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LUCERNE CULTIVAR ESTABLISHMENT AND PERFORMANCE WHEN SOWN AFTER LUCERNE

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ABSTRACT

A trial sown at Otaio, South Canterbury supported Crop Research Division's recommendation that lucerne can be resown successfully after lucerne provided that full conventional cultivation is used, that pests and diseases in the previous crop are diagnosed, and a cultivar with appropriate resistance is sown.

Initial establishment averaged 33% for the 14 cultivars sown. This was satisfactory considering the trial was sown in December and was followed by a warm dry summer. Dry matter yields averaged 5.8 t/ha for the first two cuts of the first full season's production. These were typical yields for the district.

By the third year of production dry matter yields of cultivars ranged from 0.6-6.5 t/ha from two cuts and plant populations ranged from 14 to 90 plants per m^2. The decline in production and poor persistence of some cultivars were due to their susceptibility to stem nematode. The result emphasises the need to identify pests and diseases in the previous crop if satisfactory production is to be achieved and maintained.

Additional Key Words: autotoxicity, pathogenic fungi, stem nematode

INTRODUCTION

It has been considered that the establishment of lucerne (*Medicago sativa* L.) into runout lucerne either by direct drilling or following conventional cultivation is largely unsuccessful (Kehr, 1983). Spelling of land for a number of years was therefore considered necessary before lucerne could be resown. Recent experimental evidence has shown that autotoxicity (Bohnenblust, 1983; Jensen and Hartman, 1983; Kehr, 1983; Millar, 1983; Hawthorne, 1987) and pathogenic fungi (Kehr, 1983; Thyr *et al.*, 1983; Hawthorne, 1987) may be implicated in causing poor establishment. However in some experiments establishment appears to have been normal (Kehr and Watkins, 1983; Tesar, 1983). A 1976 survey of lucerne stands in the North Island of New Zealand showed there was little difference between establishing lucerne following either lucerne or other crops (R.B. Wynn-Williams, unpublished data).

With more knowledge of the cultural requirements for establishing lucerne and the availability of cultivars resistant to pests and diseases, Crop Research Division has recommended that lucerne be sown after lucerne provided:

- that full conventional cultivation is used.
- that pest and disease problems in the previous crop are diagnosed.
- that lucerne cultivars with appropriate resistances are sown.

The objective of the trial reported in this paper was to establish some experimental evidence to verify this recommendation.

MATERIALS AND METHODS

The trial was sown on 10 December 1981 in a Claremont silt loam on rolling hill country at Otaio, South Canterbury. The paddock had previously been in Wairau lucerne, which had declined in production after 10 years. Cultivation consisted of ploughing, harrowing 3 times and rolling in the 6 weeks prior to sowing. Management of the trial including weed and pest control, fertiliser maintenance, cutting and grazing was left to the farmers.

Fourteen cultivars and breeding lines (Table 1) were sown in a randomised complete block of 4 replicates. Plots of 5 m x 1.5 m (9 x 15 cm rows) were sown using an Oyjord precision drill. A seeding rate of 10 kg/ha was sown giving approximately 380 viable seeds/m^2, assuming 90% germination.

Plant establishment was measured on 21 January 1982 by counting plant numbers in 5 randomly selected 1 m lengths of row per plot. Final plant counts were made on 5 November 1985 by digging 3 randomly selected quadrats of 0.25 m^2 in each plot. Initial dry matter yields were measured from 2 cuts on the 11 October and 20 December 1982, and final yields from 2 cuts on the 24 October 1984 and 15 January 1985.

Monthly rainfalls for the trial period were obtained from the Ministry of Agriculture and Fisheries Adair Research Station 14 km north of the trial site.

Table 1. Disease and pest resistance characteristics of cultivars and lines in the experiment.

Entry	Blue green aphid	Pea aphid	Spotted Alfalfa aphid	Bacterial wilt	Phytoph-thora root rot	Stem nematode	Verticil lium wilt
Nova	(S)	-	(R)	(MR)	(R)	(R)	-
Washoe	S	MR	(R)	R	R	R	S
Otaio	R	R	(R)	R	-	(R)	S
AS13R	S	SR	R	R	R	R	S
WL314	(S)	(R)	(R)	(R)	(R)	(MR)	(S)
3BC2A1	R	R	(R)	R	(R)	SR	S
Cimaroon	(S)	(R)	(MR)	(R)	(MR)	-	(S)
P521	S	MR	(R)	R	(S)	S	(S)
WL318	SR	R	(R)	R	(R)	SR	S
Wairau	S	S	(S)	S	S	S	S
WL311	SR	R	(R)	R	(S)	S	S
Saranc	S	MR	(S)	R	S	S	S
P524	S	MR	(R)	R	(S)	S	(S)
Rere	R	R	(R)	MR	S	S	S

Abbreviations:

R = resistant; MR = moderately resistant;
SR = sligtly resistant; S = susceptible.
- = no reliable information available;
( ) = overseas data only.

Table 2. Initial and final plant counts.

Entry	Plants/m^2 Initial			Final		
Nova	152	A	a	90	A	a
Washoe	127	ABC	abcd	50	BCD	cd
Otaio	121	ABC	bcd	57	BC	bc
AS13R	130	ABC	abcd	69	AB	b
WL314	124	ABC	abcd	52	BCD	bcd
3Bc2A1	134	ABC	abc	35	CDE	de
Cimmaron	127	ABC	abcd	33	CDE	def
P251	132	ABC	abcd	30	DE	ef
WL318	104	C	d	26	DE	ef
Wairau	137	ABC	abc	27	E	ef
WL311	148	AB	ab	27	E	ef
Saranac	111	BC	cd	14	E	f
P524	110	BC	cd	14	E	f
Rere	133	ABC	abcd	29	DE	ef
Mean	128			40		
SED	8.42			12.60		
CV	14%			31%		

Means followed by the same lower or upper case letter are not significantly different at the 5% level and 1% level respectively. Duncan's Multiple Range Test.

Table 3. **Dry matter yields from the initial two cuts, on 11 October and 20 December 1982, and the final two cuts on 24 October 1984 and 15 January 1985.**

	Tonnes/ha					
Entry	Initial			Final		
Nova	6.1	ABC	abc	6.5	A	a
Washoe	5.4	BC	cd	6.4	A	a
Otaio	5.8	ABC	abcd	6.1	A	a
AS13R	5.5	ABC	bcd	5.1	B	b
WL314	6.4	AB	a	2.7	C	c
3BC2A1	6.0	ABC	abc	2.5	C	cd
Cimarron	6.1	ABC	abc	2.0	CD	d
P521	5.2	C	d	1.2	DE	e
WL318	5.4	BC	cd	1.2	DE	e
Wairau	6.0	ABC	abc	0.9	E	e
WL311	6.6	A	a	0.9	E	e
Saranc	5.5	BC	bcd	0.7	E	e
P524	5.1	C	d	0.6	E	e
rere	6.2	ABC	ab	0.6	E	e
mean	5.8			2.7		
SED	0.33			0.30		
CV	8.1%			16%		

Means followed by the same lower or upper case letter are not significantly difference at the 5% level and 1% level respectively. Duncan's Mulitple Range Test.

RESULTS AND DISCUSSION

Establishment

The initial plant population established in the trial averaged 128 plants per m^2, then the average plant establishment was 33%. According to Tesar and Jacobs (1972) survival only reaches 40 to 50% under favourable conditions. The average establishment of 33 stands surveyed in the North Island in 1976 was 47% with a range from 15 to 80%. The 3 stands sown after lucerne ranged from 36 to 54% (Wynn-Williams, unpublished data). Although there are no controls in the trial to check the influence of the previous crop there is no reason to suggest that establishment was adversely affected by sowing lucerne after lucerne.

The late sowing may have influenced establishment. Wynn-Williams (1976) found that December sowing of lucerne can result in lower seedling survival because of high soil temperatures and low soil moisture. In this trial, 68 mm of rainfall in December should have provided sufficient moisture to facilitate rapid seed germination. However, temperatures in December were, on average, 3°C (Anon, 1981). Warm temperatures continued in January and these combined with only 18mm rainfall for the month may have reduced establishment in this trial.

Production and persistance

Yields from the first 2 cuts of the 1982/83 season averaged 5.8 t/ha and ranged from 5.1 to 6.6 t/ha (Table 3). These yields were considered typical of spring and early summer production for the district, so yields were not apparently adversely affected by establishing the lucerne after lucerne.

By the 1984/85 season, yields from the final 2 cuts of the trial ranged from 0.6 to 6.5 t/ha (Table 3). The decline in production by some cultivars was caused by stem nematode (*Ditylenchus dipsaci*). Stem nematode had not been diagnosed in the previous Wairau crop. Symptoms were first noted in spring 1983 when plots of stem nematode susceptible cultivars were beginning to thin. Infected plants appeared stunted, with swollen stems and shortened internodes. Dunbier *et al.* (1979) showed that when infected, cultivars resistant to stem nematode were higher yielding and remained productive for longer than susceptible cultivars. Other diseases listed in Table 1 were not observed but if present their effect on yield was not as significant as that of stem nematode. Blue-green aphids were observed but with no apparent effect on yield as the susceptible cultivars AS13R, Nova and Washoe remained productive.

Final plant counts ranged from 14 to 90 per m^2 (Table 2). Stem nematodes had reduced plant populations of most susceptible cultivars to below 30 per m^2, which is considered the minimum population required to achieve maximum production (Palmer and Wynn-Williams, 1976). The production results for the 1984/85 season show that in spite of having sufficient plants to achieve maximum production, cultivars not fully resistant to stem nematode, for example WL314, produced little dry matter (Table 3).

CONCLUSION

Although the trial lacked the controls to test the influence of other previous crops, establishment of lucerne was not apparently affected by resowing immediately after lucerne. To confirm more conclusively Crop Research Divisions recommendation would require more trials over several seasons in different soil types. however, the results of the trial emphasised the importance of diagnosing pest and disease problems in the previous crop as only cultivars resistant to stem nematode produced and persisted satisfactorily.

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