



The key to better
pasture persistence
and productivity

ar37.com.au



AR³⁷ The future for pasture

grasslanz endophyte

AR37 is a novel endophyte that provides considerable agronomic advantages over all ryegrass endophytes currently available in Australia.

Maintaining persistent and productive ryegrass pastures is an issue for many farms, especially in temperate regions of Australia. Insect pests play a key role in reducing pasture growth and persistence. The recent introduction of novel endophytes have provided varying degrees of protection against these pests.

AR37, developed by AgResearch and other commercial partners, provides resistance against four of the main pasture pests common to Australian pastures.

Where pasture pests are present AR37 endophyte is your key to better ryegrass persistence and productivity.

Read on and find out the results that ryegrass with AR37 can bring to your farm.

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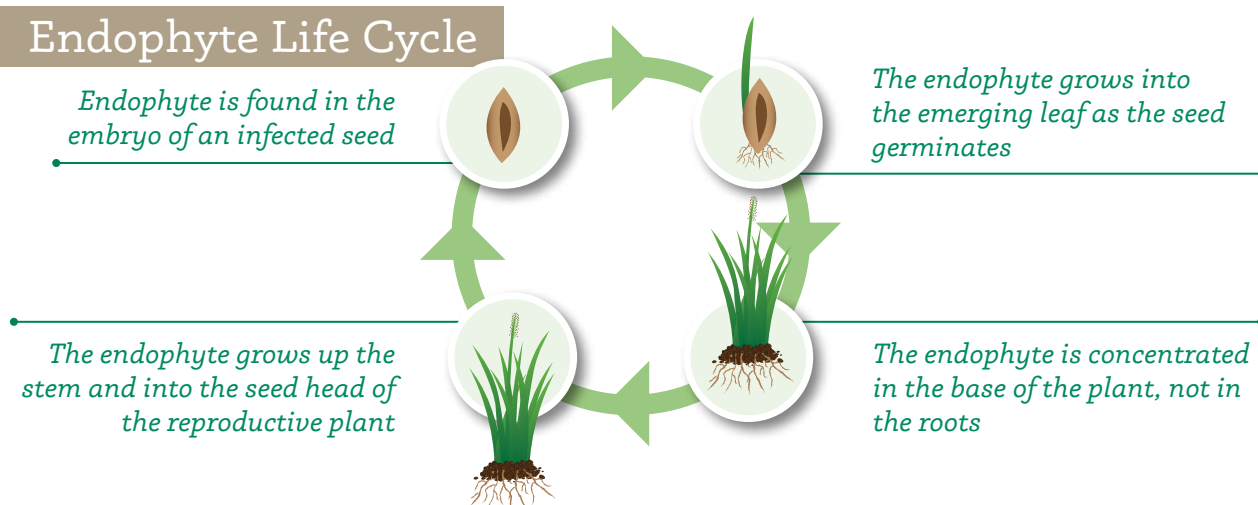
Introducing AR37 endophyte

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 can only be transmitted from one plant to another by seed. New endophyte strains can be introduced into different ryegrass cultivars, but there is no transmission between adult plants growing in a pasture.

Endophytes produce a number of chemical compounds, the types and levels of these compounds produced vary between different endophyte strains and cultivars. Some compounds are toxic or act as a deterrent to particular insects (e.g. peramine and lolines) and some can adversely affect animal health (e.g. lolitrem B) and may depress animal performance when in high concentrations (e.g. ergovaline).

Endophyte Life Cycle



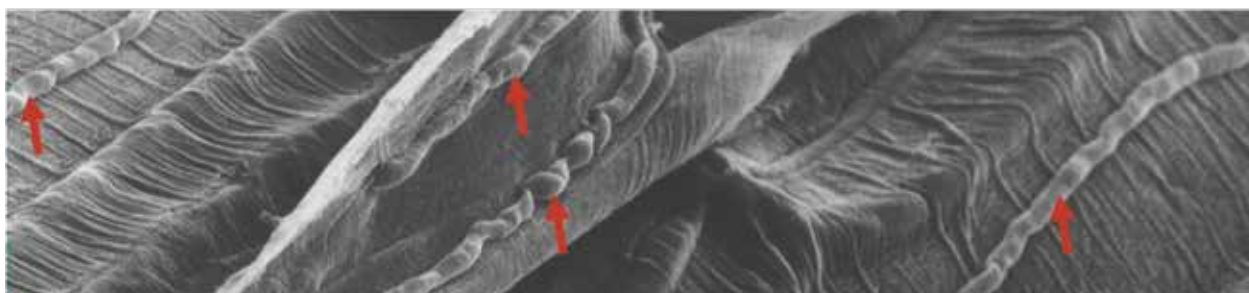
The Neotyphodium endophytes infecting these grasses are not known to be transferred with pollen or by physical contact (Siegel et al., 1984).

David E. Hume and David J. Barker 2005 GROWTH AND MANAGEMENT OF ENDOPHYTIC GRASSES IN PASTORAL AGRICULTURE. In Neotyphodium in Cool-season grasses. Eds. CA Roberts, CP West, DE Spiers 201-226 Iowa, IA: Blackwell Publishing

What is AR37?

AR37 is a novel endophyte that produces a unique compound, epoxy-janthitrems, which have never been found in any other ryegrass/endophyte combination. Epoxy-janthitrems play a role in decreasing insect activity (feeding) while having minimal adverse animal production effects. They are also suspected of being a cause of ryegrass staggers, however, on average are less severe and frequent than standard endophyte.

AR37 endophyte provides significant agronomic advantages over all ryegrass endophytes currently available in Australia where there is insect pressure. Improved pest resistance has resulted in improved ryegrass persistence and an overall increase in ryegrass production.



Magnified view of endophyte strands as indicated by the arrows running along the plant cell walls. Endophyte photo supplied by Dr H. Koga.

AR37 vs. other endophytes

The descriptions below provide an overview of some of the commercially available endophytes. Careful consideration should be given to which endophyte is best suited to your farming practice.

Ryegrass containing standard endophyte (also called wild-type or high)

Standard endophyte is the naturally occurring endophyte in perennial ryegrass and has evolved over thousands of years to aid survival. It produces the toxic classes of the alkaloids lolitrem B and ergovaline, which are primarily implicated in the causes of perennial ryegrass staggers and heat stress. Recent studies have also shown that other sub-clinical effects including summer-autumn ill-thrift, reduced liveweight gain, reduced milk-production, scours and water intake, which may have considerable impacts on the profitability of grazing systems. Standard endophyte offers some protection against ryegrass pests and a deterrent of grazing. This provides reasonable persistence but animal safety and performance is significantly compromised.

Ryegrass without endophyte (also called endophyte free or nil endophyte)

In some areas, cultivars without endophyte are occasionally used. Such pastures are animal safe and will give excellent animal performance. However, endophyte free ryegrass pastures have been shown to be less productive and less persistent in the many areas where pasture pests are present.

Ryegrass with AR37 endophyte

AR37 is a novel endophyte that takes pasture pest resistance to a new level. AR37 provides resistance to four of the main pasture pests in Australian pastures (Argentine Stem Weevil larvae, Pasture Mealy Bug, Root Aphid and Black Beetle). Ryegrasses with AR37 show improved persistence, with higher tiller densities over time than the same cultivars with nil endophyte or standard endophyte. With higher persistence the need to renew pasture due to poor pasture composition may be reduced. 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 insect pressure and/or other stresses.

Ryegrass with AR1 endophyte

Provides a safer pasture than standard endophytes with excellent animal performance while providing a moderate range of insect protection. Ryegrass with AR1 endophyte has demonstrated poor persistence in areas with major insect pest pressure in Australia (primarily due to the presence of Black Beetle and Root Aphid), though persistence is moderately better than ryegrass without endophyte.

Ryegrass with Endo5 endophyte

Pastures with Endo5 (as with AR1) contain no lolitrem B (the main cause of ryegrass staggers), but provide good control of adult Black Beetle, Argentine Stem Weevil larvae, Root Aphid and Pasture Mealy Bug. Ryegrass with Endo5 persists better than ryegrass with AR1 in areas where these pests are present. Cultivars containing Endo5 have been specially bred to produce less ergovaline than many cultivars containing standard endophyte, but may have lower animal performance levels over summer-autumn compared with AR1 and nil endophyte options. Endo5 is still a better proposition than standard endophyte.

AR37

pest protection

AR37 endophyte has been shown to provide superior resistance to a wider range of insects than either standard endophyte (SE) or AR1 endophyte.

Endophyte insect control in perennial and long rotation ryegrass

These ratings are indicative and may vary slightly between cultivars. If Argentine Stem Weevil larvae or Black Beetle are present at sowing, an appropriate seed treatment is recommended to improve insect control during establishment. The ratings in this table are based in part on glasshouse studies where test plants are 100% infected with endophyte, whereas commercial seed must meet minimum standards of 70% of seeds infected. The tables were compiled by AgResearch, Agricom, Agriseeds, Grasslanz, DairyNZ and PGG Wrightson Seeds.

Table 1 - Diploid ryegrasses

Key to Table 1 is on Page 8. This table has been developed in New Zealand from New Zealand information.

Insect	AR1	NEA2	AR37	Standard Endophyte	Without Endophyte
Argentine Stem Weevil	◆◆◆◆	◆◆◆	◆◆◆◆ ¹	◆◆◆◆	—
Pasture Mealy Bug	◆◆◆◆	(◆◆◆◆)	◆◆◆◆	◆◆◆◆	—
Black Beetle	◆	◆◆◆	◆◆◆	◆◆◆	—
Root Aphid	—	◆◆	◆◆◆◆	◆◆	—
Porina ³	— ²	Not tested	◆◆◆	◆	—

Table 2 - Tetraploid ryegrasses⁴

Key to Table 2 is on Page 8. This table has been developed in New Zealand from New Zealand information.

Insect	AR1	NEA2	AR37	Endo5	Without Endophyte
Argentine Stem Weevil	(◆◆◆)	◆◆	(◆◆◆) ¹	◆◆◆	—
Pasture Mealy Bug	(◆◆◆◆)	(◆◆◆◆)	(◆◆◆◆)	(◆◆◆◆)	—
Black Beetle	◆	◆◆◆	◆◆◆	◆◆◆	—
Root Aphid	— ²	(◆)	◆◆◆◆	(◆◆)	—
Porina ³	—	Not tested	(◆◆◆)	(◆)	—

Key

— NO CONTROL

◆ LOW LEVEL CONTROL: Endophyte may provide a measureable effect, but is unlikely to give any practical control.

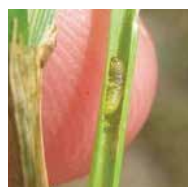
◆◆ MODERATE CONTROL: Endophyte may provide some practical protection, with a low to moderate reduction in insect population.

◆◆◆ GOOD CONTROL: Endophyte markedly reduces insect damage under low to moderate insect pressures. 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 data are needed to support the rating. Testing is ongoing.

AR37 protects against these major Australian pasture pests:



Argentine Stem Weevil Larvae



Pasture Mealy Bug



Black Beetle



Root Aphid

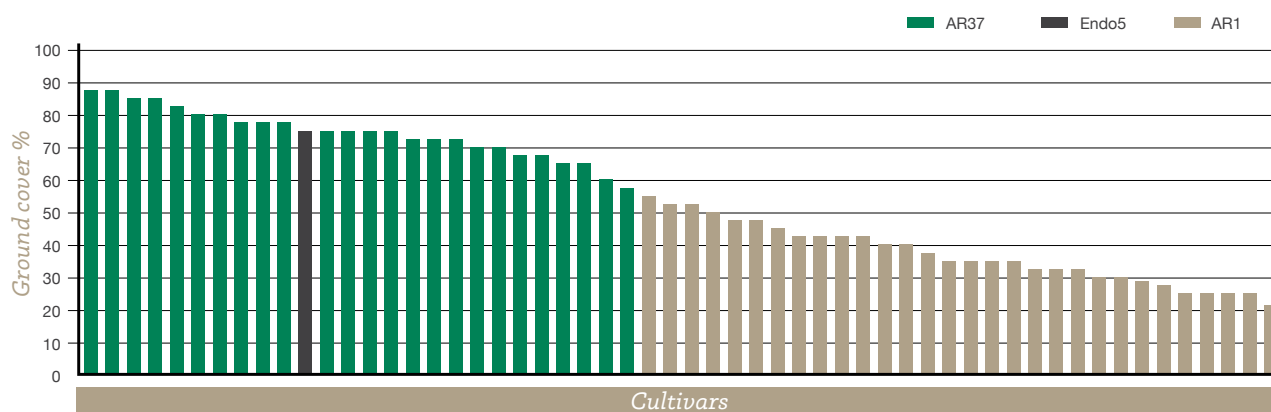
Increased dry matter performance

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, standard or nil endophytes.

Ryegrasses with AR37 show improved persistence, with higher tiller densities over time when compared to the same cultivars with nil endophyte or standard endophyte. With higher persistence the need to renew pasture due to poor pasture composition may be reduced. The resulting higher producing sward also has long-term benefits in assisting the maintenance of excellent animal performance. The dry matter production of ryegrasses with AR37 is 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 -
(Trial sown 23 April 2008, ground assessment score taken 22 February 2010)*

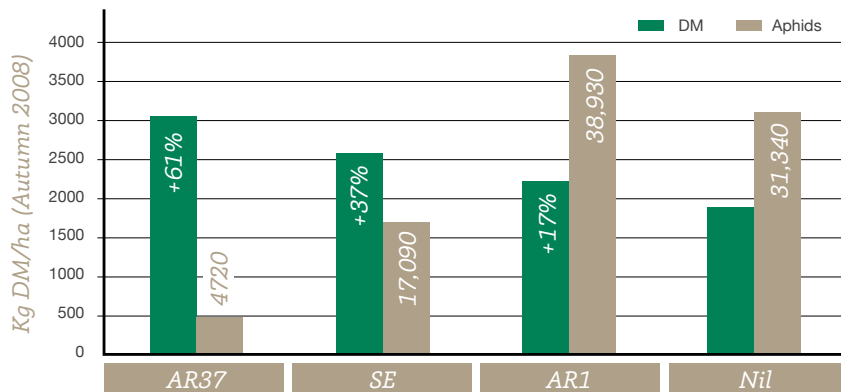


All plots were uniform and no persistence differences were evident until an infestation of Root Aphids occurred in February 2010 following a dry period in summer. Examination of the regrowth in plots at this time revealed that varieties with the AR37 endophyte were more persistent; evidenced by the greater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

Image 1. Root Aphid colonies in AR37 compared with AR1

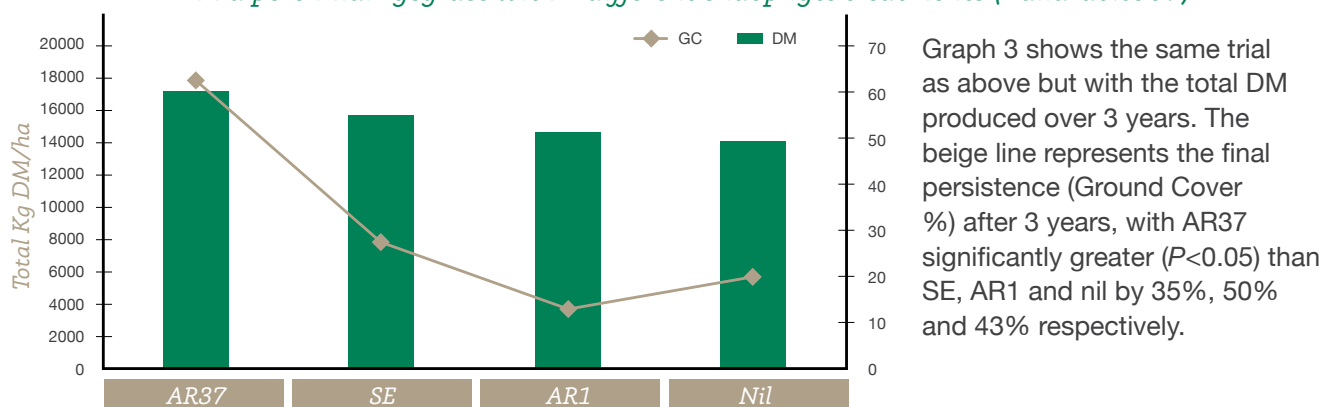


Graph 2. Dry matter yield and Root Aphid presence in perennial ryegrass with 4 different endophyte treatments (Trial sown 2007, yield assessment autumn 2008)



At Ballarat, in south-west Victoria, an agronomic field experiment with different endophyte types in the same background cultivar (mid-flowering diploid) showed significant ($P < 0.05$) differences for growth and tiller density in autumn (Graph 2). Relative to nil endophyte (endophyte-free), dry matter (DM) yields in autumn were +17% with AR1, +37% with standard endophyte and +61% with AR37, which corresponded with greater numbers of root aphids/m² in the nil (31,340) and AR1 (38,930), intermediate numbers in standard endophyte (17,090), and low numbers in AR37 (4720).

Graph 3. Total dry matter over 3 years and final ground cover % in a perennial ryegrass with 4 different endophyte treatments (Ballarat 2007)



Graph 3 shows the same trial as above but with the total DM produced over 3 years. The beige line represents the final persistence (Ground Cover %) after 3 years, with AR37 significantly greater ($P < 0.05$) than SE, AR1 and nil by 35%, 50% and 43% respectively.

Image 2. Perennial and long rotation tetraploid ryegrasses, of similar generic background, with a range of endophytes at Ballarat in February 2010 (sown April 2008)

Image 2 illustrates the differences in persistence of late season tetraploid ryegrasses due to different endophytes in the presence of common ryegrass pests.



* This image was taken at the same time as the assessment from the Graph 1 trial

Animal performance on ryegrass with AR37

Perennial and long rotation ryegrass

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

Table 3 – Livestock performance - sheep & lambs

This table has been developed in New Zealand from New Zealand information.

	AR1	NEA2	AR37	Endo5	Standard Endophyte	Without Endophyte
Freedom from ryegrass staggers	◆◆◆◆	◆◆◆◆	◆◆◆◆ ²	◆◆◆◆	◆◆ ¹	◆◆◆◆
Animal production	◆◆◆◆	◆◆◆◆	◆◆◆◆ ³	◆◆◆	◆◆ ¹	◆◆◆◆

Table 4 – Livestock performance - dairy cows & beef cattle

This table has been developed in New Zealand from New Zealand information.

	AR1	NEA2	AR37	Endo5	Standard Endophyte	Without Endophyte
Freedom from ryegrass staggers	◆◆◆◆	◆◆◆◆	◆◆◆◆ ²	◆◆◆◆	◆◆ ¹	◆◆◆◆
Animal production	◆◆◆◆	Not tested	◆◆◆◆ ³	Not tested	◆◆◆ ¹	◆◆◆◆

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.

Notes on Table 1 & 2

- AR37 endophyte controls Argentine Stem Weevil larvae, but not adults. While larvae cause most damage to pastures, adults can damage emerging grass seedlings. In Argentine Stem Weevil prone areas it is recommended to use treated seed for all cultivars with novel endophyte.
- AR1 plants are more susceptible to Root Aphid than plants without endophyte.
- 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.
- 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 control 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.

Notes on Table 3

- Standard endophyte can cause severe ryegrass staggers, can significantly decrease lamb growth rates in summer and autumn, and significantly increase dags.
- Ryegrass containing AR37 endophyte can cause severe ryegrass staggers, but the frequency of ryegrass staggers is much lower than for ryegrass with standard endophyte. One50 AR37 may give rise to higher instances of ryegrass staggers than other AR37 cultivars in some situations.
- Lambs grazing ryegrass containing AR37 endophyte can have reduced LWG during periods of severe staggers.

Notes on Table 4

- Standard endophyte can cause ryegrass staggers, and has been shown to depress milk solids (MS) production through summer and autumn.
- While ryegrass staggers has not been observed on cattle and dairy cows, it could occur on rare occasions.
- In dairy 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.



Animal health on ryegrass with AR37

Grazing management

Animal health problems caused by ryegrass with endophyte can be reduced by adjusting summer-autumn grazing management. Hard grazing to the base of pastures containing endophyte will increase the likelihood of endophyte related animal health problems.

***Note:** Although AR37 does not produce lolitrem B it can cause ryegrass staggers. Trials have shown that on average the frequency, duration and severity of ryegrass staggers is less than for standard endophyte. However on occasions, sheep (and potentially other animals) grazing AR37 ryegrass may be severely affected for short periods. To date no ryegrass staggers have been reported on any class of cattle grazing AR37 ryegrass. Due to the fact that research has only been with sheep and cattle, pasture or conserved feed made from AR37 endophyte ryegrass should not be fed to other stock classes, including deer and horses.*

Common questions

Who should use AR37?

Farmers who want improved pasture production, persistence and animal performance from their ryegrass pastures should use AR37, especially where damaging insects are likely to be present. Trials that have been undertaken to date show it is a suitable pasture for dairy cows, beef animals and can be used for sheep grazing provided farmers are aware it can cause ryegrass staggers.

Which ryegrass cultivars have AR37?

AR37 is available in a range of ryegrass cultivars from Agricom and PGG Wrightson Seeds.

To find out what will work best for you, contact your local agronomist or AR37 accredited seed retailer or see page 10.

How should AR37 pastures be established?

All existing ryegrass plants should be removed from the paddock (using spraying and/or cultivation) before planting ryegrass with AR37 endophyte. Re-establishment of old ryegrass plants will not result in failure but can reduce animal performance (if old ryegrass has standard endophyte), pasture production and possibly persistence.

AR37 is not the perfect endophyte - so what is?

The perfect endophyte would provide excellent resistance against all pasture insects leading to more persistent and higher yielding ryegrass plants, without having any potential detrimental effects on animal health and production.

At the moment AR37 endophyte is the closest to this as ryegrass with AR37 endophyte provides considerable agronomic advantages over all commercially available endophytes, however, it can cause ryegrass staggers.



Which ryegrass cultivars have AR37?

To find out what will work best for you view the following product information. For more information contact your local agronomist or AR37 accredited seed retailer.

Commercial cultivars available with AR37 endophyte:



Base AR37 – Australian bred under tough conditions

- ✓ Bred in Australia from drought surviving plants
- ✓ Excellent late season quality feed
- ✓ Very high tiller density and high dry matter production



Halo AR37 – Optimum quality all-year-round

- ✓ Very late heading date
- ✓ Good tiller density
- ✓ Strong year round growth



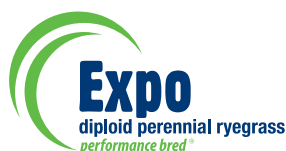
Excess AR37 – The cool season performer

- ✓ Excellent dry matter production at key times
- ✓ Diploid with Mid-season maturity
- ✓ Low aftermath heading for improved late season quality



Ohau AR37 – Quality tetraploid ryegrass

- ✓ High yielding ryegrass
- ✓ Very strong cool-season production
- ✓ Mid-late heading ryegrass



Expo AR37 – Bred for increased palatability

- ✓ Excellent late season quality
- ✓ Higher levels of water soluble carbohydrates (sugars)
- ✓ Very high tiller density



One50 AR37 – Outstanding in the field

- ✓ Long season, high yielding production
- ✓ Outstanding summer, autumn and winter production
- ✓ High quality late feed



Extreme AR37 – Persistence and high dry matter production

- ✓ Very good dry matter production
- ✓ Low aftermath heading to maintain good early summer quality
- ✓ Very high tiller density



Prospect AR37 – Versatile performer

- ✓ A dense, fine leaved cultivar
- ✓ Strong year round performer
- ✓ High total production

Aerial photo showing trials at Leigh Creek Research Station, Ballarat, Victoria. Some of these trials are used to assess dry matter production and persistence of a range of cultivars and endophyte combinations under Australian conditions.





AR37 endophyte on your farm

AR37 endophyte really does provide the answer to establishing strong and persistent ryegrass pasture, and better production on your farm. When you're renovating, simply specify one of the ryegrass cultivars with AR37 endophyte when ordering your pasture seed from your local AR37 accredited seed retailer.

Go to www.ar37.com.au for a full list of accredited retailers.



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