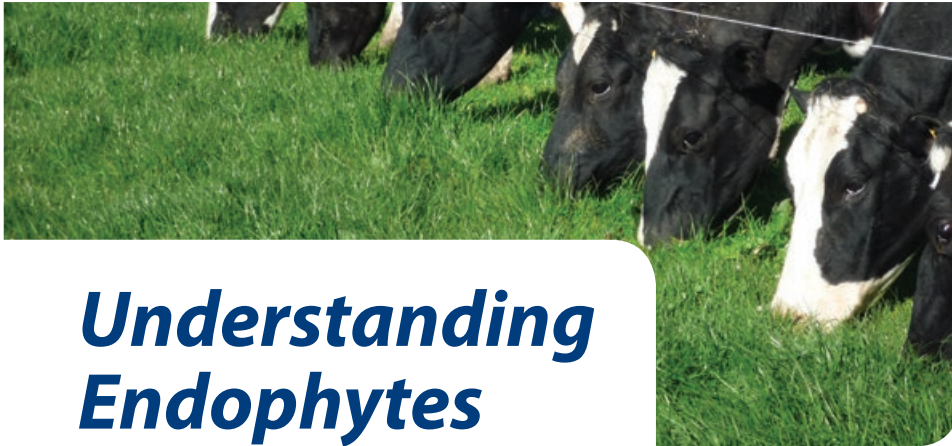


Forage Focus



Farming Systems

Endophytes

- Increase pest tolerance
- Increase dry matter performance
- Improve animal safety
- Increase persistence

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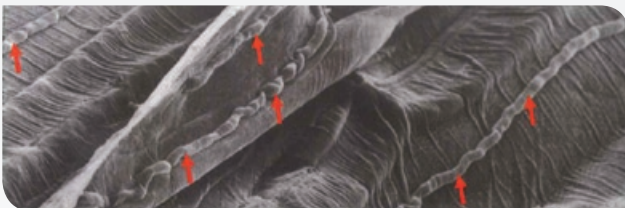
Understanding Endophytes

Endophytes are important to the success of perennial ryegrass and continental tall fescue for persistence and productivity.

What is an endophyte?

An endophyte is a fungus found naturally in many grass species, including ryegrass. It provides the plant with protection from insects, and in return the plant provides the endophyte a place to live and reproduce.

Endophytes produce a number of chemical compounds. Some of these compounds are toxic or a deterrent to particular insects and some can adversely affect animal health when in high concentrations, so it is important to choose the right endophyte for your farming system.



Magnified view of endophyte strands as indicated by the arrows running along the plant cell walls.

Endophyte photo supplied by Dr H Koga

Why is endophyte important?

Presence of endophyte enhances the yield and persistence of the host grass, because the endophyte produces a number of compounds that are toxic to a range of insects and other grass pests. However, it can also cause animal health problems such as ryegrass staggers and heat stress. A number of novel endophytes that are less toxic to stock have been found, and today are available in a number of grass cultivars, predominately perennial ryegrass. When used correctly, these novel endophytes can improve animal performance, and provide improved yield and persistence of the grass.

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Endophyte options

A number of options are now available and the decision is getting easier about the ryegrass endophyte combination for the best value for money.

Endophyte Options	Argentine Stem Weevil	Pasture Mealy Bug	Root Aphid	Black Beetle
Ryegrass without Endophyte	–	–	–	–
Standard / Wild Type / High	••••	••••	••	•••
AR1	••••	••••	– ²	•
Endo5	••• ¹	••••	•••	•••
AR37	•••• ¹	••••	••••	•••

•••• = Excellent control • = Poor control – = No control

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 of an appropriate seed treatment is recommended for sowings in Argentine Stem Weevil prone situations.
2. AR1 plants are more susceptible to root aphid than plants without endophyte

In some areas, ryegrass without endophyte can be used. Such pastures are animal safe and deliver excellent animal performance. However, you can expect less persistence in areas where pasture pests are present.

Ryegrass with standard endophyte

An option where price is crucial and high animal production is not a major issue. Stock grazing these pastures can often suffer from ryegrass staggers and experience reduced weight gains throughout the warmer months. Available in Fitzroy diploid perennial ryegrass.

Higher performing endophytes

For many years, PGG Wrightson Seeds has worked with AgResearch (NZ) and Grasslanz Technology, striving to develop novel endophytes to provide improved grass performance across a wide range of pasture conditions. Here are a few of your novel endophyte options:



Taking pasture persistence to a premium level

Features and benefits

- Protects against four of the main pasture pests in Australia
- Shows improved persistence with higher tiller densities over time
- With higher persistence, the need to renew pastures is often reduced
- Can cause ryegrass staggers which can be as severe as standard endophyte
- Pastures with AR37 are recommended for cattle only

Available in

- Extreme® AR37 diploid perennial ryegrass
- Base AR37 tetraploid perennial ryegrass



High animal performance novel endophyte option

Features and benefits

- Delivers excellent animal performance
- Provides a moderate range of insect protection
- Has demonstrated poor persistence in areas with major insect pest pressure from Black Beetle and Root Aphid

Available in

- Extreme® AR1 diploid perennial ryegrass

Forage Focus

Higher performing endophytes (continued)

Endo5

Good pest control and no ryegrass staggers

Features and benefits

- Contains no Lolitrem B, the main cause of ryegrass staggers
- Provides good control of Black Beetle, Argentine Stem Weevil, Root Aphid and Pasture Mealy Bug
- Produces less ergovaline than many ryegrass cultivars containing standard endophyte. This said, it may produce lower animal performance levels over summer/autumn compared with AR1 and nil endophyte options

Available in

- Banquet® II tetraploid long rotation ryegrass

MaxP

Ideal for grazing stock and excellent protection against Black Beetle

Features and benefits

- Protection against the scourge Black Beetle is one of the biggest benefits of MaxP®
- Aids persistence of tall fescue
- MaxP® endophyte in continental tall fescues has been used and trialed against a number of animal species with no known adverse animal health effects.

Available in

- Quantum II MaxP®

Endophyte compounds

The alkaloids that make are produced endophyte are different. The information below summarises and explains the key alkaloids produced by each endophyte type.

Table 1: Endophyte toxin status

Endophyte Type	Peramine	Lolitrem B	Ergovaline	Janthitrem
Ryegrass without endophyte	X	X	X	X
Standard	✓	✓	✓	X
AR1	✓	X	X	X
Endo 5	✓	X	✓	X
AR37	X	X	X	✓

Peramine: A natural insecticide against some insect pests. Peramine has no known impacts on stock.

Lolitrem B: May provide protection against some insect pests. Lolitrem B is the main cause of ryegrass staggers.

Ergovaline: A compound that in moderate to high amounts can reduce animal performance by increasing the body temperature of the animal, therefore causing heat stress in the animals. Ergovaline does provide good protection against some important pests.

Lolines: Toxic to a broad range of pasture pests. Lolines in continental tall fescue have not shown adverse effects on animals. Lolines are found to be only in the MaxP endophyte which is a fescue endophyte utilized in some continental tall fescue varieties.

Janthitrem: A group of compounds providing very good insect control. Janthitrem can cause ryegrass staggers, but cases recorded are normally of a shorter duration, less frequent and less severe than those caused by Lolitrem B.

It is important to note that the above alkaloids are the ones that are known about today, but there are many others that are still being researched in order to better understand them and their effect on insect pests and their effect on grazing animals.

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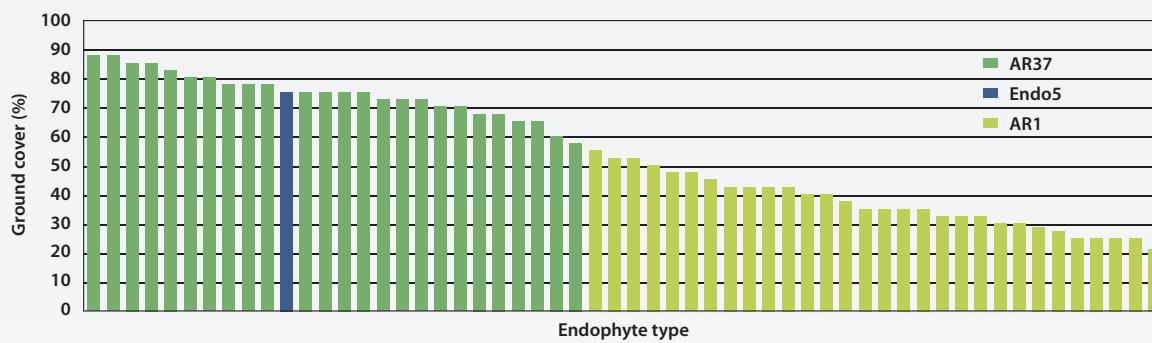
Increased dry matter performance

With superior resistance to insects making for a stronger root system, ryegrass with AR37 has been shown to produce higher levels of dry matter than the same ryegrass varieties with AR1 or standard or without endophyte.

Ryegrasses with AR37 show improved persistence, with higher tiller densities over time when compared to the same cultivars with without endophyte or standard endophyte. With higher persistence the need to renew pasture due to poor pasture composition may be reduced, which is a potential benefit. The resulting higher producing sward also has long-term benefits in assisting the maintenance of excellent animal performance. The dry matter benefits of ryegrasses with AR37 are higher in areas with greater stress and/or insect pressure.

A range of commercial and experimental perennial and long rotation ryegrass varieties with a range of endophytes were sown at Ballarat in April 2008.

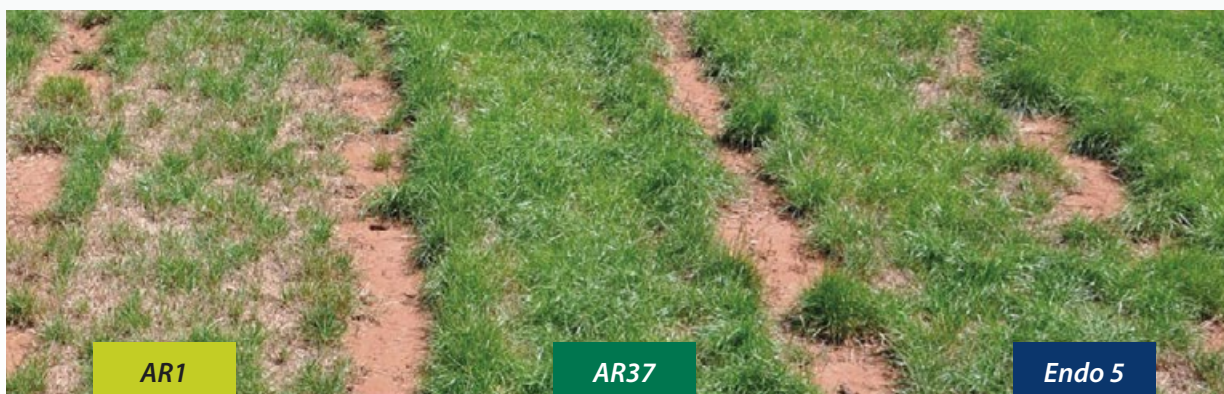
Graph 1. Ground cover percentage in a perennial ryegrass trial - (Ballarat) - colour coded by endophyte type (Trial sown 23 April 2008, ground cover score taken 22 February 2010)



All plots were uniform and no persistence differences were evident until an infestation of Root Aphids occurred in February 2010. Examination of the plots at this time revealed that plots with varieties with the AR37 endophyte were more persistent evidenced by the greater ground cover percentage as shown in Graph 1 above.

Figure 1 below illustrates the differences in persistence of late season tetraploid ryegrasses due to different endophytes in the presence of common ryegrass root pests.

Figure 1. Perennial and long rotation ryegrasses with a range of endophytes at Ballarat in February 2010 (sown April 2008)



Forage Focus

Animal performance and health

It is important to understand the effects on animal performance and health when selecting a ryegrass that includes an endophyte.

Comparison of ryegrass endophytes on animal performance and health:

The ratings below are indicative. Animal performance and health can vary under different management systems and between seasons.

Key:

- 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

Livestock performance – dairy cows and beef cattle:

AR37 has been thoroughly tested by Dairy NZ in New Zealand and at Ellinbank in Victoria for milk production where three year trials have been completed. No ryegrass staggers were measured during the duration of these trials from cows grazing ryegrass with AR1 or AR37. Cows grazing ryegrass with standard endophyte at Ellinbank were recorded having ryegrass staggers in the summer of 2007/2008.

Endophyte Options	AR1	AR37	Endo5	Standard endophyte	Without endophyte
Freedom from ryegrass staggers	••••	•••• ²	••••	•• ¹	••••
Animal production	••••	•••• ³	Not tested ⁴	••• ¹	••••

Notes:

1. Standard endophyte (also known as wild-type or high endophyte) can cause ryegrass staggers, and has been shown to depress milksolids (MS) 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 the DairyNZ trials overall MS production from ryegrass containing AR37 endophyte is not significantly different from that with 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. Source: DairyNZ
4. While Endo5 has not been tested in replicated trials on cattle or dairy cows, it has been used extensively in this segment with no observations or reports of animal health issues to date.

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Animal performance and health (continued)

Livestock performance – sheep and lambs:

Ryegrass with AR37 has been tested for liveweight gain in sheep, with animal performance being the same as ryegrass without endophyte and AR1 ryegrass. Sheep grazing ryegrass with AR37 performed considerably better than those grazing standard endophyte. The incidence of dags is low. Ryegrass with AR37 may cause ryegrass staggers².

Endophyte Options	AR1	AR37	Endo5	Standard endophyte	Without endophyte
Freedom from ryegrass staggers	•••	•• ²	••••	•• ¹	••••
Animal production	•••	•••• ³	••	•• ¹	••••

Notes:

1. Standard endophyte (also known as wild-type or high endophyte) can cause severe ryegrass staggers, has resulted in considerable numbers of lamb deaths, can significantly decrease lamb growth rates in summer and autumn, and significantly increase dags.
2. Trials involving AR37 in New Zealand have shown that on average the frequency, duration and severity of ryegrass staggers is less than for standard endophyte. While this has been confirmed by preliminary investigation using paired paddocks in Australia, ryegrass staggers has occurred in on-farm situations. One50 AR37 may give rise to higher instances of ryegrass staggers in some situations.
3. Lambs grazing ryegrass containing AR37 endophyte can have reduced liveweight gain during periods of severe staggers. Anecdotal evidence indicates that, compared to standard endophyte, AR37 endophyte decreases water consumption, dags scores and incidence of fly strike in summer.

Learning

Forage Focus
Base AR37

Forage Focus
Banquet® II Endo5

Forage Focus
Understanding Endophytes
in a Dairy System

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Lets Grow Together

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