CEREAL APHID CONTROL TRIALS IN NORTH CANTERBURY

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Summary

The effects of insecticides, applied to control the cereal aphid *Rhopalosiphum padi* and thereby prevent BYDV damage, on the yields of autumn-sown wheat crops are described. At some sites, application(s) of insecticide(s) resulted in higher yields, although this was not general.

INTRODUCTION

EACH YEAR, in some Canterbury districts, damage caused by barley yellow dwarf virus (BYDV) infection results in reduced yields of wheat and other cereal crops. Smith (1963) estimated in the 1960–61 season that over the main wheat-growing area of the central part of Canterbury the total yield loss caused by BYDV was over 15% and stated that BYDV was by far the most important disease affecting cereals in New Zealand.

The cereal aphid *Rhopalosiphum padi* is the only BYDV vector known in this country (Smith 1963). Lowe (1966) has shown that at each of three sites in Canterbury flights of the cereal aphid occur more or less regularly in each of two main periods, one in the spring, mid-September to December; and the other in the autumn, February to early June. Early autumn-sown wheat crops are likely to be exposed to infestation by both autumn and spring flights of the cereal aphid. Wheat crops which emerge after the autumn flights have ceased may be exposed to infestation by the spring flights of the cereal aphid. Complete control of the cereal aphid by application(s) of a suitable insecticide and the prevention of BYDV damage in autumn-sown wheat crops requires either that the insecticide should remain effective for several months or that timely multiple applications of insecticide be made.

This paper gives brief details of insecticide trials put down to control the cereal aphid and thereby prevent BYDV damage in North Canterbury autumn-sown wheat crops. In these trials the effects of the applications of insecticide(s) have been assessed by measurement of yield responses of wheat crops rather than by counts of cereal aphid populations.

WHEAT VARIETIES × INSECTICIDE TRIALS 1965–6

In trials on sites at Horrelville, Rotherham, Southbridge, Barrhill, Ashburton and Darfield, several wheat varieties and selections were drilled after the middle of May in randomized blocks, replicated eight times. One of each pair of adjacent blocks was treated in early September and again in early October with demeton-S-methyl 3 oz (all rates in a.i. per acre).

Prior to harvest some BYDV damage was apparent in the untreated crops on sites at Rotherham, Horrelville and Southbridge, indicating that cereal aphids had established in these crops.

The average yields obtained from treated and untreated blocks at each site are given in Table 1.

TABLE 1: WHEAT YIELDS (BUSHELS PER ACRE)

Site (Time Crop Drilled)	*Nil*	*Demeton-S-methyl 2 × 3 oz*	*CV %*
Horrelville (Mid-May)	65.3a	69.0a	4.8
Rotherham (Mid-May)	46.2bB	59.0aA	2.9
Southbridge (Late June)	51.3a	50.0a	7.8
Barrhill (Early June)	81.1a	80.4a	2.8
Ashburton (Early June)	92.2a	87.9a	4.4
Darfield (Late June)	61.3a	61.8a	3.8

At each site except Rotherham small non-significant yield responses to the applications of demeton-S-methyl occurred. At Rotherham a significant yield increase of 27% or 12.8 bushels per acre was obtained.

The presence of some BYDV damage in the untreated crops on two sites. Horrelville, and Southbridge, suggests that cereal aphids were not present in sufficient numbers for the widespread transmission of BYDV to occur. The absence of BYDV damage in the treated crops on sites at Barrhill. Ashburton and Darfield indicates that these crops did not become infested with the cereal aphid.

TIMES OF APPLICATION OF DEMETON-S-METHYL TO AUTUMN-SOWN WHEAT TRIALS 1965–6

At six sites single applications of demeton-S-methyl 3 oz were made alone at two times and in combination to cereal-aphid-infested autumn-sown wheat crops. At each site the initial application of insecticide was made in early September and the subsequent application was made six weeks later in mid-October.

Prior to harvest, some BYDV damage was apparent in the untreated areas of the crop on each site. Also at Waikari (1), Amberley (1), Loburn and Cust some BYDV damage was present in the insecticide-treated crop. The average yields obtained at each site from each treatment are given in Table 2.

TABLE 2: WHEAT YIELDS (BUSHELS PER ACRE)

Site (Time Crop Drilled)	*Nil*	*Demeton-S-methyl 3 oz Sept.*	*Oct.*	*Sept & Oct.*	*C.V. (%)*
Waikari (1)	42.1	44.1	42.6	45.7	6.1
(Early May)	bA	abA	bA	aA	
Waikari (2)	40.3	56.6	40.7	53.6	9.6
(Late April)	bB	aA	bB	aA	
Amberley (1)	42.2	48.0	40.9	48.9	3.8
(Late April)	bB	aA	bB	aA	
Loburn	63.2	65.1	64.7	64.8	2.5
(Mid-May)	bA	aA	abA	abA	
Cust	50.9	53.1	52.5	53.6	3.3
(Late May)	bB	aAB	abAB	aA	
Amberley (2)	33.1	35.1	33.5	35.0	4.0
(Late May)	cA	aA	bcA	abA	

At the Waikari (2), Amberley (1), Loburn and Amberley (2) sites, the early September application of insecticide caused statistically significant yield increases which were not improved by the subsequent application of insecticide. At the Waikari (1) and Cust sites the multiple application of insecticide tended to be more effective than either single application.

The presence of BYDV damage in the insecticide-treated crop on the Waikari (1) site suggests that the early September application of insecticide was not made early enough to control the cereal aphid infestation and prevent transmission of the virus. On the other hand, the absence of BYDV damage in the early September treated crop on the Waikari (2) site suggests that at that site the insecticide was applied at the optimal time for control of the cereal aphid.

TIMES OF APPLICATIONS OF DISULFOTON AND DEMETON-S-METHYL TO AUTUMN-SOWN WHEAT TRIALS 1966–7

In trials on sites at Rotherham and Waikari, disulfoton 5% granules were drilled with the wheat seed; in mid-August disulfoton 5% granules were topdressed on to the surface of the seedbed of the established wheat crop and demeton-S-methyl 3 oz was applied to the established wheat crop in mid-August and mid-September. Each application of each insecticide was made alone and various combinations of the single applications were also made. At Rotherham the disulfoton 5% granules were applied at a rate of 14 lb per acre and at Waikari at a rate of 20 lb per acre.

At both sites cereal aphids were observed in the wheat crops in the early winter and early spring.

The average yields obtained at each site from each treatment are given in Table 3.

TABLE 3: WHEAT YIELDS (BUSHELS PER ACRE)

Treatments	*Site (Time Crop Drilled)*	
	Rotherham (Early May)	*Waikari (Early May)*
1. Control	63.8dB	62.5cB
2. Disulfoton (with seed)	76.8abA	68.4abA
3. Disulfoton (August)	76.0abA	66.8abA
4. Demeton-S-methyl (August)	73.7bA	68.2abA
5. Demeton-S-methyl (September)	68.3cB	63.0cB
6. Disulfoton (with seed) + Demeton-S-methyl (September)	77.8aA	68.9aA
7. Disulfoton (August) + Demeton-S-methyl (September)	75.2abA	67.4abA
8. Demeton-S-methyl (August) + Demeton-S-methyl (September)	75.4abA	66.0bA
CV	3.1%	2.5%

At each site disulfoton 5% granules drilled with the wheat seed, disulfoton 5% granules topdressed on to the established crop in mid-August and the mid-August application of demeton-S-methyl 3 oz gave yield increases. At Rotherham the September application of demeton-S-methyl where applied alone caused a smaller yield increase and where applied

TABLE 4: WHEAT YIELDS (BUSHELS PER ACRE)

Site (Time Crop Drilled)	*Rotherham (Early May)*	*Hororata (Early May)*	*Springston 1 (Mid-May)*	*Springston 2 (Mid-May)*
MAIN EFFECTS				
Early winter application				
Nil	62.9 **	38.8 *	69.1	65.2
Demeton-S-methyl 3 oz	65.7 (+2.8)	40.2 (+1.4)	69.2 (+0.1)	66.4 (+1.2)
Late winter application				
Nil	62.2 **	39.4	69.4	65.6
Demeton-S-methyl 3 oz	66.4 (+4.2)	39.6 (+0.2)	69.0 (—0.4)	66.0 (+0.4)
Early spring application				
Nil	62.7 **	39.4	69.2	65.7
Demeton-S-methyl 3 oz	65.8 (+3.1)	39.6 (+0.2)	69.2 (0.0)	66.0 (+0.3)
Late spring application				
Nil	63.3 **	39.2	68.4	65.5
Demeton-S-methyl 3 oz	65.3 (2.0)	39.8 (+0.6)	70.0 (+1.6)	66.1 (+0.6)
Minimum difference required for significance at				
5%	0.9	1.4	2.4	1.1
1%	1.3	2.0	3.3	1.5

INTERACTIONS					
	— Early winter × Late winter 5%	N.S.	N.S.	— Early spring × Late winter 5%
	— Early winter × Early spring 5% + Early winter × Late winter × Early spring 5%			
	— Late winter × Early winter 1%			
CV	2.4%	4.8%	4.4%	2.2%

in combination with the earlier applications of disulfoton 5% granules and demeton-S-methyl had no effect on yield. At Waikari the September application of demeton-S-methyl had no effect on yield.

TIMES OF APPLICATION OF DEMETON-S-METHYL TO AUTUMN-SOWN WHEAT TRIALS 1966–7

On sites at Rotherham, Hororata, Springston (1) and Springston (2), single and multiple applications of demeton-S-methyl 3 oz were made at four different times; in the early winter, late winter, early spring and late spring. At Rotherham the times of applications of insecticides were late June, late July, late August and late September. At the other sites the applications of demeton-S-methyl were made in mid-July, mid-August, early September and late September.

Prior to the initial application of insecticide, cereal aphids were observed in the wheat crop on each site and in the spring were still present in the crops on the Rotherham and Hororata sites.

The yields obtained from each treatment at each site are given in Table 4.

Small statistically significant responses to the early winter application of insecticide were obtained at Rotherham, Hororata and Springston (2). At Rotherham the late winter, early spring and late spring applications of insecticide also caused statistically significant yield increases and much larger yield increases were obtained from the multiple applications of insecticide. This is shown in Table 5.

TABLE 5: ROTHERHAM WHEAT YIELDS (BUSHELS PER ACRE)

Early Winter	*Late Winter*	*Early Spring*	
		Not Sprayed	*Sprayed*
—	Sprayed	56.4cB	64.1abA
Sprayed	—	63.4bA	65.2abA
—	Sprayed	64.9abA	66.0abA
Sprayed	Sprayed	66.4abA	67.9aA

DISCUSSION

On some sites the application of a suitable insecticide to a cereal-aphid-infested autumn-sown wheat crop resulted in higher yields but on other sites little response occurred.

In the 1965–6 season, routine applications of demeton-S-methyl were made to late-autumn-sown wheat crops in anticipation that these crops would have become infested with cereal aphid. In that season the routine applications of insecticide resulted in a crop yield increase on only one out of six sites. This response was similar to that which had been obtained in similar trials put down by Farm Advisory Division officers in each of the two preceding years. It appears that the routine application of an insecticide to control cereal aphid in wheat crops in every district is not warranted.

In the 1965–6 season, cereal-aphid-infested wheat crops were treated with the systemic insecticide demeton-S-methyl at times then considered to be optimal for effective control of the pest. Yield responses show that, although the crop on the Waikari (2) site was treated at a time which

proved to be best for that crop, that time was not optimal for the most effective control of the cereal aphid in crops on other sites, including the nearby Waikari (1) site. The presence of BYDV damage in insecticide-treated crops in the 1965–6 season suggested that the September applications of demeton-S-methyl were not early enough for maximum control of the cereal aphid.

In the 1966–7 season, applications of demeton-S-methyl were made earlier and over a longer period in the winter and spring to cereal-aphid-infested crops. These applications of insecticide had little effect on crop yield except at Rotherham. At that site three applications of the insecticide were necessary for maximum yield increase.

In the same season, early single applications of disulfoton 5% granules and demeton-S-methyl resulted in satisfactory yield increases.

The effective control of cereal aphids and the prevention of BYDV damage in autumn-sown wheat crops may be achieved by timely application(s) of a suitable insecticide. It appears, however, if maximum efficiency in the use of these materials is desired, that applications to individual crops must be related to the numbers and the rate of increase of cereal aphids in each crop which are related to the time of emergence of the crop, rather than to generalized district recommendations. Farmers should not drill their crops too early, and after the crops have established they should inspect them regularly throughout the winter for cereal aphids.

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