Proceedings of the New Zealand Grassland Association 48: 137-141 (1987)

EVALUATION OF FOUR PERENNIAL RYEGRASS CULTIVARS IN NEW ZEALAND

G.A. KERR
Yates Research. Christchurch

Abstract

Four perennial ryegrass (*Lolium perenne)* cultivars have been evaluated at a range of summer-autumn drought prone sites in New Zealand. Evaluation has been carried out at seven replicated large plot grazing trials sown with clover and one trial without clover evaluated under mowing.

The cultivars with a low level of lolium endophyte (*Acremonium loliae*) infection, Ruanui and the majority of Nui lines, have displayed poor persistence. In summer-autumn dry areas, sowing seed with a high endophyte content appears the only alternative to obtain a persistent perennial ryegrass pasture.

Within the high endophyte cultivars (Yatsyn 1, Ellett and some Nui lines), Yatsyn 1 has performed consistently well in terms of long term yielding ability, indicating persistence.

Keywords: *Lolium* perenne, endophyte (*Acremonium loliae*), *annual* yields, seasonal *yields,* Ruanui, Nui, Ellett, Yatsyn 1.

INTRODUCTION

Perennial ryegrass will always have its place in the farming industry. Its ability to withstand heavy grazing and pugging gives flexibility to a management system, and its long term yielding ability reduces resowing costs.

As a large seed company centred in New Zealand, our work has been targeted towards a market demand. Perennial ryegrass seed volume dressed annually is around eight and a half thousand tonnes (NZ Official Yearbook 1985), with much of this tonnage being retailed in the drier east coast regions of New Zealand (Yates Company Report). As a consequence ryegrass cultivar evaluation sites have been positioned throughout New Zealand in generally summer-autumn drought prone east coast regions.

METHOD

Eight trials have been run in a range of sites in New Zealand to agronomically assess Grasslands Ruanui and Nui along with Yates Ellett and Yatsyn 1 perennial ryegrass cultivars (Table 1).

Table 1: List of Trial sites and districts including the period of trial and soil type at each site.

Trial Site	District	Trial Period	Soil Type
Glenbrook	South Auckland	1981.83	Patumahoe clay loam
Takapau	Hawkes Say	since 1983	Matapiro silt loam
Halkett	Central Canterbury	1981-83	Waimakariri shallow sandy loam
Porters Pass	Central Canterbury	since 1982	Lismore silt loam
Aylesbury	Central Canterbury	since 1983	Lismore silt loam
Lyndhurst	Mid Canterbury	1982-84	Lyndhurst silt loam
Lyndhurst	Mid Canterbury	since 1984	Lyndhurst silt loam
Hinds	Mid Canterbury	since 1982	Reconstituted border-dyke soil. Irrigated.

The trials have been sown in randomised complete block designs and, with the exception of the Lyndhurst 1984 trial, have had the same method of assessement. All cultivars have been sown in 4 replications in plots 12 by 12 metres in size, at 20 kg/ha of ryegrass and 3 kg/ha of Huia white clover.

Yield assessments with subsampling for dry matter determinations and herbage dissections have been carried out, on average, eight times each year when the sward height of the best cultivar has reached 7-10 cm. Each plot was assessed for yield by mowing a 10 m x 50 cm strip, using a 3-bladed reel mower adjusted to a cutting height of 1.5-2 cm. To prevent resampling of any area in a particular year, the mowing strip was shifted across the plots by 1 metre at each consecutive cut.

Large numbers of stock are used after mowing to prevent selectivity of grazing while exposing the trials to the animal effect and effectively pre-trimming the trial to a grazing height of less than 1.5 cm.

The Lyndhurst 1984 trial has been planted without clover in a randomised complete block design with 12 replicates. The plots are 10 m x 2 m in size with a strip eight square metres being mown for yield assessment. The entire plot is then pre-trimmed using a rotary mower.

The trials have had 2 equal applications of fertiliser a year with an annual application of 40 kg/ha nitrogen, 33 kg/ha phosphate and potassium and 3 kg/ha sulphur.

Since 1983 the level of infection with lolium endophyte (*Acremonium loliae*) has been assessed using the lactophenol cotton blue staining procedure. Thirty leaf sheath samples per cultivar were assessed for presence of endophyte (Neill 1941) at the Aylesbury trial after emergence (Table 2). These are the same seed lines that were sown at Takapau. For the 1984 Lyndhurst trial, a random sample of 20 seeds were tested for endophyte (adaptation of technique from Williams et *al.* 1984) prior to sowing.

Table 2: Endophyte levels of cultivars.

Trial	Cultivar	% of plants Infected with endophyte
Aylesbury and Takapau	Nui	9
	Nui (high endophyte)	51
	Ellett	77
	Yatsyn 1	70
Lyndhurst (1984)	Ruanui	5
	Nui (high endophyte)	85
	Ellett	95
	Yatsyn 1	100

The ryegrass yield results have been divided on an annual and seasonal basis, with seasons defined as

Spring – September, October, November
Summer – December, January, February
Autumn – March, April, May
Winter – June, July, August

In cases where the trial has been run for 3 years or more, the seasonal yield results do not include the first years data, minimising establishment variability.

Means tests on annual and seasonal data has been carried out using Duncans new multiple range test, at the 5 percent significance level. Where no statistically significant differences occurred, no Duncan's test is indicated.

RESULTS AND DISCUSSION

Evaluation of perennial ryegrass cultivars has been targeted to supply information to the largest market demand within New Zealand, namely summer and autumn drought prone farmers. The main requirement of a cultivar is for long term high yield. The sale of perennial ryegrasses far exceeds that of annual or short rotation ryegrasses (NZ Official Yearbook 1985) so it is essential to adequately assess perenniafity or persistence in these environments.

Table 3. Mean ryegrass yields presented annually (relative to Ellett = 100)

Site	Cultivar	Year 1	Year 2	Year 3	Year 4
Glenbrook	Yatsyn 1	96	107a		
	Ellett	100	100a		
	Nui	104	82b		
	kgDM/ha Ellett	4944	5076		
Takapau	Yatsyn 1	96	97	108	
	Ellett	100	100	100	
	Nui*	92	97	101	
	kgDM/ha Ellett	6006	6895	8810	
Halkett	Yatsyn 1	103	115a		
	Ellett	100	100ab		
	Nui	108	88b		
	kgDM/ha Ellett	2052	3834		
Porters Pass	Yatsyn 1	107	10%	95a	105a
	Ellett	100	100ab	100.3	100a
	Nui	105	93ab	72b	77b
	Ruanui	102	84b	65b	66b
	kgDM/ha Ellett	2811	7175	6576	9312
Aylesbury	Yatsyn 1 (70)	99	106	111a	
	Ellett (77)	100	100	100a	
	Nui* (51)	104	100	96a	
	Nui (9)	89	86	57a	
	kgDM/ha Ellett	5803	5384	3977	
Lyndhurst (1982)	Yatsyn 1	111a	104a		
	Ellett	100a	100a		
	Nui	72b	81b		
	Ruanui	69b	68b		
	kgDM/ha Ellett	1965	8428		
Lyndhurst (1984)	Yatsyn 1 (100)	106a	105		
	Ellett (95)	100a	100		
	Nui* (85)	96a	99		
	Ruanui (5)	55b			
	kgDM/ha Ellett	4543	5552		
Hinds	Yatsyn 1	106a	106a	114a	124a
	Ellett	100ab	100a	100a	100b
	Nui	79c	88ab	69b	59c
	Ruanui	92b	77b	68b	52d
	kgDM/ha Ellett	4695	9268	5216	3796

* Nui high endophyte (Figures in brackets from Table 2)

A good estimate of persistence may be obtained by considering cultivar yields from the third year after seeding (Table 3).

Major differences in persistence between the perennial ryegrass cultivars can be attributed to the presence or absence of lolium endophyte (*Acremonium loliae*). The cultivars Yatsyn 1 and Ellett consistently contained a high level of endophyte, Ruanui a low level and Nui a variable level (Table 2). This agrees with the results obtained from endophyte testing of commercial Ellett, Ruanui and Nui ryegrass lines (Scott 1983). In the trials, the perennial ryegrasses with a high level of infection with the endophyte fungus have significantly outyielded the cultivars containing a low level of endophyte at all sites except Halkett, where Ellett and low endophyte Nui were no different (Table 3). Lolium endophyte has been found responsible for increased yield and persistence in other trials (Barker et *al.* 1986; Prestidge *et* al. 1985). This has been attributed to endophyte conferring resistance to a range of insects (Gaynor et *al.* 1986). Within the high endophyte cultivars, no differences in long term yielding ability were significant, except at Hinds where in the fourth year Yatsyn 1 outyielded Ellett (Table 3).

Relative differences between cultivars in seasonal yields were not consistent over all sites (Table 4). However the main differences were between cultivars with different endophyte levels and occurred in the summer and autumn periods, often carrying over into the following seasons. At this time of the year pasture supply seldom meets livestock requirements, so extra herbage production can be fully utilised. Within high endophyte cultivars, seasonal yield differences were generally not significant, however, Yatsyn 1 demonstrated superior autumn yield over Ellett at Lyndhurst (1984) and Hinds, and over Nui (high endophyte) at Lyndhurst (1984), and superior winter yield over Ellett at Halkett (Table 4).

Table 4: Mean ryegrass yields presented seasonally (relative to Ellett = 100)

Site	Cultivar	Spring	Summer	Autumn	Winter
Glenbrook	Yatsyn 1	94	117a	102	102
	Ellett	100	100a	100	100
	Nui	91	78b	95	99
	kgDM/ha Ellett	1371	824	1175	1263
Takapau	Yatsyn 1	95	108	110	107
	Ellett	100	100	100	100
	Nui'	93	97	103	111
	kgDM/ha Ellett	2854	2084	1205	1463
Halkett	Yatsyn 1	115	90	105	143a
	Ellett	100	100	100	100b
	Nui	108	81	85	103b
	kgDM/ha Ellett	1874	683	656	276
Porters Pass	Yatsyn 1	103a	99a	103a	102a
	Ellett	100a	100a	100a	100a
	Nui	85b	74b	84b	78b
	Ruanui	79b	60b	78b	69b
	kgDM/ha Ellett	2303	2182	953	1585
Aylesbury	Yatsyn 1	103	113a	104a	106a
	Ellett	100	100a	100a	100ab
	Nui'	93	96a	105a	94ab
	Nui	62	57b	63b	85b
	kgDM/ha Ellett	1926	1101	842	671
Lyndhurst (1982)	Yatsyn 1	99	97a	125	139
	Ellett	100	100a	100	100
	Nui	93	65b	78	68
	Ruanui	81	52c	70	65
	kgDM/ha Ellett	1726	2069	1312	122
Lyndhurst (1984)	Yatsyn 1	98a	108a	113a	114a
	Ellett	100a	100a	100b	100a
	Nui'	96a	97a	99b	125a
	Ruanui	68b	61b	48c	76b
	kgDM/ha Ellett	2164	1353	1369	321
Hinds	Yatsyn 1	105a	118a	128a	97ab
	Ellett	100ab	100a	100b	100a
	Nui	75c	58b	98b	68c
	Ruanui	81bc	50b	68c	71 bc
	kgDM/ha Ellett	3104	1326	1175	382

' Nui high endophyte

White clover yields in the trials were small and usually inversely related to ryegrass yields, With more vigorous perennial ryegrasses, this has highlighted the importance to obtain spring control of pastures, to stop shading of clover, and in the long term the need to develop more competitive clovers.

To the sheep farmer the advantages of endophyte in perennial ryegrass are not as clear cut. Lolium endophyte has been implicated in ryegrass staggers and reduced spring liveweight gains in sheep and lambs (Fletcher 1983). However in spite of outbreaks of ryegrass staggers, farmlets of high endophyte ryegrass pastures gave higher per hectare animal production because of their higher herbage yield (Fletcher 1986). The better persistence of the high endophyte pastures would likely lead to a larger advantage in per hectare animal production in the following years.

CONCLUSIONS

In summer-autumn dry areas, sowing perennial ryegrass seed with a high endophyte content appears the only alternative to obtain a persistent ryegrass pasture.

The trial results indicate the perennial yielding ability of Yatsyn 1 ryegrass and its suitability for use in the summer-autumn dry regions in which these trials were carried out.

References

Barker G.M., Prestidge R.A., Pottinger R.P. 1966. Strategies for Argentine stem weevil control: Effects of drought and endophyte. *Proceedings* NZ *Grassland Association* 47: 107.114.

Fletcher L.R. 1963. Effects of presence of lolium endophyte on growth rates of weaned lambs, growing on to hoggets, on various ryegrasses. Proceedings NZ Grassland *Association 44:* 237-239.

Fletcher L.R. 1966. Lolium endophyte and sheep performance on perennial ryegrass cultivars. *Proceedings NZ* Grassland *Association* 47: 99.105.

Gaynor D.L., Rowan D.D. 1966. Insect resistance, animal toxicity and endophyte-infected grass. *Proceedings NZ* Grasslands Association 47: 115120.

Neill J.C. 1941. The endophytes of Lolium and Festuca. *NZ Journal of Science and Technology Vol* 23. No *4A:* 185.193.

Prestidge R.A., Di Menna M.E., Van Der Zijpp S., Baden D 1965. Ryegrass content, Acremonium endophyte and Argentine stem weevil in pastures in the Volcanic Plateau. *Proceedings 38th NZ Weed and Pest Control Conference.* 41-44.

Scott D.J 1963. Lolium endophyte levels in commercial perennial ryegrass seed lines. *Proceedings NZ Grassland Association 44: 254.256.*

Williams M.J., Backman P.A., Clark E.M., White J.F. 1964 Seed treatments for control of the tall fescue endophyte, *Acremomonium coenophialum. Plant Diseases Vof 1. No 68: 49-52.*