



ANIMAL HEALTH

NEA
ENDOPHYTES

INSECT CONTROL

SAFEGUARD YOUR STOCK

For 30 years we've been working hard to find the ultimate endophyte, one which controls insects while simultaneously giving great animal health.

The result is *NEA* endophytes. Suited to all regions of New Zealand, they provide persistent pasture for dairy cows, sheep, beef cattle and deer.

Unlike some other endophytes, *NEA* endophytes look after your stock. They have excellent animal performance with no risk of staggers in dairy cows, and a very low risk of staggers in sheep or deer. They're also effective against pests like Argentine stem weevil, black beetle and root aphid.

This makes *NEA* endophytes the obvious choice for farmers who value animal welfare.

When combined with superior ryegrasses – like *Trojan* or *Rohan* – we believe *NEA* endophytes offer the best balance of animal health and insect control you can buy. Here's our summary of how market-leading endophytes compare.

QUICK OVERVIEW - UPPER NORTH ISLAND

		Insect control		
		Great	Very good	Not recommended
Animal health	Great		<i>NEA2</i>	<i>ARI</i>
	Good	<i>AR37</i>		
	Not recommended		<i>SE</i>	

In trials animal performance of *NEA2* has been great, equal to *ARI*. We have never seen staggers on *NEA2* on a commercial dairy, beef or sheep farm, but it may cause low level staggers in extreme situations. For detail see the Animal Science section.

While *ARI* provides great animal health it is susceptible to black beetle in the upper North Island.

AR37 endophyte is great for dairy cows, but can cause severe staggers in lambs and reduce weight gain during these periods, and isn't recommended for deer or horses.

Standard endophyte (*SE*) isn't recommended as it can cause more severe staggers than *AR37* and significantly depress animal performance in summer and autumn.

QUICK OVERVIEW - REST OF NEW ZEALAND

		Insect control		
		Great	Very good	Not recommended
Animal health	Great		<i>NEA2</i> <i>ARI</i>	
	Good	<i>AR37</i>		
	Not recommended		<i>SE</i>	

In trials animal performance of *NEA2* has been great, equal to *ARI*. We have never seen staggers on *NEA2* on a commercial dairy, beef or sheep farm, but it may cause low level staggers in extreme situations. For detail see the Animal Science section.

AR37 endophyte is good for dairy cows, but can cause severe staggers in lambs and reduce weight gain during these periods, and isn't recommended for deer or horses.

Standard endophyte (*SE*) isn't recommended as it can cause more severe staggers than *AR37* and significantly depress animal performance in summer and autumn.

The science behind NEA endophytes

ANIMAL SCIENCE

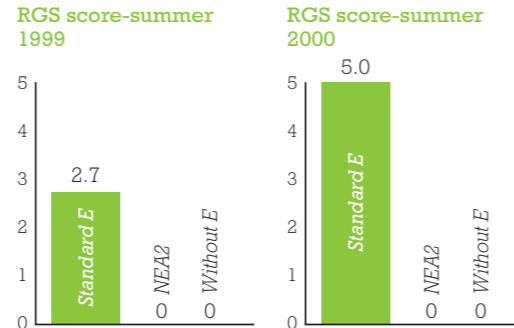
NEA big picture

- 21 separate 8 week animal trials on NEA endophytes (1999–2018).
- Animal performance on NEA2 has been great (equal to AR1).
- Very low chance of NEA2 ever causing staggers.

Barenbrug Agriseeds started testing NEA endophytes for animal safety back in 1999. At that time novel endophytes were new; endophyte science was not well understood, and our initial screening was to check if NEA endophytes were staggers free, compared to the old *Standard (SE)* endophyte.

That first trial showed very promising results, which were repeated and confirmed in 2000, and the Barenbrug Agriseeds novel endophyte programme was away.

Ryegrass staggers scores in 1999-2000
Lincoln University lamb trials*



*Scored in 0-5 Keogh scale. Where 0 = no staggers to 5 = very severe staggers. In the 1999-2000 trial the SE cultivar was Yatsyn 1, NEA2 was Tolosa, and Without Endophyte was Nui.

19 more trials have followed to further evaluate NEA endophytes, and make sure each ryegrass/endophyte combination works well from *Trojan* and *Bealey* to *Rohan* and *Viscount*.

The trials are exactly what you shouldn't do if you want good animal performance!

We grow pure ryegrass pastures up to 4 t DM/ha so they have plenty of stem and seedhead. Then we set stock them with lambs for up to 8 weeks in the hottest part of the year.

The result is truly a worst case scenario in terms of LWG, but it does give us the best test of what could go wrong.

Lambs are weighed and randomly allocated across the replicated plots. For the first 4 weeks, they eat higher ME parts of the pasture (leaf) but as time passes they are forced to graze into poorer quality material, which will be higher in endophyte alkaloids if these are present.

We assess staggers and other health indicators every day or two, and lambs are weighed at the end of the trial to assess growth. All work is done

under strict animal ethics and welfare protocols. Stock are removed to safe pasture if they suffer severe staggers, as often occurs on *SE* plots

These 21 trials show animal performance on NEA2 is consistently very good. Trial lambs have never had lower weight gain than those on the animal-safe benchmark of *AR1*.

There is only a very low chance of NEA endophytes ever causing staggers. In 21 trials, this has happened just once, in a very hot, dry summer where NEA2 caused low level staggers (1.7 Keogh score). In the same trial AR37 caused significantly more staggers (3.2 Keogh score) and lambs on *SE* were so badly affected they had to be removed from the trial 15 days earlier.

In a commercial situation, where conditions are typically better than those we create in the trials, you are unlikely to see a situation (or staggers) like this.

Overall the animal health and performance of stock grazing the NEA endophytes has proven very good.

A typical endophyte lamb trial. Each 0.3ha plot is a different endophyte. Plots are set stocked for 8 weeks to assess animal health and performance.





INSECT SCIENCE

NEA big picture

- Wide field testing backed up by 18 separate insect bioassays (1999–2018).
- *NEA2* provides good insect control across a range of pests.
- Field performance of *NEA* endophytes is enhanced by the great ryegrass genetics they come in.

Since 1999, dozens of field trials and over 1 million ha of commercial sowings have shown ryegrasses with *NEA* endophytes offer very good persistence. Part of this success is due to superior ryegrass genetics, part to the natural

cultivar/endophyte relationship, and part due to the endophytes' ability to deter insects.

Our science programme uses specific bioassays to tease out the specific mechanism behind the *NEA* endophytes' great field performance.



Black beetle can be a devastating pest – in this Waikato trial some ryegrass plots had no endophyte, and the black beetle hunted them out and enjoyed eating them.

*Argentine stem weevil have destroyed plots without endophyte (front right & back left) while *NEA* endophytes performed well (front left & back right). Photo taken February in Hawkes Bay.*

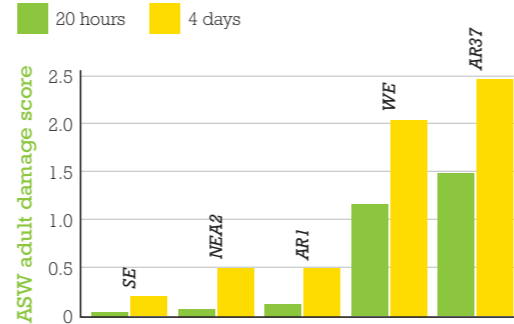
ARGENTINE STEM WEEVIL (ASW)

Endophyte control of ASW can be confusing, as it happens in two different ways.

NEA endophytes control adult ASW, stopping their feeding, and in turn preventing their egg laying, which protects the pasture. We test this by putting adult ASW on leaves with different endophytes to compare their feeding level on a scale of 0 (no feeding) to 5 (extreme damage).

NEA2 and *ARI* provided significant control of ASW adults (see graph). Whereas *AR37* or ryegrass without endophyte (*WE*) had no effect on the weevils.

ASW adult preference scores for endophytes after 20 hours and 4 days*



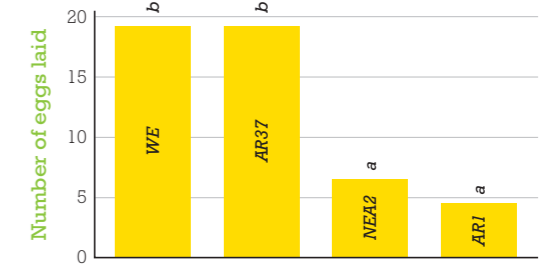
*Scores are made on a 0-5 basis:
 0 = no damage; 5 = over 80% of leaf damaged.
 LSD (5%) = 0.57 (20 hours) & 0.50 (4 days)



Given a choice, adult ASW much prefer ryegrass with *AR37* endophyte or without endophyte (far left of picture).

To measure egg laying the same number (10) adult ASW were caged onto individual plants with different endophytes. In this no-choice test significantly fewer eggs were laid on *NEA2* and *ARI* (see graph). Whereas *AR37* or ryegrass without endophyte (*WE*) had no effect on the weevils.

No-choice ASW egg laying (after 2 days)*

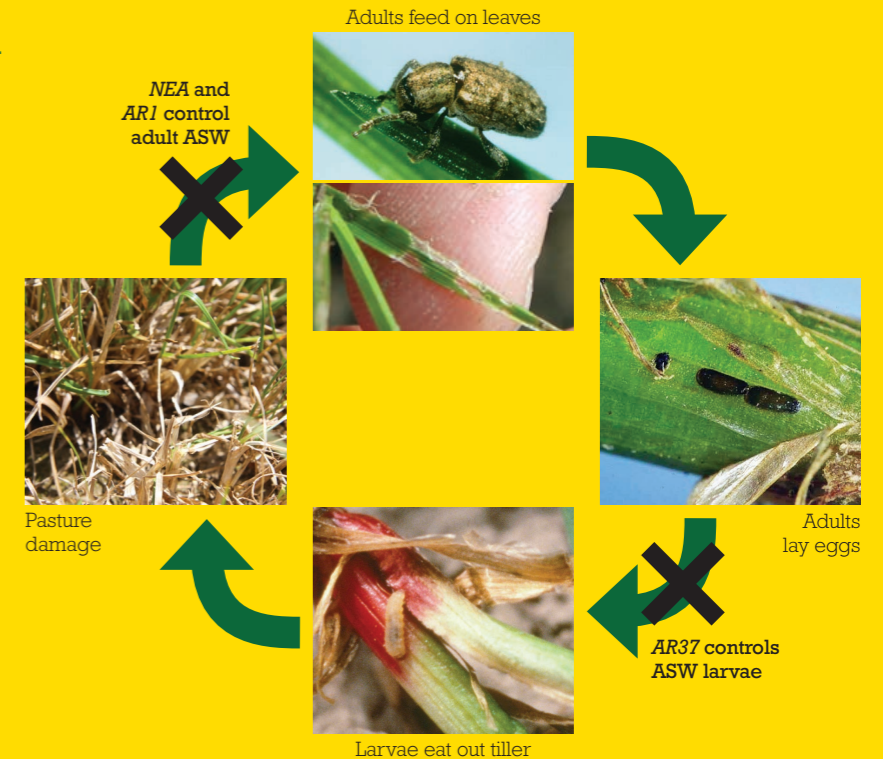


*Mean number eggs laid per plant. LSD (5%) = 3

Endophytes control Argentine stem weevil differently

NEA endophytes and *ARI* control adult ASW, preventing their feeding and egg laying, so protecting pastures.

AR37 controls ASW larvae, stopping larval feeding, so protecting pastures.

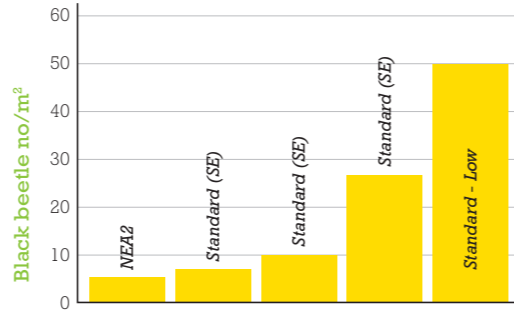


BLACK BEETLE

NEA2 gives good control of black beetle, significantly better than *ARI*. This was very evident in the upper North Island in 2000 when black beetle caused massive damage to some pastures, and *NEA2* gave a good level of control of black beetle larvae numbers in two trials at Cambridge and Ngarua.

The good black beetle control provided by *NEA2* has been recognised in industry ratings, and *AR37* endophyte has been given the same rating. *ARI* is susceptible to black beetle and can't be recommended where this is a pest.

Black beetle larvae/m² (combined results for Cambridge and Ngarua)*



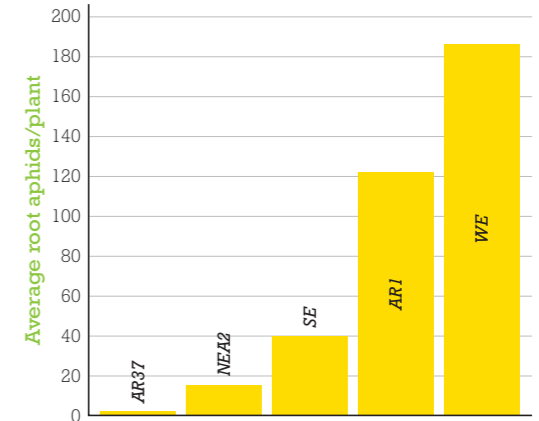
*NEA2 was in the diploid cultivar *Tolosa*, Standard endophyte (SE) was in the diploid cultivars *Impact*, *Bronsyn*, *Samson* and *Aries HD*. SED = 10.0 Significance = ***

ROOT APHID

NEA2 has been tested for root aphid, and provides a moderate level of control, similar to *SE*. This is a significantly higher level of control than *ARI*, and less than *AR37*.

Root aphid counts have been undertaken on the same ryegrass, with a wide range of endophytes as shown in graph.

Average number of root aphids/plant*



*LSD (5%) = 85



INDUSTRY RATINGS FOR ENDOPHYTES

Animals

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

Sheep & lambs

	<i>AR1</i>	<i>NEA</i>	<i>NEA2</i>	<i>AR37</i>	<i>U2</i>	<i>Standard endophyte</i>	<i>Without endophyte</i>
Freedom from ryegrass staggers	◆◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆ ²	◆◆◆◆	◆◆ ¹	◆◆◆◆
Animal performance	◆◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆◆ ³	◆◆◆◆	◆◆ ¹	◆◆◆◆

Notes on sheep & lambs table:

¹ *Standard* endophyte can cause severe ryegrass staggers, can significantly decrease lamb growth rates in summer and autumn, and significantly increase dags.

² 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.

³ Lambs grazing ryegrass containing *AR37* endophyte can have reduced LWG during periods of severe staggers.

Dairy cows & beef cattle

	<i>AR1</i>	<i>NEA</i>	<i>NEA2</i>	<i>AR37</i>	<i>U2</i>	<i>Standard endophyte</i>	<i>Without endophyte</i>
Freedom from ryegrass staggers	◆◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆◆ ²	◆◆◆◆	◆◆ ¹	◆◆◆◆
Animal performance	◆◆◆◆	Not tested	Not tested	◆◆◆◆ ³	◆◆◆◆	◆◆◆ ¹	◆◆◆◆

Notes on dairy cows & cattle table:

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 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.

Key to tables

◆◆	Moderate animal performance and health: This endophyte is known to regularly cause significant problems.
◆◆◆	Good animal performance and health: This endophyte can cause problems from time to time.
◆◆◆◆	Very good animal performance and health.

Insects

Summary These ratings are indicative and may vary slightly between cultivars. If Argentine stem weevil or black beetle are present at sowing, an appropriate seed treatment is recommended to improve insect resistance 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. These tables were compiled by AgResearch, Agricom, Barenbrug Agriseeds, Cropmark, Grasslanz and PGG Wrightson Seeds.

Endophyte insect control for perennial ryegrass, festulolium & short-term (hybrid) ryegrass.

	Argentine stem weevil	Pasture mealy bug	Black beetle adult	Root aphid	Porina	Grass grub	Field cricket
Diploid perennial ryegrass							
<i>AR1</i>	◆◆◆◆	◆◆◆◆	◆	_ ²	-	-	Not tested
<i>NEA2</i>	◆◆◆	(◆◆◆◆)	◆◆◆	◆◆	Not tested	-	Not tested
<i>AR37</i>	◆◆◆◆ ¹	◆◆◆◆	◆◆◆	◆◆◆◆	◆◆◆	◆	Not tested
<i>SE</i>	◆◆◆◆	◆◆◆◆	◆◆◆	◆◆	◆	-	Not tested
<i>WE</i>	-	-	-	-	-	-	Not tested

Tetraploid perennial ryegrass

<i>AR1</i>	(◆◆◆)	(◆◆◆◆)	◆	_ ²	-	-	Not tested
<i>AR37</i>	(◆◆◆) ¹	(◆◆◆◆)	◆◆◆	◆◆◆◆	(◆◆◆)	◆	Not tested
<i>WE</i>	-	-	-	-	-	-	Not tested

Festulolium

<i>U2</i>	◆◆◆◆	(◆◆◆◆)	◆◆◆◆ ³	◆◆◆◆	(◆◆)	◆◆◆	◆◆◆
-----------	------	--------	-------------------	------	------	-----	-----

Italian and short term (hybrid) ryegrass

<i>AR1</i>	◆◆	(◆◆◆◆)	◆	_ ²	Not tested	-	Not tested
<i>NEA</i>	Not tested	(◆◆◆◆)	◆◆◆	Not tested	Not tested	-	Not tested
<i>AR37</i>	◆◆◆ ¹	(◆◆◆◆)	◆◆◆	Not tested	Not tested	-	Not tested
<i>WE</i>	-	-	-	-	-	-	Not tested

Notes on table:

¹ *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.

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

³ Also active against black beetle larvae

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 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.

Take pasture to a whole new level.

NEA Endophytes:
Control insects while
caring for your stock.

