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Evaluation of a meadow fescue (Festuca *pratensis)* population from Northland

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Abstract

Meadow fescue *(Festuca pratensis* Huds.) is not commonly. recognised as a significant pasture species in New Zealand. On a Northland dairy farm near Kaitaia a population of meadow fescue was increasing and providing significant feed in drought years. Meadow fescue ecotype seed lines from Kaitatia were collected and compared for relative vigour to Grasslands Supernui perennial ryegrass *(Lolium perenne),* Grasslands Wana and Grasslands Kara cocksfoot *(Dactylis glomerata),* Palaton and Venture reed canary grass *(Phalaris arundinacea)* and Grasslands Advance tall fescue *(Festuca arundinacea).* Variation occurred within the 22 meadow fescue lines in terms of early growth, 4 lines being superior to Advance tall fescue during winter and spring. Overseas lines failed to persist. Vigour of remaining lines declined as the trial progressed, Persistent meadow fescue plants remained small and were slow to tiller. Overseas meadow fescue introductions had no endophyte present, but local lines contained *Acremonium uncinatum* which does not produce the mammalian mycotoxins Iolitrem B and ergovaline. Unless a specific role for the species can be determined further work is largely unjustified, as productivity did not surpass that of control species. Animal health relationships with different endophytes warrant further investigation.

Keywords: *bactylis glomerata,* ecotypes, endophytes, *Festuca arundinacea, Festuca pratensis* Huds., *Lolium perenne,* Northland, *Phalaris arundinacea*

Introduction

Meadow fescue *(Festuca pratensis* Huds.) is not common in old pastures in New Zealand. The species is not regarded as of any value and hence is not usually included when renovating and developing new pasture (Levy 1970). Meadow fescue originates from Europe and south-west Asia. In England (Hubbard 1954) it is considered a valuable grazing and hay grass for fertile moist soils. None of the pasture species used for intensive grazing in New Zealand are native. Pasture seeds commonly used in Europe were introduced to New Zealand by early missionaries and farmers. Ecotypes of many pasture species and associated organisms evolved in response to environmental factors such as drought, moisture, pests and soil physical constraints (Corkill et *al.* 1981). In Northland isolated meadow fescue plants have been observed on dairy farms. In 1990 the species was identified as being common and widespread on one dairy farm in the Kaitaia district (J. Bryant pers. comm.), and provided valuable summer and autumn feed during drought years. Although there are unstantiated reports of early populations in the region the origins of this meadow fescue population are not known. Plants were collected from the property. This paper reports a trial comparing meadow fescue lines with other traditional temperate pasture species and discusses possible roles for the species.

Materials and methods

In June 1992, 52 plants at least 10 m apart were collected from 3 paddocks on a dairy farm. at Tangonge Rd, Pukepoto between Kaitaia and Ahipara. The farm was situated on a Kaitaia clay soil derived from estuarine clays, sands and alluvium. Collected plant material was initially potted and grown on during winter in the glasshouse at AgResearch, Kaikohe, before being hardened off.

Seed was obtained from parental plants which had been polycrossed in isolation, after being placed in a clearing in an area of native scrub during late September 1992. Most plants were heading by early December, and seed was harvested on 3 occasions from December to January. Seed weights, for individual maternal half-sibling families were recorded. Sufficient seed was obtained from 22 parental plants for testing. Plants were raised from seed under glasshouse conditions before being transplanted to the field during autumn 1993.

A spaced plant trial consisting of 22 meadow fescue ecotype families, 4 overseas meadow fescue, 2 perennial ryegrasses (*Lolium perenne* L.) one tall fescue *(Festuca arundinacea* Schreb), two cocksfoot *(Dactylis glomerata* L.) and two reed canary grass cultivars *(Phalaris arundinacea)* was established at Kaikohe on

alluvial soil (Wairoro clay loam). Cultivars and entry numbers are presented in Table 1. The 33 seed line treatments were planted in a randomised complete block design trial with 4 replicates. Each plot contained 2 rows of 5 spaced plants, planted on a 300 mm grid. These spacings allowed some within-row competition, but individual plants were identifiable throughout the trial.

Spaced plants were not grazed during establishment. The trial was then mob grazed with sheep between notings. Nine notings were made from winter 1993 to summer 1995. Individual plants were scored for total herbage mass on a O-5 scale. Presence or absence of disease was recorded in February 1994. Annual dressings of 400 kg/ha of 30% potassic superphosphate were applied. Nitrogen fertiliser as urea was also applied. Endophyte status of all meadow fescue lines were examined using lactophenol cotton blue staining of squashed seed taken from parental plants or original accessions.

Results

Plant form was assessed on potted parent plants after hardening off during September 1992. Plants ranged from prostrate to erect forms with a range of fine and coarse leaves, but most plants were semi-erect with fine leaves.

Overall locally collected parent plants, seed yields were generally poor. Nineteen collected plants failed to produce any seed. The remaining 33 parent plants produced up to 8.35 g per plant. At flowering time plants were generally small being only a few tillers. Only 22 parent plants produced sufficient seed for evaluation.

All spaced plants derived from seedlines were well established by the first winter after autumn planting. Significant vigour differences occurred between species before the first field noting (Table 1). Throughout the trial introduced meadow fescue lines Maldo, Sequana, Cosmos 11 were poorer than Grasslands Advance tall fescue. Bundy was initially similar to Advance but also

Table 1 Growth of meadow fescue families and other enteries relative to Grasslands Advance tall fescue.

Entry	Species	Origin	1993				1994			1995	
			W	SP	SP	SP	Su	Su	AU	W	Su
T2523	G Advance	NZ									
A5853	G Supernui	NZ	*	*	*	*			-		
A6874	G 51	NZ	*	*	*	*					
J110	DP Maldo	Denmark	-	-	-				-		
Jill	Bundy	Netherlands			-		-	-	-		
J112	Sequana	France	-	-	-	-	-	-			
J113	Cosmos II	Germany	-	-	-	-	-	-	-		
K2620	G Wana	NZ	•	-	-	-					
K2398	G Kara	* c.	•							*	
	Palaton			-	-	-	-		-		
	Venture			-	-	-	-				
MF1		ex NZ					-	-	-		
7		N Z					-		-		
8		N Z							-		
9		N Z		•	*				-		
11		N Z									
16		N Z	-	-					-		
18		NZ							-		
19		N Z	*								
20		N Z							-		
21		NZ						-	-		
24		N Z				-	-	-	-		
25		N Z				-	-	-	-		
26		N Z	•	•	*				-	-	
28		* c.							-		
33		* c.		-		-	-	-	-		
36		* c.									
39		* c.						-	-		
40		* c.							-		
43		* c.									
44		* c.							-		
50		* c.									
51		* c.		*					-		

* Significantly better growth than Advance tall fescue ($P < 0.05$)
\- Significantly poorer growth than Advance tall fescue ($P < 0.05$)
W = winter, Sp = spring, Su = summer, A = autumn

declined during the trial. Within the local meadow fescue collection, families MF9, 19, 26 and 51 showed early superior growth, compared to Advance tall fescue. MF 16 and 33 both had significantly poorer early growth. Generally families in the meadow fescue collection was significantly less vigorous than Advance tall fescue. By summer 1994 all meadow fescue families were less vigorous than other species,

The two perennial ryegrass cultivars Grasslands Supernui and G5 1 were superior to Advance tall fescue in the first winter and spring notings. Subsequent perennial ryegrass performance was similar to Advance tall fescue. Supemui perennial ryegrass was poorer than Advance tall fescue during autumn 1994. The two cocksfoots Grasslands Wana and Grasslands Kara were initially better than Advance tall fescue. Wana's vigour later declined in spring. Kara had better growth over the first summer, and was improving in later notings. The two reed canary grass cultivars showed good plant survival but growth was inferior to that of Advance tall fescue.

Rust was the only disease observed during the trial. In February 1994 there were large differences between species and some cultivars in disease presence. The percentage of plants affected was Supemui 6 1%, Wana 15%, and G51 14%. The overall infection rate for the introduced and collected meadow fescue lines was less than 1%.

All meadow fescue seed families originating from local material contained *Acremonium uncinatum*. Overseas meadow fescue introductions did not contain endophytes.

Discussion

Meadow fescue is adapted to fertile heavier soils (Levy 1970). Under New Zealand conditions it is not normally associated or encountered with fertile dairy pastures. The species combined well in the mixed pasture at the site sampled.

The failure of approximately half the locally collected plants to produce seed may have resulted from a lack of winter chilling as a consequence of the timing and husbandry used. It is unlikely that a narrow genetc base could account for failure to produce seed.

Of the 22 local families evaluated only 4 showed an early advantage over Advance tall fescue (Table 1). Although the locally collected material persisted throughout the trial, individual plants did not tiller strongly and increase in size. This observation concurs with plant densities observed on the collection farm where meadow fescue maintains a strong presence in pastures, but as many small plants composed of only a few tillers (Levy 1970). Meadow fescue has usually performed poorly in New Zealand, and this contrasts with its useful role on the Northland farm.

Poor persistence of introduced meadow fescue accessions may be associated with the absence of endophyte imparting protection from insect attack. The lack of endophyte in these lines can be compared with the lack of endophyte in most European perennial rye grass and turf cultivars, and probably results from seed storage conditions at some stage in cultivar development. The role of the endophyte A. *uncinatum* requires further investigation. This endophyte is known to be associated with high concentrations of loline alkaloids in the plant which are toxic to a number of insect pests, but it is not associated with the two important mammalian alkaloids lolitrem B and ergovaline. (M. Christensen, pers. comm.). Endophyte associations with grasses are known to affect animal production in Northland (Easton *et* al. Kearns 1986) There may be opportunities for utilising the lack of mammalian toxicity associated with this endophyte in other grass species.

Comparisons made in this trial were all relative to the control Advance tall fescue, a slow-establishing species. Perennial ryegrass lines showed better early season growth, but as the plants increased in size Advance tall fescue showed similar vigour. The two reed canary grasses, Palaton and Venture were not adapted to this site or its management. Both Wana and Kara cocksfoot were faster to establish than Advance tall fescue. Kara showed excellent growth in the later stages of the trial compared with tall fescue. Further work would be needed to determine how meadow fescue would combine with these and other improved cultivars in new pastures.

Conclusions

There was significant variation within the local collection and among overseas introductions of meadow fescue. Four local lines may offer scope for further selection for improved productivity.

Productivity and tillering were generally lower than other common pasture species and further development of meadow fescue is probably unwarranted unless a specific alternative uses can be identified.

Future work may focus on utilising features of the endophyte *A. uncinatum* associated with meadow fescue. This endophyte does not produce the common mammalian mycotoxins associated with other pasture grass and endophyte species.

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