PRELIMINARY STUDIES OF CHEMICAL CONTROL OF BLUE-GREEN LUCERNE APHID

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Summary

The blue-green lucerne aphid (*Acyrtosiphon kondoi*), first reported in New Zealand late 1975, has spread rapidly throughout the North and northern South Islands. Insecticide control trials conducted in 1976 showed a number of insecticides gave good short term control of the aphids. Only permethrin and thiometon gave control for as long as two weeks and following the use of some broad spectrum insecticides aphid numbers exceeded untreated populations after 14 days. On lucerne at the hay stage systemic insecticides were less effective than contact materials. Large reductions in lucerne yield were recorded as a result of aphid attack.

INTRODUCTION

A recent entrant into New Zealand, the blue-green lucerne aphid (BGLA) (*Acyrtosiphon kondoi*) was first reported in late 1975 (Morrison pers comm) and is now widespread throughout the North Island and the northern half of the South Island. Of Asian origin, the species was first recorded from Northern China but occurs throughout much of Japan (Sharma *et al* 1975). The occurrence of BGLA was first reported in USA in early 1975 and it is now widespread throughout California and parts of Nevada and Arizona. Little information is available on the biology, ecology, pest status and control of the BGLA.

Acceptable host plants of BGLA include a wide range of small seeded legumes belonging to the genera *Melilotus*, *Medicago*, *Trifolium* (Dickson 1975) and *Lotus* (Neilson and Kodet 1975).

Experience in USA and New Zealand has shown that the aphid can multiply and spread rapidly under cool conditions but in USA numbers diminished rapidly with the onset of hot weather (Summers 1975).

BGLA colonises the apices of lucerne plants and damaged plants may exhibit retarded growth, shortened internodes, chlorosis and small misshapened leaves (Summers 1975; Sharma *et al* 1975). Similar symptoms have been observed in New Zealand (Fig. 1). In California losses of complete harvests of lucerne have been attributed to BGLA (Sharma *et al* 1975).

In the USA a number of insecticides have been shown to give control of these aphids but reinfestation was rapid (Sharma *et al* 1975). The results of preliminary studies on the efficacy of a range of systemic and contact insecticides for control of BGLA in New Zealand and the effect on lucerne production are presented in this paper.

Proc. 29th N.Z. Weed and Pest Control Conf.

Lucerne

Fig. 1: Effect of blue-green lucerne aphid on lucerne growth two months after attack. Note the narrower leaves of the plants located by the arrow.

Fig. 2: Effect of blue-green lucerne aphid on lucerne growth. The light coloured strips (see arrow) are areas that missed being treated with insecticide.

METHOD

Design

Two insecticide trials were conducted in March 1976, one at Massey University and another at Dannevirke. A split plot, randomised block design was used with three replications of main insecticide plots (6 x 16 m). Main plots were divided into four subplots on a factorial arrangement of two insecticide rates by two crop heights (immediately post-harvest and hay), which were established prior to treatment. Ten days after treatment hay plots were harvested. Insecticide application was made in 224 litres/ha. Because aphid numbers increased at Dannevirke some subplots, selected at random, were re-sprayed with 0.25 kg/ha chlorpyrifos 30 days after the initial spraying.

In addition to the two formal trials, studies on aphid damage were extended on to a lucerne paddock at Woodville. Here infested lucerne was harvested for hay and 2 weeks after cutting the paddock was sprayed with dicofol 0.25 kg/ha in 150 litres of water. Spray coverage was poor and strips of lucerne were left untreated (Fig. 2). A fortnight later the whole paddock was re-sprayed giving good control. Eight paired subplots were located on damaged and undamaged strips for subsequent harvest.

Aphid counts

Aphid numbers were assessed on the insecticide trials at the times given in Tables 1 and 3. Ten shoots, cut to ground level, were harvested from each subplot and bulked. Aphids were washed off foliage with hot water and then counted with a Lowe and Dromgoole (1958) aphid counter.

Measurement of damage

Foliage from four quadrats, 0.5 x 0.5 m, on each subplot were harvested by cutting to ground level. The Massey trial was not harvested as it contained too many weeds. Plant counts were made at Woodville and Dannevirke from four 1 x 1 m quadrats per subplot.

Statistical analyses

The distribution of the BGLA was extremely aggregated. For this reason all data were transformed to a loge ($x + 1$) base prior to analyses. Means presented in tables are geometric means or the antilog of the mean of log transformed data.

RESULTS

Insecticide trials

The results of the Massey University trial are summarised in Tables 1 and 2. Assessment 7 days after spraying showed that all insecticides gave significant reductions in aphid numbers, irrespective of insecticide type, rates and crop height. Permethrin gave significantly better control than pirimicarb, mevinphos, carbofuran and methomyl (Table 1). When assessed 14 days after treatment only permethrin and thiometon plots had significantly fewer aphids than control. After 28 days aphids were not reduced by any treatment but numbers were significantly higher on the carbofuran treatment than the untreated plots at 14 and 28 days.

TABLE 1: EFFECT OF DIFFERENT INSECTICIDES ON APHID NUMBERS ($\dagger$ mean/shoot) WITH TIME AFTER TREATMENT AT MASSEY UNIVERSITY

Insecticide	Days after treatment			
	7	14	28	42
*pirimicarb DP	1.01 bBC	0.48 bcdBC	1.33 cB	1.47 a
*carbofuran DP	1.01 bBC	2.57 aA	7.43 aA	3.61 a
**methomyl EC	1.20 bBC	0.72 bcdBC	3.57 abABC	3.30 a
*permethrin EC	0.19 dC	0.18 dC	1.42 cB	3.13 a
**mevinphos AC	1.56 bB	0.57 bcdBC	1.30 cB	2.38 a
*chlorpyrifos EC	0.89 bcdBC	0.68 bcdBC	2.06 bcAB	3.43 a
*diazinon EC	0.86 bcdBC	0.97 bcBC	4.63 abAB	3.48 a
**thiometon EC	0.73 bcdBC	0.39 cdBC	2.97 bcAB	4.23 a
untreated	7.18 aA	1.28 bB	2.88 bcB	2.09 a

$\dagger$ Overall geometric mean of insecticide applied at two rates (0.25 and 0.75 kg/ha) and on two crop heights

* Contact insecticides

** Systemic insecticides

There were no overall differences between contact and systemic insecticides or rates of application. There were no differences between crop heights 7 days after treatment for contact insecticides or overall insecticides (Table 2). However, significantly higher aphid numbers were found in high crops than in low crops treated with systemic insecticides. After harvest all the "high" crops had fewer aphids until the 42 day sample.

Excellent control was obtained in the Dannevirke trial (Table 3) and all insecticides reduced aphid numbers significantly. However, signifi-

Lucerne

cantly higher numbers of aphids were recorded in the high crops treated with recommended rates of maldison and mevinphos than on other treatments.

Damage

Significant reductions in autumn lucerne production (Tables 4 and 5) were recorded on aphid damaged areas.

TABLE 2: EFFECT OF DIFFERENT INSECTICIDES ON APHID NUMBERS ($\dagger$ mean/shoot) WITH TIME AFTER TREATMENT AT MASSEY UNIVERSITY

Insecticide type	Crop height	Days after treatment			
		7	14	28	42
systemic	low	0.64 bA	0.75 abAB	3.67 aA	3.67 a
	high*	1.78 aA	0.37 bB	1.58 bB	2.84 a
contact	low	0.79 bA	1.25 aA	3.59 aA	3.35 a
	high*	0.73 bA	0.50 bAB	2.19 abAB	2.54 a
all insecticides	low	0.73 a	1.05 aA	3.61 aA	3.47 a
	high*	1.06 a	0.44 bB	1.96 bA	2.65 a

Duncan's letters refer to comparisons between crop heights within insecticide types

$\dagger$ Geometric mean (see Table 1)

* harvested 10 days after treatment

TABLE 3: EFFECT OF INSECTICIDES ON APHID NUMBERS ($\dagger$ mean/shoot) 6 DAYS AFTER TREATMENT AT DANNEVIRKE

Treatment	Rate kg/ha	Crop height	
		low	high
maldison	0.15	1.2 $\pm$.6	6.8 $\pm$ 1.5
	0.75	0	2.0 $\pm$.26
mevinphos	0.40	0	3.6 $\pm$.6
	0.75	0	0
chlorpyrifos	0.17 & 0.75	0	0
demeton-S-methyl	0.24 & 0.75	0	0
thiometon	0.20 & 0.75	0	0
untreated		8.1 $\pm$ 1.7	33.0 $\pm$ 7.2

$\dagger$ Geometric mean (see Table 1)

TABLE 4: PLANT NUMBERS AND PRODUCTION OF LUCERNE FROM SPRAYED AND UNSPRAYED STRIPS AT WOODVILLE ($\pm$ standard errors)

	Undamaged	Damaged	% Difference
Plant numbers/m ² 15.5.76	102 $\pm$ 5.1	87 $\pm$ 5.0	15
Production (kg DM/ha) 11.3-15.5.76	1037 $\pm$ 70	294 $\pm$ 23	71

DISCUSSION

In view of the limited time that BGLA has been in New Zealand and the short duration of these studies care should be taken in the extrapolation of this information from one season or region to another. Although BGLA in New Zealand has been recorded as attacking red clover (*Trifolium pratense*), white clover (*T. repens*) as well as various cultivars of *Lotus* spp (Charlton pers comm) highest populations have been recorded on lucerne.

Excellent knockdown of BGLA was provided by all insecticides used which substantiated work in California where the species is reported to be susceptible to most of the common insecticides (Sharma *et al* 1975). The control obtained with maldison and mevinphos at the lower rates was not as good as with other insecticides. Other insecticides showed no

TABLE 5: EFFECT OF BLUE GREEN LUCERNE APHID ON LUCERNE YIELD 31.5.76 AT DANNEVIRKE

Treatments	No. subplots	*High crop kg DM/ha	**Low crop kg DM/ha
***Sprayed 1 + 2	18	836	488
Sprayed 1	14	643	431
Control	4	478	393
LSD		43	34

* High Crop = cut 7/4/76 after first spraying

** Low Crop = cut 22/3/76 before first spraying

*** Sprayed 1 + 2 treated 23/3/76 and 22/4/76 respectively

rate responses and lower rates may have been just as effective. The rapid reinfestation rates recorded in these trials suggests spraying may have to be repeated every two to three weeks.

The relatively higher post-treatment aphid numbers on carbofuran plots may indicate that predator and parasite numbers were adversely effected by this chemical. At Dannevirke predators were uncommon but at Massey, lace wing (*Micromus tasmaniae*), eleven spotted ladybird (*Coccinella undecimpunctata*) and syrphid larvae were numerous. The obliteration of natural enemies by wide-spectrum insecticides has been advanced as a reason for the rapid reinfestation rates of BGLA in California (Sharma *et al* 1975).

The trials have shown that BGLA can severely reduce lucerne yields and studies of severely damaged lucerne showed that recovery is not complete until the second or third regrowth phase following attack. Similar losses in lucerne productivity were observed in many parts of the southern North Island during autumn 1976.

ACKNOWLEDGEMENTS

The assistance of Miss M. Llewellyn, with biometrical analyses and Mr R. Marsden with technical matters is gratefully acknowledged.

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