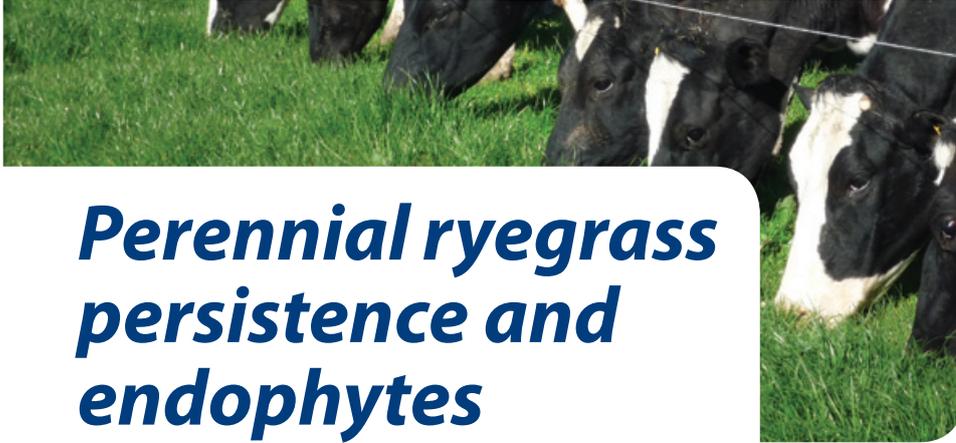


Forage Focus



Perennial ryegrass persistence and endophytes

Farming Systems

Pasture Persistence

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- Improved drought tolerance
- Improved pest tolerance
- Improved heat tolerance
- Increased dry matter performance

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Understand more about the technical aspects of ryegrass persistence and associated characteristics.

Defining persistence

'Persistence' is not a stand-alone, discreet, trait and ryegrass survival can be due to a complex of characteristics which, under different circumstances, may aid survival.

Drought tolerance

The ability to conserve moisture by summer dormancy, typified by Australian types of ryegrass (e.g. Victorian ryegrass), is an effective strategy as is the ability of Spanish types of ryegrass to respond rapidly to summer rain and replenish root reserves, which also improves their ability to survive long dry periods.

Heat tolerance

The link between heat tolerance and drought tolerance is ill-defined but some varieties do seem to survive long hot droughts better than others irrespective of endophyte status. Experiments have indicated that tetraploids persist better than diploids with similar genetics and endophytes in un-grazed small plot trials in hot environments (PGG Wrightson Seeds Banquet® versus Impact at Maryborough in 2003).

Summer dormant varieties will also tolerate extreme heat better than varieties which remain active.

Graze tolerance

It is apparent that some varieties are either more tolerant of close grazing or are not grazed as hard as others. Perhaps due to high levels of endophyte alkaloids, a lower and denser growth habit or lower palatability.

It is possible, although hard evidence is lacking, that tetraploids may not persist as well as diploids under hard and constant grazing. However, in many experiments where tetraploids are reported as not persisting as well there has been no effort to eliminate selective grazing pressure - and tetraploids are more palatable and therefore grazed harder.

Insect tolerance

We have seen no evidence that selection for persistence will improve insect tolerance in the absence of endophytes.

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Seedling recruitment

In marginal ryegrass environments the ability to set viable seed is an extremely important component of 'persistence', as shown in the dry years of 2003 and 2004 at trials in Maryborough, Victoria. Under such circumstances early maturity is the most important determinant of viable seed and PGG Wrightson Seeds Fitzroy is therefore probably the most 'persistent' ryegrass in many areas. However, some softer Kangaroo Valley types with nil endophyte may die out before an adequate seed bank has been established and recruitment can be poor, as was seen at our research farm in Ballarat in the 2005 experiments. Experiments at the Department of Primary Industry, Hamilton have shown how important this characteristic can be (PhD thesis Rachel Waller) and generally the Australian types are much better (largely because they are earlier) than New Zealand types in this regard.

Characteristics associated with persistence

Dense fine leaves

New Zealand plant breeders have selected varieties based on plant architecture which should be able to tolerate close grazing by sheep. No doubt this characteristic does confer improved persistence under some circumstances but it does not over-come pest or drought problems and such varieties when tested in Australia with the AR1 endophyte have persisted poorly.

Summer dormancy

Australian ecotypes are summer dormant and don't respond to occasional summer showers. Although it is can be difficult to isolate the wild type endophyte benefit with some varieties, this characteristic seems to be associated with improved persistence in harsher environments - but it does come at a cost. These varieties respond slowly to the autumn break which means that not only do they not provide a useful 'green pick' in autumn (very important here in providing protein to rumen bugs so they can digest dry carryover grass), but they also go into winter with insufficient leaf area to photosynthesise efficiently and consequently winter growth is very poor.

Experiments at our research centre in Ballarat, where persistence is closely correlated with pest resistance, have shown that higher yielding cultivars based on material from North West Spain persist just as well as the much lower yielding Australian types, and persist much better if those Australian types have no endophyte.

Early to mid season Australian types with poor after-math heading and dormancy after heading do not provide quality feed in December when it is in great demand for finishing stock.

The recent focus by dairy farmers on leaf number, quality and stocking rates have not allowed plants to mature and replenish energy reserves as much as they used to and reports by dairy advisers suggest that, under these circumstances, Australian types may not persist any better than Spanish types. The reverse is likely to be true in the sheep beef zone with extensive periods of set-stocking where the Australian types with an effective endophyte do persist better.

While rust susceptibility may not be inevitably associated with Australian ryegrasses, those currently on the market seem to be extremely susceptible to rust which, in some years, significantly reduces their value.

After-math heading (AMH)

A prolonged seeding period will improve the chances of maintaining a seed bank. Selecting for improved AMH has significantly improved the summer feed quality of our newer varieties and enables varieties like Extreme® to provide quality feed through December equal to varieties 3 or 4 weeks later in maturity. However, varieties with good AMH may not persist as well as similar maturity Australian types and it seems likely that the extra growth during the start of summer may be a factor limiting its persistence – a cost that in some situations is considered to be worthwhile.

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Prolific and early seeding

In very marginal areas early maturity and prolific seed production (and poor AMH) are useful characteristics. Sometimes there are suggestions that seedling recruitment is not important, but there is evidence that it is important in Australia. At the our research site in Maryborough, early maturing Australian types both persist better and recover better (from seedlings) after a long drought. In this largely pest free environment the Australian types have an advantage irrespective of endophyte status but in an area with pest pressure it is the endophyte which determines persistence.

Reports from New Zealand that there is no evidence that older cultivars persist any better than new cultivars are supported by our observations in good ryegrass country where persistence is largely a product of endophyte effectiveness. However in marginal country this is not the case, as seed set and summer dormancy are very important to persistence (if we include seedling recruitment in our definition of 'persistence').

Effective endophytes

Within the regions where perennial ryegrass is adapted, it is common to see damaging populations of pasture pests, for which endophyte can play a role. While not every pest of pasture is controlled by endophytes, there are a number of important pests which are prevalent in many regions which affect persistence or perennial ryegrass.

Although it may appear counterintuitive, the presence of an effective endophyte is more important in good ryegrass country than it is in marginal country. With high rainfall, well-structured soils, plenty of summer growth (providing a green bridge for pests) and many paddocks of ryegrass to host pests, pest numbers will be greater. In harsh, lower rainfall areas where very few ryegrass paddocks exist, and little green growth is present over summer to maintain pest life cycles, few ryegrass pests exist.

While the presence and prevalence of insect pests is variable within regions and years, there are a few ryegrass areas where it could be claimed that pest pressure is minimal. However even on those areas there are occasionally damaging populations of pests, and when it does occur the most likely pests are Black Beetle and root aphid.

We have seen nil endophyte Australian types of ryegrass persist better than New Zealand types in harsh environments in the absence of pests, and in some 'pest free' years in good ryegrass environments. However nil endophyte ryegrasses do not persist in the presence of significant pressure from ryegrass pests irrespective of their breeding.

So at our Maryborough trial site we find very few benefits from endophytes and major benefits from summer dormancy and seedling recruitment. Only in marginal areas, where ryegrass is of limited value (compared to other pasture species), are endophyte benefits minimal, even though old pastures invariably contain endophyte in this zone too. (Locusts can certainly be problems in marginal areas and are well controlled by endophytes but they occur infrequently and are leaf grazers, like sheep, and don't suck sap or burrow into stems leading to plant death).

In areas where ryegrass is frequently sown and an important species effective endophytes can be essential for its persistence. PGG Wrightson Seeds consider that the only two commercially available endophytes which are both effective in controlling our major pests are AR37 and Endo5. Recent trials have shown that in 'soft' years with low pest pressure, AR1 can be as productive as other endophytes. However in years and locations where pest pressure is high, AR1 does not provide sufficient pest protection and, whether it is in a summer dormant Australian type or a New Zealand type, stand life is likely to be reduced from either Black Beetle or root aphid pressure.

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Effective endophytes continued

Dairy farmers may have come to accept a two to three year stand life of a highly productive pasture as an acceptable trade off for improved quality but sheep farmers will not. It should be noted that in regions where there are occasional damaging populations of pasture pests, or where there is any doubt as to the prevalence of those pests mentioned above, AR37 endophyte should be used as an 'insurance policy' as through higher insect resistance than AR1 endophyte, AR37 supports perennial ryegrass cultivars to be more productive and persistent.

Recent trials run by the Victorian Department of Primary Industries, when considered with other agronomic trials, PGG Wrightson Seeds suggest that AR37 is probably the best endophyte for dairy, coupling together good pest protection with seasonal production, animal safety and persistence.

Endo5 contributes strong pest protection and persistence and has a useful combination of seasonal production and animal safety.

Ploidy

In the mid 1970's the Victorian Department of Agriculture evaluated a number of English tetraploids in Victoria. They persisted very poorly and led to the belief that all tetraploids persist poorly. With hindsight we would not expect a nil endophyte northern European ryegrass to persist in Victoria, irrespective of ploidy. Those who have experienced poor persistence from hybrids often tend to blame the ploidy but in recent years the introduction of tetraploids based on North-West Spanish germplasm has shown that they can be more persistent than equivalent diploids, providing grazing is managed correctly.

PGG Wrightson Seeds Banquet® II with Endo 5 endophyte has consistently been amongst the most persistent varieties in our trials and a number of experienced consultants have reported how impressed they are with its persistence.

However Base perennial ryegrass with AR37 endophyte was selected from drought surviving parent plants at the Maryborough trial site, and coupled with its endophyte will be a strong contender.

Selection for persistence

Selection based on plant architecture or structural characteristics which are considered to be important for persistence may only provide improved grazing tolerance but breeding from individuals which have survived droughts is quite likely to provide a broader genetic improvement. It seems that to select drought tolerant plants you need to have a drought and the gain may come from unseen metabolic differences, summer dormancy or, conversely, plants which are more vigorous and monopolise the limited moisture. The variety, Base from PGG Wrightson Seeds, was selected from a very small number of drought survivors and it has proven to be amongst the most productive ryegrasses we have ever tested, demonstrating that persistence is not necessarily based on summer dormancy and low yields.

Lets Grow Together

Planning your forage and seed requirements in advance can make a big difference to your productivity. For over 75 years PGG Wrightson Seeds have been working with farmers to get the balance right.

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