
***NEA4* endophyte science**

*Eight years testing on livestock, insects
and in the field*



INTRODUCTION

Barenbrug Agriseeds started testing *NEA* endophytes back in 1999. At that time endophyte science was not well understood. But that first trial showed very promising results, and the Barenbrug Agriseeds novel endophyte programme was away.

We've been testing *Maxsyn* and *NEA* the last eight years, and are pleased to release it. This booklet is a summary of some of the data on *NEA4*.

Animal safety data

Page

3 - 6

Insect control data

7 - 12



Maxsyn demo paddock showing up in North Waikato, January 2020.



Maxsyn (L) showing its summer growth at Reporoa in January 2019.



Maxsyn strip (C) doing its summer thing in the dry, Taranaki, February 2019.



Maxsyn bouncing back well after summer at Kaipaki, April 2019.



Maxsyn the middle green strip in the dry, Canterbury, January 2020.



Maxsyn is liked by all livestock! Waverley, August 2019.

NEA4 = SUPERIOR ANIMAL PERFORMANCE

NEA4 endophyte shows excellent animal performance (the same as *ARI*).

NEA4 endophyte has been tested against other endophytes in 10 separate replicated animal trial runs, from 2012 to 2019. These are 'worst case scenario' conditions, specifically designed to reveal any endophyte issues.

The trials are exactly what you should not do if you want good animal performance! We grow pure ryegrass pastures to 4+ t DM/ha so they have plenty of stem and summer seedhead. Then lambs are weighed and allocated across the plots, where they are set stocked for up to 8 weeks.

For the first 4 weeks, they eat higher ME parts of the pasture (leaf) but as time passes they graze into stem, which is higher in any endophyte alkaloids.

Lambs are weighed again at the end of the trial to assess growth. All work is done under strict animal ethics and welfare protocols.

The result is truly a worst-case scenario in terms of animal performance, but it does give the best test of any endophyte issues.

Across all the trials lambs grazing *NEA4* endophyte have shown the same liveweight gain as *ARI*, which is known for its excellent animal performance.



At the start of the trial lambs are weighed and carefully sorted into equal mobs.

NEA4 = VERY LOW CHANCE OF EVER SEEING STAGGERS

Dairy cows and beef - NEA4 provides ryegrass staggers free pasture.

Sheep and deer – Ryegrass staggers grazing NEA4 is a very low risk. In an extreme situation (i.e. summer drought where animals are forced to graze close to the ground) a low level of staggers might occasionally be seen.

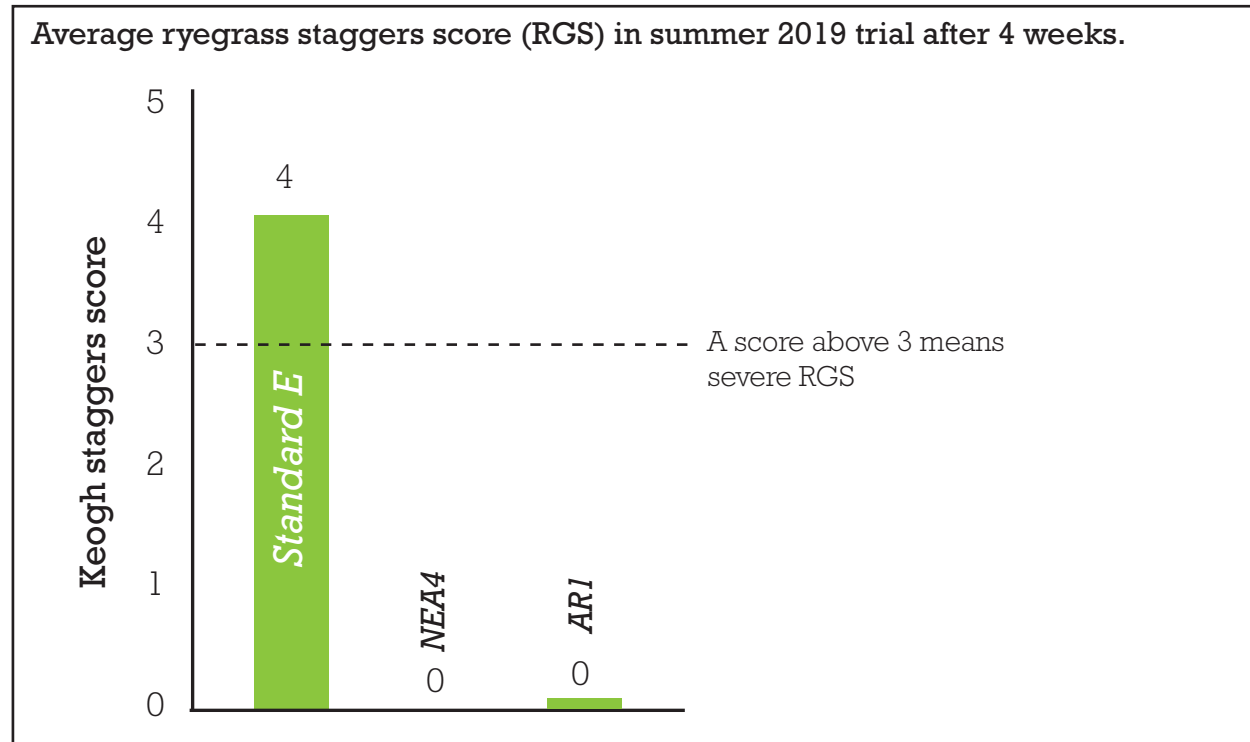
Our 'worst case scenario' animal trials are designed to cause ryegrass staggers (RGS), with pure ryegrass pasture (no clovers), grown to a very high herbage mass over summer then set-stocked for 8 weeks, or until staggers on lambs grazing *Standard* endophyte control become too serious and lambs must be removed.

RGS is scored every week by moving lambs around the plot for a set period and individually assessing them for symptoms. Animals are scored with the Keogh Scale, on a 0-5 basis, where 0 represents no symptoms, and 5 very severe ryegrass staggers. Events with an average score ≥ 3 are significant staggers events.



A plot in the 2019 Courtenay trial, halfway through the 8 week summer period. As it progresses lambs are exposed to more stems and seedheads, with higher alkaloid levels.

In the 2019 trial year we saw extreme levels of RGS in some animals after only two weeks, which is the quickest we've ever seen them. By week 4 staggers were so severe in the *Standard* endophyte plots the trial was finished early due to animal ethic considerations. No RGS was seen in lambs grazing ryegrass with *NEA4* plots. A very small level of background RGS symptoms were seen in animals on *ARI* plots which was not related to alkaloids.



This notable result for *NEA4* is backed up by previous trials in 2012/13 and 2016 where a high level of RGS was seen in lambs grazing *Standard* endophyte, and no signs in lambs on *NEA4*.

NEA4 = GOOD BLACK BEETLE CONTROL

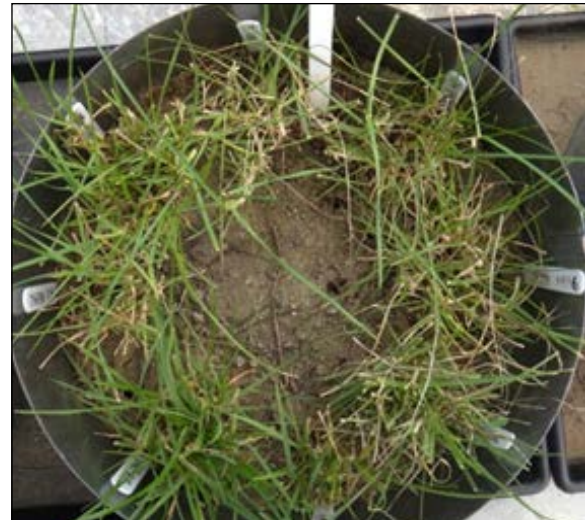
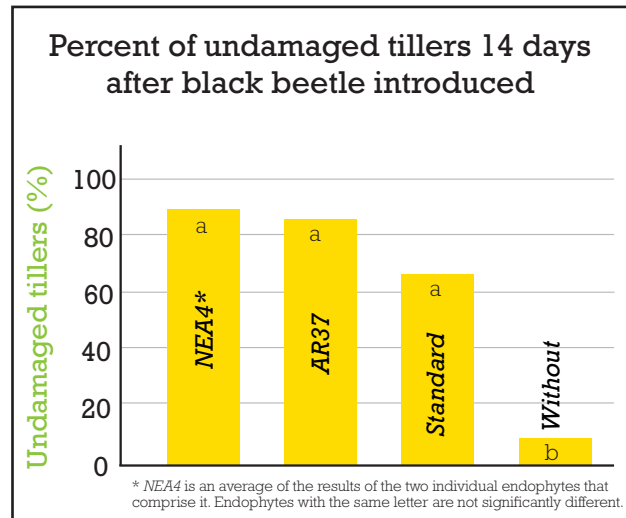
NEA4 gives a good level of black beetle control (equal to *NEA2* and *AR37*).

NEA4 endophyte provides good control of black beetle adults, limiting egg laying and larval numbers. To provide data *NEA4* has been tested both in laboratory pot trials and in-paddock under high feeding pressure.

2016 pot trial

In this trial the same diploid perennial ryegrasses, infected with a range of endophytes and *Without* endophyte (WE), were tested for control of black beetle feeding, with 15 replications.

14 days after the introduction of the black beetle, large difference in their feeding preference were seen as shown in the graph below. In WE ryegrass only 9% of tillers were undamaged, compared to 88% undamaged in the same ryegrass with *NEA4*. There was no significant difference between *NEA4*, *AR37* and *Standard* endophyte (SE).



Ryegrass containing different endophytes were sown around pots, then black beetle introduced, with a choice of plants to feed on.

2014 St Peters School field trial

In this field trial very high levels of damage were noted in autumn, and ryegrass trial plots were scored for the level of black beetle feeding.

Large endophyte differences in black beetle feeding were recorded. The plots containing *AR37*, *NEA4* and *NEA2* had less than half the feeding damage than those *WE* or with *AR1* endophyte control.

Results below are for the same perennial ryegrass cultivar containing different endophytes. 50 tillers per plot were assessed.

Endophyte	Black beetle tiller damage (%) 16th June 2014*
<i>AR37</i>	8.0 a
<i>NEA4</i>	9.5 a
<i>NEA2</i>	10.0 a
<i>Without</i>	24.9 b
<i>AR1</i>	25.2 b
Significance	***
LSD (5%)	6.1

* Endophytes with the same letter are not significantly different.

NEA4 = GOOD ARGENTINE STEM WEEVIL CONTROL

NEA4 gives good control of Argentine stem weevil (ASW)

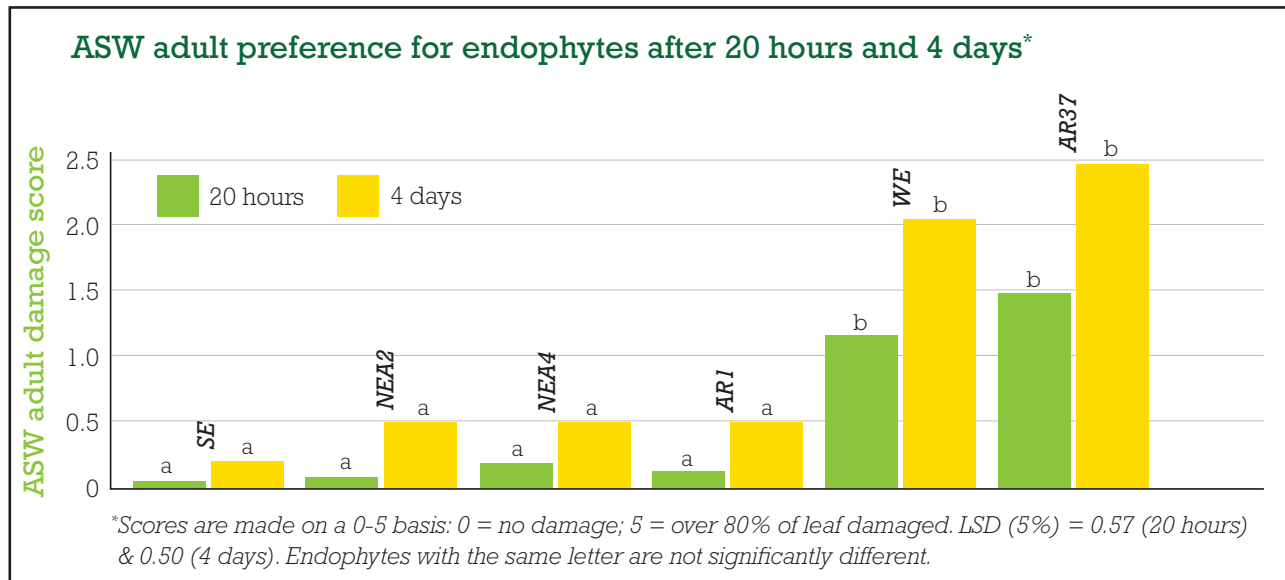
NEA4 endophyte controls ASW in two ways. First, adult ASW numbers are reduced as they don't like the natural insecticide produced by this endophyte. This reduces adult populations. Second, any remaining adults egg laying is significantly reduced. In combination these two factors limit ASW larval numbers.

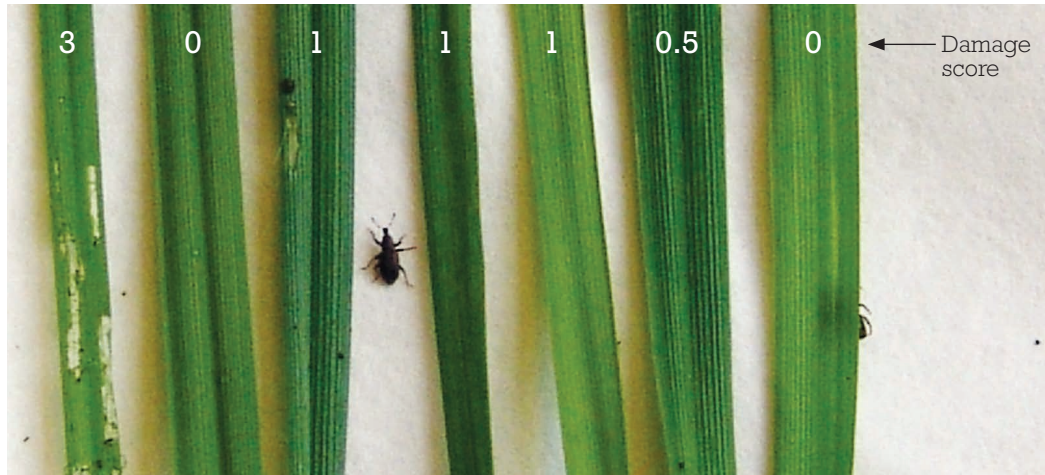
Adult ASW feeding preference

This is tested this by putting adult ASW on ryegrass leaves of the same cultivar side by side in a petri dish, each with different endophytes, to compare their feeding.

Feeding can be clearly seen on some leaves after 4 days (see picture page 9), and is scored on a scale of 0 (no feeding) to 5 (extreme damage).

NEA4, NEA2, SE and AR1 endophytes provided significant control of ASW adults (see graph). AR37 had no effect on the weevils.



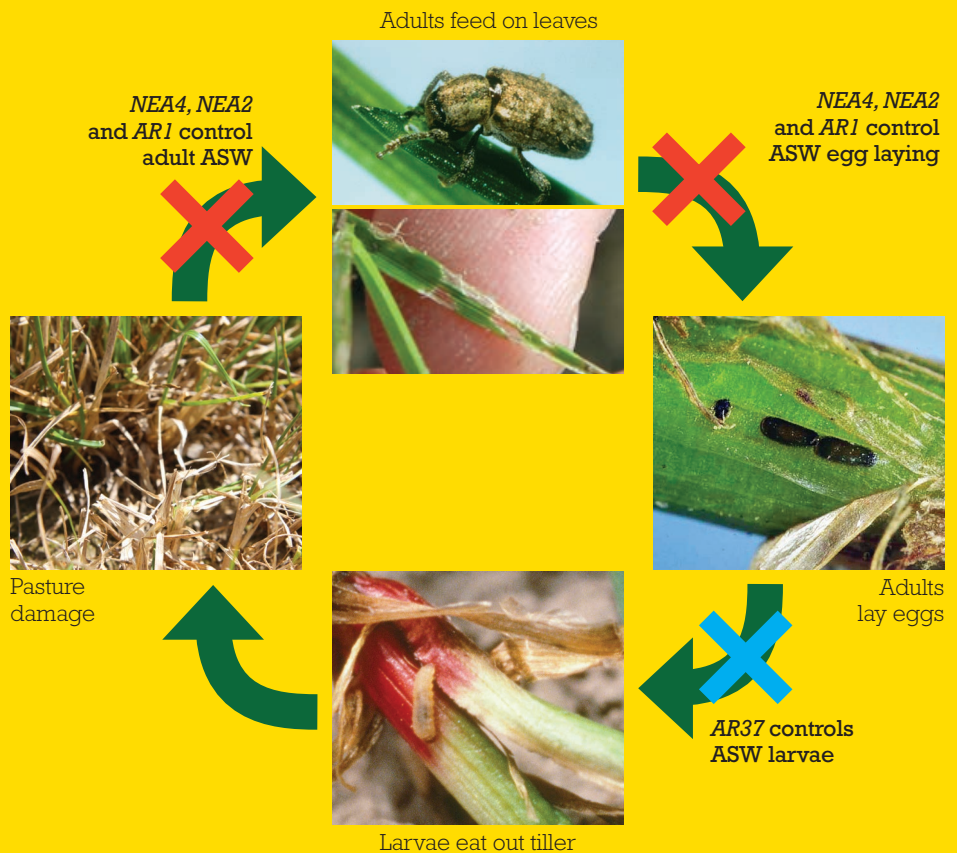


Given a choice, adult ASW greatly prefer the leaf with AR37 or without endophyte.

Endophytes control Argentine stem weevil differently

✗ *NEA* endophytes and *ARI* control adult ASW. Plus also limit egg laying, so protecting pastures.

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



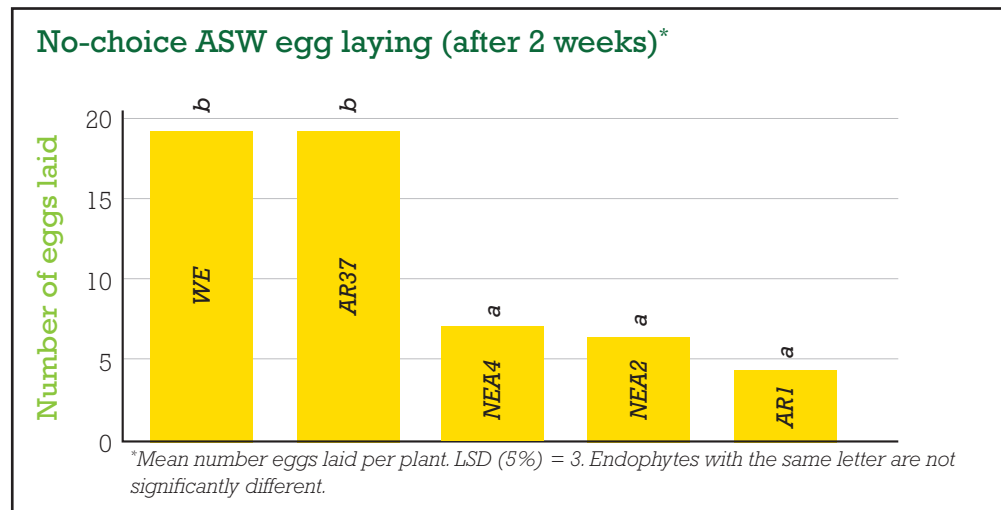
ASW egg laying control

To measure endophyte control of egg laying 10 adult ASW were caged onto each individual plant of the same ryegrass cultivar with different endophytes.



Each plant had 10 adult ASW caged onto it, and after 2 weeks the number of eggs laid were counted.

NEA4, NEA2 or AR1 reduced egg laying by about two thirds (see graph). Conversely *AR37* or *WE* ryegrass had no effect on the egg laying.

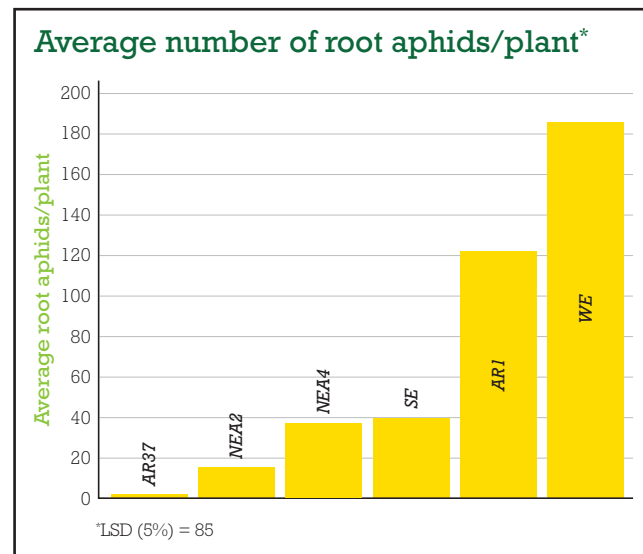


NEA4 = MODERATE ROOT APHID CONTROL

NEA4 gives moderate control of root aphid (significantly better than *AR1*).

NEA4 has been tested for root aphid, and provides a moderate level of control, similar to both *NEA2* and *SE*. This is a significantly higher level of control than *AR1*, but less than *AR37*.

In the trial the same perennial ryegrass, with a range of different endophytes, had root aphid colonies both inside and outside their planter bags (see photo). These root aphids were recovered and counted.



NEA4, *NEA2*, *AR37* and *SE* ryegrass all had significantly fewer root aphids than ryegrass with either *AR1* or *WE*.