months after sowing, particularly after a wet spell. Yellow leaf tips is the most obvious symptom of this occurring.

Before grazing grass for the first time it will pay to test a sample for nitrate toxicity. Nitrate poisoning is not uncommon when grazing resown pastures, especially annuals.
Endophyte effect on animal health and performance

These ratings are indicative. Endophyte effects on animal performance and health can vary under different management systems and between seasons.

Key to table

- ★★★ Moderate animal production and health: This endophyte is known to regularly cause significant problems
- ★★★★ Good animal production and health: This endophyte can cause problems from time to time
- ★★★★★ Very good animal production and health

Table 4: Livestock performance – dairy cows and beef cattle

<table>
<thead>
<tr>
<th></th>
<th>AR1</th>
<th>NEA2</th>
<th>AR37</th>
<th>Endo5</th>
<th>Standard endophyte</th>
<th>Without endophyte</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freedom from ryegrass staggers</td>
<td>★★★★</td>
<td>★★★★</td>
<td>★★★★</td>
<td>★★★</td>
<td>★★1</td>
<td>★★★★</td>
</tr>
<tr>
<td>Animal production</td>
<td>★★★★</td>
<td>Not tested</td>
<td>★★★★</td>
<td>Not tested</td>
<td>★★1</td>
<td>★★★★</td>
</tr>
</tbody>
</table>

Notes of explanation

1. Standard endophyte can cause ryegrass staggers, and has been shown to depress milksolids production through summer and autumn
2. While ryegrass staggers has not been observed on cattle and dairy cows, it could occur on rare occasions
3. In dairy trials, overall MS production from ryegrass containing AR37 endophyte was not significantly different from ryegrass containing AR1. A small reduction in MS was observed over summer on ryegrass containing AR37. A contributing factor to this was the lower clover content in AR37 pastures.
Principles for successful pasture renewal

Successful pasture renewal can be defined as when the farmer’s expectations of a productive and persistent new pasture have been met; often these expectations are not met because of mistakes made in establishment, exacerbated by factors such as high insect pest populations and droughts.

This article focuses on some evidence-based principles that must not be overlooked when renewing 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. Ryegrasses are particularly well suited to drilling because of their exceptional seedling vigour but this can be a difficult option for white clover.

Refer to the DairyNZ website (dairynz.co.nz) for information on the ryegrass types, examples of current cultivars, endophyte selection and black beetle in DairyNZ FarmFacts 1-22, 1-23, 1-24 and 1-29.

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 12)
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 (Tables 5 and 6 on pages 14-15)
6. Making silage or hay in the first spring (see Principle 3, page 12)
7. Managing new pasture like existing pasture from the first spring onwards (see Principle 3, page 12).
8. Sowing old ryegrass varieties or uncertified seed – Nui ryegrass for example (see page 27).
The following principles for successful pasture renewal apply

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

Identify under-performing paddocks (cow grazing days, milk in vat). Talk with your contractor about your renewal requirements. Do a soil test before renewal and correct any nutrient deficiencies according to soil type (see recommendations in DairyNZ Facts and Figures for New Zealand Dairy Farmers booklet available free on dairynz.co.nz or call 0800 4 DairyNZ (0800 4 324 7969) to order). Don’t forget soil pH which on ash, sedimentary and pumice soils should be about 6.0 (details also available in the booklet).

Use the DairyNZ Pasture Condition Scoring tool (pages 16-17) to assess the status of each paddock.

Check insect populations (see DairyNZ FarmFact 1-29) and use a ryegrass which contains the endophyte that will deter attack from the main insects present (e.g. AR37 endophyte for black beetle).

Any drainage issues or soil compaction problems must be corrected before sowing. Take a spade and do a visual soil assessment to evaluate any soil related issue that you might need to deal with (see “Visual Soil Assessment Volume 1” by T. Graham Shepherd, available at landcareresearch.co.nz/research).

**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 grow only half as much grass as the best paddocks.
Principle 2: Choose the appropriate method of renewal

Preferred method: Spray and drill (direct-drilling after existing pasture killed by herbicide)

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigour of new plants is unaffected by competition</td>
<td>Adds $80/ha to initial cost compared with undersowing</td>
</tr>
<tr>
<td>Large plants going into summer survive better (Table 6)</td>
<td>Two drill passes at half the seeding rate are desirable to achieve a dense pasture</td>
</tr>
<tr>
<td>Impact of new varieties is maximised</td>
<td>Immediate loss of pasture production for six to eight weeks after spraying</td>
</tr>
<tr>
<td>Improved control of insect pests (e.g. using treated seed with an appropriate endophyte)</td>
<td></td>
</tr>
<tr>
<td>White clover establishment is possible (see below)</td>
<td></td>
</tr>
<tr>
<td>Long term solution</td>
<td></td>
</tr>
</tbody>
</table>

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.

Note: Sowing ryegrass and white clover seed in the same coulter results in poor white clover establishment because the clover is drilled too deep, (1-2 cm is suitable for ryegrass but not clover) and clover seedlings are forced to compete with the more vigorous ryegrass seedlings growing in the same drill row.

Least preferred methods: Undersowing (direct-drilling into existing pasture)

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases plant density in open pastures</td>
<td>New plants forced to compete with existing plants</td>
</tr>
<tr>
<td></td>
<td>Small plants result in more summer losses (see Table 6)</td>
</tr>
<tr>
<td></td>
<td>Not suitable for white clover establishment</td>
</tr>
<tr>
<td></td>
<td>Not suitable when self-sown species (e.g. paspalum) are present or in dense pastures</td>
</tr>
<tr>
<td></td>
<td>Short term solution</td>
</tr>
</tbody>
</table>

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 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. Cultivation also reduces soil compaction and allows paddock levelling to take place, disrupts insect populations and improves weed control.
Principle 3: New pastures require special management in Year 1 – different management to the existing pastures

Aim: to improve new plant size before summer

- Graze for the first time when new seedlings cannot be pulled out by hand plucking, usually five to seven weeks after drilling (see page 20)

- Graze regularly (e.g. when pasture height reaches 10-15 cm), leaving a 4 cm stubble during the winter/spring following drilling, this encourages growth of new ryegrass and white clover seedlings. Due to the shading effect of existing plants, undersowing is a much less effective way to establish new seedlings

- Do not make hay or silage from new pastures in the first spring as this causes plant damage (reduced tillering and root growth) and increases the chance of plant death during summer

- Small applications of nitrogen fertiliser (e.g. 25 kg/ha) six to eight weeks after drilling will increase seedling size, especially where the existing pasture was killed before drilling

- New pastures take at least one year to establish and require special treatment during that year. Consider management options such as stand-off areas, and feeding supplements to reduce pugging and overgrazing damage

- The assumption that new ryegrass is established (looks can be deceiving) by the spring following sowing can lead to excessive damage and a less persistent pasture if treated like the older pastures on the farm

- 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 (see Tables 5 & 6).
Relevant research topics

Increasing the seeding rate will not improve the performance of new pastures.
Lower seeding rates will reduce seed cost and could improve persistence.

Forcing large numbers of ryegrass seedlings to compete with each other for light, water and nutrients (when drilled at high seed rates), results in small plants which are more susceptible to stress and with a lower probability of survival.

Some recent research in Northland and Waikato looked at the effect of ryegrass seed rate on pasture yield in Waikato and Northland (Gerard et al. 2009) after cultivation or spraying of existing pasture.

This showed that pastures resulting from doubling the ryegrass seed rates from 8 kg/ha produced similar DM yields in the first (Northland) or the third year (Waikato) after sowing, even though 27% more ryegrass seedlings were present four weeks after the higher seed rate in Waikato.

- Current recommended seed rates for perennial ryegrass (18-25 kg/ha) may be too high. Further work has begun to investigate if reduced seed rates affect plant survival and long-term pasture production.
- High seed rates are not justified to cover for poor seedbed preparation.

18 kg/ha of ryegrass seed = 9 million seeds / ha for perennial ryegrasses. 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.
Eliminate the competition from resident species: no short cuts

Table 5 shows the advantages of spraying before drilling.

- Spraying improved new plant numbers by 74%
- Large plant losses occurred over the first year, especially in summer
- After 5 years, sufficient plants (250/m²) remain in the pastures established by spray and drill to maintain stability (L’Huillier 1987; Thom 1991).

Table 5: Effect of killing existing pasture by spraying with glyphosate before drilling on survival of new ryegrass plants over five years (Thom et al. 1993).

<table>
<thead>
<tr>
<th>Time from sowing</th>
<th>Density (plants/m²)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Undersown</td>
<td>Spray and drill</td>
</tr>
<tr>
<td>54 days (15 May)</td>
<td>452</td>
<td>788</td>
</tr>
<tr>
<td>268 days (15 Dec)</td>
<td>400</td>
<td>720</td>
</tr>
<tr>
<td>1 year</td>
<td>175</td>
<td>400</td>
</tr>
<tr>
<td>5 years</td>
<td>90</td>
<td>250</td>
</tr>
</tbody>
</table>

Date of maximum plant numbers; ** 99% chance that the differences were caused by spraying of existing pasture.
Survival of the first summer after pasture renewal is critical

Large size of plants (tillers/plant) at the beginning of the first summer is necessary to ensure survival (Table 6).

Table 6 shows how competition for light restricted plant growth and summer survival:

- Large plants at the beginning of first summer (14 December) had a greater chance of surviving than did small plants.
- 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.

**Table 6:** 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).

<table>
<thead>
<tr>
<th>Period</th>
<th>Average plant size (tillers/plants)</th>
<th>Deaths (% of marked plants)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No competition¹</td>
<td>Competition</td>
</tr>
<tr>
<td>7 Aug-14 Dec</td>
<td>17 (36)</td>
<td>6 (8)</td>
</tr>
<tr>
<td>15 Dec-15 May</td>
<td>29</td>
<td>6</td>
</tr>
</tbody>
</table>

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

**References**


# Pasture condition score tool

<table>
<thead>
<tr>
<th>Rank</th>
<th>Description</th>
<th>Suggested action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Whole paddock has dense sward of desired grasses and clovers.</td>
<td>No action required. Would be happy if whole farm was in this state.</td>
</tr>
<tr>
<td>4</td>
<td>Parts of the paddock show signs of low level damage, less vigorous grasses and some weeds.</td>
<td>Check fertility. Apply summer N to encourage tillering. Paddock probably OK for coming season.</td>
</tr>
<tr>
<td>3</td>
<td>Majority of paddock has low level damage, weeds, and less vigorous grasses.</td>
<td>Apply summer N. Undersow in the following autumn with perennial ryegrass containing appropriate endophyte.</td>
</tr>
<tr>
<td>2</td>
<td>Parts of the paddock have severe damage, a lot of weeds and bare ground.</td>
<td>Either: Sow into summer crop this spring, and plan to sow in perennial pasture in the autumn, or this spring oversow chicory with fertiliser, or undersow paddocks with chicory, and plan to renew in 6-18 months, or undersow with Italian ryegrass next autumn, and plan to renew in the following 6-12 months.</td>
</tr>
<tr>
<td>1</td>
<td>Entire paddock severely damaged.</td>
<td>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 &lt;10% of the farm area.</td>
</tr>
</tbody>
</table>
DairyNZ Forage Value Index

A profit-based evaluation system for perennial ryegrass cultivars

About the DairyNZ Forage Value Index

The DairyNZ Forage Value Index (FVI) is an independent, profit-based and region-specific evaluation system for perennial ryegrass cultivars. It allows farmers to make more informed, confident and profitable decisions when choosing seed.

Dairy cattle have had a well-developed Breeding Worth (BW) system, but until now pastures have not had a profit based evaluation system.

DairyNZ FVI and performance values

Initially, DairyNZ FVI (an estimated profit index: $/hectare) will rate cultivars based on seasonal pasture production. Nutritive value and persistence will be included over time as more information becomes available.

Most perennial ryegrass cultivar will have a DairyNZ FVI and associated performance values for seasonal pasture production.

Display of information

Cultivars are grouped based on their DairyNZ FVI and performance values.

Farmers can choose cultivars that are estimated to be the most profitable, or cultivars that meet specific pasture supply needs e.g. summer dry matter production.
Regional information

Farmers will get information that is relevant to their region. DairyNZ FVI and performance values are estimated for four regional zones. The economic values used in the DairyNZ FVI take into account the differences in pasture growth between regions. For instance in the Upper North Island (which consists of regions north of Taupo), extra summer feed is more valuable than in the Lower North Island (which consists of regions south of Taupo in the North Island).

Future of DairyNZ FVI

The DairyNZ FVI will steadily strengthen over time as more research is carried out, ensuring that:

- More cultivars are included
- More data on traits such as nutritive value and persistence is generated
- The system will build into a world-class resource that includes more than just perennial ryegrass.

Online resource – dairynzfvico.nz

A wide range of information is housed at dairynzfvico.nz, providing an excellent starting point for farmers looking to renew pastures. A step-by-step cultivar selector allows farmers to select endophytes, plant characteristics and ultimately the most profitable cultivars that meet their pest protection and pasture supply needs with more confidence. The website takes you through the entire pasture renewal process. From the first phase of choosing which paddocks need to be renewed, to seed selection and finally management of new pastures.

Key website features include:
- Full explanation of DairyNZ FVI
- Cultivar selector
- Renovation checklist
- Pasture condition score tool.
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** – if the leaves break off and the roots stay in the ground.

**Fail** – if the roots come out.
Grazing management for ryegrass persistence

The seasonal breakdown on pages 20-24 defines current knowledge of seasonal grazing management impacts on ryegrass persistence, for dairy farms with perennial ryegrass and white clover pastures.

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

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. For pastures to 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 short of feed and at the two leaf stage if there is plenty of feed
- Graze to a consistent, even post-grazing residual of 3.5-4cm height (1500-1600kg DM/ha, 7-8 clicks using the rising platemeter [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.

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

Pasture response relevant to ryegrass persistence
Frequent grazing favours ryegrass tiller initiation by:

• Preventing shading. 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
• Silage and hay crops too long. More than 4000 kg DM/ha
• Insufficient (less than 26 days) recovery time after cutting silage and hay
• Repeated grazing before the two leaf stage
• Pre-grazing levels regularly above 3000 kg DM/ha.

Recommended rotation length

• 16-26 days
• Graze closer to the three leaf stage (26 days) if higher growth rates 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 is seven to eight clicks (1500-1600 kg DM)
• Achieve consistent grazing height at each grazing event
• If fewer than seven clicks (1500 kg DM), feed supplement to maintain herd intake
• If more than nine clicks (1750 kg DM), mow to a lower height after grazing.
Transition spring to summer – November and December

Pasture response relevant to ryegrass persistence

- Development of reproductive tillers and flowering peaks (see photo page 21)
- 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
- 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
- Grazing area offered per day on January 1: approximately 80 percent of the area offered on November 1. i.e. A change from a 20 to a 30 day rotation
- Supplements fed if changing rotation lowers grazing residual below seven clicks. Alternatively, de-stock.

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 (see photo page 21)
- Reduced height of grazing residual compared with spring indicates underfeeding is occurring and threats to the growing points of existing and developing tillers
- Grazing to a lower residual than the previous grazing.

Recommended rotation length

- Shift from 20 towards 30 days.

Recommended grazing residuals

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

- No more than eight clicks (1600 kg DM) on the rising plate meter. Target is seven to eight clicks (1500-1600 kg DM)
- Achievement of consistent grazing height at each grazing is important
- If fewer than seven clicks (1500 kg DM), feed supplements to maintain herd intake.
**Principles for increasing the persistence of new pastures (cont’d)**

*Summer – December to February*

**Pasture response relevant to ryegrass persistence**
- Increased temperature and lower soil moisture means new ryegrass leaves take longer to emerge after grazing
- The 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, by using supplements or crops.

**Bad management: reduced persistence**
- Repeated severe grazings, to residuals below target
- Grazing prior to three 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 the summer grasses to dominate
  - Inability to achieve target grazing residuals if moisture is not limiting.

**Recommended grazing residuals**
*(grazing residuals are expressed as height in clicks, as measured by the rising plate meter, based on the winter formula)*
- No fewer than seven clicks (1500 kg DM)
- If fewer than seven clicks (1500 kg DM), feed supplements to maintain herd intake and protect pasture
- If fewer than seven clicks (1500 kg DM) and insufficient supplement, stand cows off pasture once they reach residual target.
Autumn – March to May

Pasture response relevant to ryegrass persistence

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

Good management: improved persistence

- Feed supplements and keep a long rotation to allow pasture recovery after a dry period
- 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
- 60 days May.

Recommended grazing residuals

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

- No fewer than seven clicks (1500 kg DM)
- If fewer than seven clicks (1500 kg DM), feed supplements to maintain herd intake and protect pasture
- If fewer than seven clicks (1500 kg DM) and insufficient supplement, stand cows off pasture.
Principles for increasing the persistence of new pastures (cont’d)

Winter – June to August

Pasture response relevant to ryegrass persistence

• 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
• In the North Island, rotation lengths may need to be more than 60 days to meet feed cover targets
• 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

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

• Winter is the time of the year where grazing below seven clicks does not appear to damage ryegrass regrowth.
**MYTH: I am better off sowing Nui than any modern perennial ryegrass**

**BUSTED!**

**DairyNZ:** Modern ryegrass cultivars are 10 percent higher yielding than Nui. Endophyte levels in Nui ryegrass are variable, increasing the likelihood of insect attack, and old varieties like Nui are the most susceptible to rust fungus attack. Therefore, sowing Nui ryegrass is a backward step, despite savings on the cost of seed.

Farmer experience suggests modern ryegrass varieties are less persistent than old varieties like Nui, but... many Nui ryegrass seedlines have no endophyte, increasing their susceptibility to insect attack, or they contain wild-type (HE) endophyte, increasing the risk of ryegrass staggers.

**Modern varieties versus Nui:**

1. Plant breeding has advanced yield potential by 10-15 percent (about 0.4 percent/yr\(^1\) or a total of about 1.5 t DM/ha) over the 37 years since Nui ryegrass became commercially available. *NZ Plant Breeding and Research Association data summarising 42 trials throughout New Zealand (1991-2009) show annual dry matter yields of modern cultivars are about 10% above Nui\(^2\).*

2. New parent material in modern cultivars has changed the seasonal distribution of pasture growth by modifying heading date, making pasture management easier. Earlier heading cultivars than Nui are more productive in winter/early spring and later heading types have better forage quality in late spring\(^1\). *Nui ryegrass heads mid-season (late October), accentuating late spring growth and the need to make silage\(^3\).*

3. Modern ryegrasses contain selected endophytes (e.g. AR37) that deter insect attack with little or no risk of ryegrass staggers in cattle\(^4\). *Many Nui ryegrass seedlines have no endophyte and are therefore vulnerable to insect attack. Ask for evidence for the presence of HE endophyte in the Nui seedline before purchase, realising this endophyte increases the risk of ryegrass staggers and loss of milk production.*

4. Modern ryegrasses are the most resistant to current strains of rust diseases\(^5,6\). *Nui ryegrass plants are susceptible to damage from current rust strains because these have changed since Nui was bred.*

**References cited**


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 grass and clover, and are generally less palatable. This leads to patchy grazing and lower pasture and animal production in the long-term. The Pasture Renewal Leadership Group, is concerned that too few renewed pastures are sprayed for weeds at an early stage.

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 affect on grasses and are relatively harmless to clovers when applied after seedling clovers have grown one to two trifoliate 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 trifoliate 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.

The type of weed present can influence the need for herbicide control. Consult with specialists through your local rural suppliers, as the choice of herbicides is subject to change.

<table>
<thead>
<tr>
<th>Recommended to control with herbicide at seedling stage</th>
<th>Weeds that can be controlled by pasture competition and management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dock</td>
<td>Fat hen</td>
</tr>
<tr>
<td>Californian</td>
<td>Willow weed</td>
</tr>
<tr>
<td>Scotch</td>
<td>Nightshade</td>
</tr>
<tr>
<td>Nodding and winged thistles</td>
<td>Redroot</td>
</tr>
<tr>
<td>Ragwort</td>
<td>Chickweeds</td>
</tr>
<tr>
<td>Buttercups</td>
<td>Wild turnip.</td>
</tr>
</tbody>
</table>

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

Strategic use of nitrogen applied at 25kg 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 growing weeds, especially the C4 grass weeds like yellow bristle grass and summer 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 at all times.
In this new pasture, 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*