Blue-Green Lucerne Aphid

EFFECT OF BLUE-GREEN LUCERNE APHID ON SEEDLING LUCERNE IN A GLASSHOUSE

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Summary

Seedlings of lucerne (*Medicago sativa*) were infested with blue-green lucerne aphid (*Acyrtosiphon kondoi*) in a glasshouse experiment conducted at Lincoln during August-September 1976. Aphids increased in number according to the amount of plant material available. Seedling height was reduced more by aphid infestation than were plant development or survival. Early infestations had more effect than late, long feeding periods, had greater effect than short periods and high rates, had more effect than low rates. Low rates had no effect if the aphids were removed within 7 days or if infestation was at the first trifoliate leaf stage or later. It is concluded that when field infestations occur within 3-4 weeks of sowing, under dry conditions, stands should be protected with insecticides.

INTRODUCTION

The blue-green lucerne aphid (BGLA) was first reported in New Zealand late in 1975. A glasshouse trial was conducted at Lincoln during August-September 1976 to investigate the effect of this new pest on the growth and survival of seedling lucerne.

METHOD

Lucerne cv 'Washoe' was sown in 84 flats (180 mm x 460 mm) at the rate of 100 seeds per flat in standard potting soil on 16 August and thinned to 50 plants (in two rows) on 6 September. Glasshouse temperature was maintained at 20-25°C and the flats were watered from below.

Mixed-age field populations of aphids were introduced at two rates; 25/flat (low) and approximately 250/flat (high).

Aphids were applied and removed according to the growth stage of uninfested seedlings, rather than number of days after sowing or emergence, so that the results could be more easily applied in the field. However, the rate of seedling development in the glasshouse in August-September was found to be approximately equal to lucerne sown in the field at Lincoln in late December.

A scoring system was devised to define the stage of growth at which treatments were applied viz: cotyledon 1; unifoliate 2; 1st trifoliate 3; etc. The total value per flat was divided by 50 thus automatically assigning a zero value to dead plants and producing a mean growth stage score for the flat. This was carried out each time aphids were applied. The final application was on day 19 (day 0 being the day aphids were applied at the cotyledon stage).

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There were eight control treatments, four kept free of aphids by aspirating daily and four sprayed with insecticide when necessary. The trial was replicated three times.

Aphids aspirated from 5 plants chosen at random in each flat were counted at 4-5 day intervals. The height of 10 randomly chosen plants/flat was measured at days 5, 11, 17, 23 and 38 (day of plant harvesting). Numbers of live plants were counted at each growth stage measurement and on the final day, when plants were cut at soil level, oven dried and weighed.

RESULTS AND DISCUSSION

Aphid Numbers

Initially aphid numbers increased according to the plant size, and 23 days after the first infestation, mean aphid numbers and plant height were highly significantly correlated, $r = 0.79$ and 0.86 (d.f.8) at low and high rates respectively. When aphids were applied early, at either rate, they reduced plant growth, and aphid increase was limited. Thus on plants infested with 5 aphids/plant at the cotyledon stage, aphid numbers reached a maximum of 8 aphids/plant, but on seedlings infested with 1 aphid/2 plants at this stage numbers reached a maximum 15/plant. Aphid numbers generally declined 25 days after the first infestation. The highest level reached before this decline was 28 aphids/plant, on seedlings infested with high rates at the second trifoliate stage.

Lucerne growth

There were no differences among the controls between those kept free of aphids by spraying and by aspiration.

With one exception the effect of aphid infestation on lucerne growth was predictable; early infestations had considerably more effect than late infestations, infestations for long periods of time had more effect than infestations for short periods of time, and high levels of aphid infestation had more effect than low (Table 1).

The exception occurred at the low aphid rate applied early. Aphid numbers built up very rapidly on plants infested at the unifoliate leaf stage (from 1 aphid/2 plants to 17 aphids/plant in 6 days), and development and height were depressed more than in plants infested at the cotyledon stage when aphids built up slowly to a lower peak (from 1 aphid/2 plants to 15 aphids/plant in 18 days). Although the effect on growth stage (73 vs 80) on day 19 was no longer statistically significant, and the effect on height at day 23 had disappeared, plants remained 16% lighter at harvest.

Of the three components examined regularly: plant survival, growth stage, and plant height, the last was affected most, and it was closely related to final yield ($r = 0.96^{**}$ d.f. 18, over all treatment combinations).

When seedlings at the cotyledon stage were infested with a high rate of aphids until plant harvest, the plants produced small, deformed leaves at about half the rate of the untreated plants. At the same time, the plants did not increase in height, suggesting that the feeding damage caused by BGLA or its associated toxin, affected cell expansion much more than cell division and differentiation.

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TABLE 1: Lucerne growth stage, height and plant survival, relative to untreated (100), after infestation with BGLA at different growth stages for varying lengths of time and at high and low rates.

Growth stage when aphids applied	Number of days of infestation (day 19)	Lucerne growth stage (day 19)		Height of lucerne (day 23)		Number of surviving plants (day 38)	
		High	Low	High	Low	High	Low
Cotyledon (1.1)	19	47	80	14	45	66	93
	12	59	92	46	68	84	97
	9	67	94	57	87	90	99
	5	80	102	73	98	95	106
Unifoliate (1.9)	14	60	73	35	46	70	98
	7	81	112	63	93	97	100
	4	99	107	92	97	103	101
1st Trifoliate (2.9)	10	81	90	53	77	101	102
	3	105	101	91	99	98	101
2nd Trifoliate (4.0)	7	96	104	82	101	101	103
*LSD (P<0.05)		14.5	13.3	13.4	10.2	11.7	NS
(Untreated)	(0)	(5.9)		(96 mm)		(49/flat)	

* Waller & Duncan

Seedling survival

Seedling survival was influenced less than plant height but followed the same trend. In spite of marked aphid damage, survival was surprisingly high perhaps because of adequate soil moisture and lack of competition. Observations suggested that root growth in damaged plants was reduced in proportion to the top growth, which suggests that had these infestations occurred in the field under dry soil conditions plant survival might have been poor.

CONCLUSIONS

Early aphid infestations, which in the field would be difficult to detect, had detrimental effects on growth and survival of lucerne seedlings under good growing conditions in a glasshouse.

When aphids are likely to infest stands at or before the unifoliate leaf stage (3-4 weeks after sowing, depending on soil temperatures) and moisture stress is likely to occur soon after sowing, it is recommended that either seed be sown with granular aphicide or stands be inspected regularly and sprayed as soon as aphid numbers exceed an average of 1 aphid per 4 plants.