

INCIDENCE OF ENDOPHYTES IN SEED LINES AND THEIR CONTROL WITH FUNGICIDES

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Abstract

Two seed transmitted endophytic fungi occur in many New Zealand ryegrasses. The percentage of viable endophytes in commercial seed is influenced by the incidence of endophytes in cultivar parent plants and the seed storage conditions. Endophytes may be killed in infected plants by drenching benomyl into the soil around plants or by spraying prochloraz on the foliage. Infected seed can be treated with 1g of prochloraz/kg of seed to kill the endophytes.

Keywords: Endophytic fungi, ryegrass staggers, seed transmission, fungicides.

Two endophytic fungi have been isolated from New Zealand ryegrasses. The more common fungus is an *Acremonium* species, the other is sterile and has not yet been identified. Whether either or both of these fungi are involved with ryegrass staggers is uncertain.

Endophyte mycelium occurs systemically throughout all parts of the infected ryegrass plant including the seed. When this seed germinates the fungal mycelium grows into the developing shoots and roots. Seed transmission may be the only way in which these fungi can spread since attempts to infect ryegrasses with them have always been unsuccessful. If plants do become infected in the field, evidence suggests that the rate is not high. Several mown swards and one pasture of perennial ryegrass have been found which were free of endophytes 4 years after establishment. The incidence in pastures of plants with endophyte may increase however through reseedling from infected plants or through hay transferred from infected pastures.

It has been known for many years that endophyte mycelium in infected seed dies if seed is stored at room temperature for 18-24 months (Neill 1940). Thus, the infection cycle is broken and endophyte-free pastures will result from sowing this stored seed. Recently endophytes in infected seed have been found to remain viable for at least 15 years if the seed is stored at temperatures of 0-5°C and at low humidity. Storage conditions play an important role in determining the incidence of endophyte in seed lines.

Many of the parent plants of DSIR perennial and hybrid ryegrass cultivars are infected with endophytes. Table 1 shows that only the parents of Ruanui, Manawa and the new Italian ryegrass selection do not contain endophytes. Ruanui is free of infection because a fresh nucleus isolation of seed was made from progeny of the original parents using nucleus seed that had been stored for 10 years. This seed was low in germination and presumably the endophytes were dead. (H.S. Easton, pers comm.) Italian ryegrass appears to be resistant to endophyte and the hybrid Manawa, which is closer to Italian than to perennial ryegrass, is also resistant. Parents of the other two hybrid ryegrasses have a high incidence of endophyte. Both cultivars are backcrosses between perennial ryegrass and Manawa.

Table 1: INCIDENCE OF ENDOPHYTES IN RYEGRASS CULTIVAR PARENT PLANTS AND IN 33 COMMERCIAL SEED LINES OF NEW ZEALAND RYEGRASSES.

	Parents with endophyte (%)	Average per cent endophyte in seed lines (mean %)
<i>L. perenne</i>		
'Grasslands Nui'	91	30
'Grasslands Ruanui'	0	3
Grasslands new selection	100	—
'Yates Ellett'	—	86
uncertified	—	64
<i>L. perenne</i> x <i>L. multiflorum</i>		
'Grasslands Ariki'	75	0
Grasslands new selection	100	—
'Grasslands Manawa'	0	1
<i>L. multiflorum</i>		
'Grasslands Paroa'	—	0
Grasslands new selection	0	

Because these endophytic fungi are seed transmitted it would be expected that commercial lines of these cultivars would reflect the endophyte status of the parents. This is not the case. From the percentage of seeds infected with endophyte in each of 33 commercial lines of ryegrass seed (Table 1) it can be seen that endophyte infection is very different from that in the cultivar parents. The explanation lies in the mechanics of the seed certification process. Parent plants of a cultivar are grown in an isolation glasshouse and the flowers cross-pollinated. Part of the seed from this nucleus isolation is sown for multiplication immediately on the DSIR farm, and the remainder is stored under varying conditions during the next 2-8 years. The precise storage conditions and age of seed will influence the viability of endophytes in the nucleus isolation seed and ultimately the incidence of endophyte in lines of seed derived from it. The absence of endophyte in commercial lines of Ariki seed is due to the fungi dying in the nucleus seed during storage. Fresh nucleus seed was harvested from the parent plants several years ago and commercial lines of Ariki, high in endophytes, will soon be available.

Unless there are compelling reasons to grow endophyte infected ryegrasses one can probably avoid ryegrass staggers by having endophyte-free pastures. It is possible to kill endophytes in infected plants by spraying them with systemic fungicides but the quantities of chemical required make the spraying of pastures uneconomic. As the main source of endophyte infection in pastures is from sowing infected ryegrass seed, the remedy is to sow seed which is free of endophytes.

Endophyte-free seed can be obtained by several means. The most satisfactory method is to ensure that parent plants of cultivars are free from these fungi so that certified seed derived from these plants will also be endophyte-free. Systemic fungicides can be used to eradicate endophyte mycelium from parent plants. This has been accomplished by growing infected plants in pots and drenching the soil around plants with benomyl. All trace of fungus has disappeared within two months. Another method is to spray a 1% solution of the systemic fungicide prochloraz on plants to kill the fungi. Seed produced by these chemically treated plants will be endophyte-free.

If commercial seed lines are infected with endophytes the fungi can be killed in several ways. The seed can be stored at room temperature for 18-24 months or else soaked in hot water at 57°C for 15 minutes. Neither method is very practical and seed germination is reduced. The most effective method is to treat seed with systemic fungicides such as prochloraz applied at 1g per kg of seed. At this rate the fungicide is mildly phytotoxic, seedling emergence is delayed 2-3 days and the primary leaves may be distorted slightly. However, plants soon recover from this temporary check.

In conclusion, it is apparent that many commercial lines of perennial ryegrasses in New Zealand have a high incidence of endophytes. If it is thought desirable to sow endophyte-free seed the simplest way to obtain such seed is to ensure that cultivar parent plants are free of endophytes. This may be achieved using systemic fungicides.

REFERENCE

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