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APHID RESISTANT LUCERNE CULTIVARS IN MID CANTERBURY

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Abstract

Six lucerne cultivars (Wairau, Rere, WL318, AS13R, Pioneer 521 and Saranac) were evaluated in Mid Canterbury since 1979 under two contrasting management systems; dryland grazing and irrigated 'cut and cart'. In addition, the effect of strategic aphicide application was examined on the irrigated system. Principal interest in both these studies centred on Rere, the N.Z. bred aphid resistant cultivar released in 1979.

All the cultivars established well and for the first three years no consistent differences between cultivars in herbage yield were recorded under either system. However, in the third full production season (1982183) substantial differences in herbage yield began to develop between the cultivars, and the trend continued in the fourth and final production season (1983/84). By the end of the fourth season Rere was clearly the lowest yielding cultivar under both systems, producing only 69% and 29% of the yield of the highest producing cultivar (Wairau) under dryland and irrigated conditions respectively.

Application of aphicide gave no herbage yield benefit on any cultivar in any season.

Keywords: *Medicago sativa,* irrigated, non irrigated, cultivars, aphicide, Wairau, Rere, WL318, AS 13R, Pioneer 521, Saranac.

INTRODUCTION

Many things affecting lucerne in N.Z. have changed in the last 8-10 years. The most important include the arrival in this country of bacterial wilt *(Corynebacterium insidiosum),* Sitona weevil *(Sitona* sp), blue-green aphid *(Acyrthosiphon kondoi)* and pea aphid (A. *pisum*). Importation of U.S. bred cultivars resistant to bacterial wilt has now largely resolved this problem for N.Z. growers. Maintaining high lucerne production in the presence of Sitona weevil is still very much a current research priority (S.L. Goldson, pers. comm.).

What of the aphid situation? The impact of aphids in some areas was swift and dramatic (Kain et *a/* 1978), when they were first recorded in N.Z. in the mid 1970's; pea aphid in 1974 (Kain & Trought 1982), and blue-green aphid in 1975 (Cox & Dale 1977). This forcibily reminded both grower and breeder alike that none of the current cultivars were resistant. Furthermore, the problem could not be resolved by importations, for, while there were North American varieties resistant to pea aphid, no suitable varieties were available with resistance to both pea and blue-green aphid.

Crop Research Division of DSIR began a breeding programme for aphid resistance which in 1979 yielded its first release, Rere, a cross between CUF101 and selected plants of Saranac. In this same year two studies commenced at Winchmore in Mid-Canterbury to evaluate the performance of Rere under two contrasting management systems.

MATERIALS AND METHODS

The two management systems chosen for this cultivar evaluation were 'dryland/grazed' (traditional) and 'irrigated/cut and remove' (for dried lucerne, protein

extraction, or hay).

In each trial Wairau was included as the standard N.Z. control cultivar, well adapted to N.Z. management systems but susceptible to all major pests and diseases in this country. Rere was included as the newly released locally bred cultlvar resistant to both pea and blue-green aphid and moderately resistant to bacterial wilt. WL318 and AS13R were included as two of the most popular imported commerically available cultivars resistant to pea aphid, bacterial wilt, stem nematode and phytophthora root rot. One additional cultivar was included in the two studies; Saranac in the irrigated trial and Pioneer 521 in the dryland trial. These two cultivars are both moderately resistant to pea aphid, resistant to bacterial wilt and susceptible to blue-green aphid, stem nematode and root-rot.

Both studies were conducted on a Lismore stony silt loam on two areas where lucerne had not been grown for the previous three years.

The experimental design of the dryland study was a simple randomised block with the five cultivars as the five treatments. No aphlcide was used at any time on the dryland study. The irrigated layout was a split plot design with aphicide treatments as the two main plots and cultivars as the five subplots. On both studies plot size was 11 x 5.4 metres and there were four replicates.

Both areas were sown on October 251979 with a cone seeder, at 10 kg/ha for all cultivars. Only one harvest was taken in the establishment year to ensure the development of strong, vigorous plants. In the four subsequent years, harvests (cutting or grazing) occurred at the late bud/early flower stage.

On both trials a 5 x 1 m strip was cut from each plot at each harvest for yield determination. Immediately following this the remainder of the trial area was harvested: on the irrigated trial with a forage harvester and on the dryland trial with adult sheep — in both cases to a residual stubble length of approximately 3 cm.

Aphicide (pirimicarb at 125 g/ha a.i.) was applied to the appropriate main plots of the irrigated trial whenever aphid numbers on these plots reached an average of five per stem on 25 stems selected at random from the most heavily affected cultivar.

Water was applied to the irrigated trial by the border dyke method (approximately 100 mm per application) whenever soil moisture fell to 15%.

Details of soil tests and fertiliser used on the two trials are given in Table 1.

Table 1: SOIL TEST RESULTS AND FERTILISER USED

	Irrigated	Dryland
a) Soil test — June 1980 (MAF quick test)		
pH	6.5	6.7
Ca	13	14
K	6	9
P	15	15
Mg	11	13
b) Fertlliser applied — kg/ha		
October 1979	250 super'	250 super
July 1980	375 super	250 super
July 1981	310 super + 310 KCl	250 super
July 1982	370 super + 300 KCl	250 super
July 1983	400 super + 450 KCl	250 super

' superphosphate 0:9:0:11

RESULTS AND DISCUSSION

Table 2 summarises the annual number of harvests, irrigations and aphicide applications used in these studies. Clearly aphid incidence declined as the study

progressed. Also, minimal irrigation in 1983/84 reflected the high summer rainfall in Canterbury that year.

Trends in lucerne yield during the course of the study are shown in Table 3. All the cultivars established well and in this first year and the two succeeding seasons, 1980/81 and 1981/82, no consistent differences between cultivars in herbage yield were recorded under either system. However, by the third full production season, 1982183, substantial differences in herbage yield between the cultivars were becoming evident, especially under the irrigated system. Rere was the lowest yielding cultivar in this third production season producing 1.5 and 3.5 t/ha DM less than the highest yielding cultivar under the dryland and irrigated systems respectively.

Table 2: NUMBERS OF HARVESTS (CUTTING/GRAZING), IRRIGATIONS, AND APHICIDE APPLICATIONS EACH YEAR.

Year	Dryland	Irrigated		
	grazings	cuts	irrigations	aphlcide applications
1979180	1	1	-	-
1980181	6	5	6	3
1981/82	4	4	6	1
1982183	2	4	6	1
1983184	3	3	1	-

Table 3: EFFECT OF CULTIVAR ON LUCERNE HERBAGE YIELD (t/ha DM) OVER FIVE SEASON UNDER TWO MANAGEMENT SYSTEMS.

	1979180	1980/81	1981182	1982183	1983184
a) Dryland					
Wairau	1.6 a'	7.3 a	4.0 a	4.6 abA	10.4 aA
Rere	1.9 a	7.4 a	3.5 a	3.7 bA	7.2 bC
WL318	2.0 a	7.3 a	3.9 a	5.2 aA	9.4 aAB
AS 13R	1.6 a	7.1 a	3.9 a	3.7 bA	8.0 bBC
Pioneer 521	1.6 a	7.2 a	3.7 a	5.1 aA	10.0 aA
C.V.	14.7%	5.1%	9.9%	15.3%	9.6%
b) Irrigated (main effects only)					
Subplots					
Wairau	1.1 a	12.0 aA	9.1 bA	7.7 aA	4.0 aA
Rere	1.4 a	11.8 aA	9.9 abA	4.2 bB	1.2 bB
WL318	1.4 a	12.4 aA	10.1 aA	6.1 aAB	2.8 aAB
AS 13R	1.1 a	10.4 bB	9.3 abA	6.9 aA	3.1 aA
Saranac	1.1 a	12.5 aA	10.1 aA	7.7 aA	3.6 aA
C.V.	8.9%	6.7%	8.4%	23.0%	40.5%
Main plots					
no aphicide	1.3 a	11.9 a	10.0 a	6.5 a	2.7 a
aphicide	1.1 a	11.7 a	9.4 a	6.6 a	3.2 a
C.V.	6.7%	8.5%	16.6%	4.8%	22.6%
main plot x subplot	N.S.	N.S.	N.S.	N.S.	N.S.

[1] Within each column, treatment means without a common letter are significantly different; lower case $P<0.05$, upper case $P<0.001$.

This trend continued into the fourth and final production season, 1983/84. Lucerne yield from Rere at the end of this season was approximately 3 t/ha DM lower than that from the highest yielding cultivar (Wairau) under both systems.

Under the dryland system the lucerne yield of AS13R fell, relative to the other cultivars, over the last two seasons in a similar way to that of Rere, but under irrigation no other cultivar declined in herbage yield as fast as Rere in those last two years.

The complete absence of a significant herbage yield response to aphicide application in any year of this study, even in 1980181 when three applications were made, is interesting. It contrasts with reports of damage from aphids in the 30.70% range (Kain et a/ 1979) and is no doubt a reflection of the generally low aphid incidence in this study (aphid counts on unsprayed areas in the 1980181 season never exceeded 20-25/stem and were generally much lower than this).

The substantial increase in yield of all cultivars on the dryland study, 4-5 t/ha in the 1981/82 and 1982183 seasons, to 7-10 t/ha in the 1983184 season, is a reflection of the much higher than normal summer rainfall in Canterbury in the 1983/84 season (September to March 1983184 rainfall at Winchmore was 40% higher than the 33 year mean).

The steep decline in the yield of all cultivars under the irrigated system in the last three years of the study is of concern. It occurred despite high input of fertiliser P, K and S and at adequate soil pH levels (Table 1). This steep production decline is responsible for the current disenchantment with growing lucerne under surface or border dyke irrigation in New Zealand. The precise cause of the decline is ill defined and no doubt is frequently the result of several factors, but some combination of insect (aphids, weevils, nematodes) and/or disease (wilts, rots, viruses) is generally implicated.

In this study *Fusarium* spp, especially *Fusarium solani,* was by far the most consistent and predominant isolate found in the last year of the study in decaying plants of all cultivars under both systems. It would appear therefore that Rere, and to a lesser extent AS13R, lose their ability to withstand the invasion of *Fusarium* spp. a little more quickly than the other cultivars and thus succumb to crown rot earlier.

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