INSECTICIDE GRANULES AND VIRUS IN AUTUMN-SOWN WHEAT

R. I. MULHOLLAND and C. T. JESSEP

Department of Scientific and Industrial Research, Lincoln

Summary

Disulfoton granules sown with Aotea wheat in April (3 rates), May, June and August gave control of cereal aphid (*Rhopalosiphum padi* (L.) at all rates. The number of aphids per plant and number of plants infested were recorded for each time of sowing; control of the low numbers of aphids present in the autumn prevented virus spread and yield reductions of 7.8 bushels in April, and 8.6 bushels in May sowings. The highest yield of 62.5 bushels was obtained with insecticide treatment in May followed by 61.8 bushels in untreated June-sown plots.

April-sown plots sampled in October showed no differences in tiller numbers or green and dry weights between treated and untreated areas. Pre-harvest sampling of April and May sown areas showed significantly fewer tillers in the treated areas but heads were heavier and grain yield was greater.

INTRODUCTION

ECONOMIC INCREASES in yield may be obtained by the control of the aphids responsible for transmitting barley yellow dwarf virus (BYDV) (Smith and Allen, 1962; Smith and Wright, 1964), but in early-sown crops more efficient methods of aphid control are needed. Lowe (1966) has recorded the flights of the cereal aphid *Rhopalosiphum padi* (L.) at three sites in Canterbury for a period of years and these show a fairly well defined pattern. The cereal aphid spends its life on grasses and cereals (Lowe 1964a, b) and flies from sheltered areas of grass and cereal greenfeeds to autumn-sown wheat. These flights commence in early autumn and may continue until late May or early June if local weather conditions are favourable. Information on aphid flight patterns in the main wheat growing areas of the South Island has been obtained by the use of sticky traps (Close and Lamb, 1961; Lowe 1964a, b). Ground inspection of crops in the principal South Island wheat areas (Mullholland, 1964) has shown that aphid counts in August are directly related to the subsequent levels of BYDV infection in January.

Late sowing of wheat, late in May or in June, has been advocated, to ensure that crops do not emerge until aphid flights have ceased. However, in certain districts or on heavy land, sowings cannot be delayed and crops must run the risk of widespread infestation with aphids. The efficiency of a granular insecticide in protecting autumn-sown wheat, and the effect of delayed sowings on virus infection and wheat yields were tested in a trial at the Crop Research Division during the 1966-7 season. The wheat variety used was Aotea.

METHODS

Sowings were made on April 7, May 6, June 3 and August 15 using a six coulter spoon-feed drill. The insecticide, 5% disulfoton, was applied with the seed. Rate are expressed as active ingredient per acre. Infestation of the crop with cereal aphids depended entirely on natural field populations.

PLOT LAYOUT

Trial A

In the April sowing only, the efficiency of the insecticide was tested at low dosages namely, 0.7 to 1.1 lb. This trial, 50 yd $\times$ 8 drill widths, was divided into plots 25 yd $\times$ 1 drill width. There were four plots of each treatment and eight untreated plots, all randomized.

Trial B

The main trial was to test 5% disulfoton at 1.8 lb at four different sowing dates. Each sowing occupied an area of 50 yd $\times$ 16 drill widths. Plots were 25 yd $\times$ 2 drill widths, giving eight replications with insecticide and eight of control re-randomized for each sowing.

APPLICATOR

The machine used for applying the granules, a Horstine Farmery applicator, was attached to the drill. This unit consists of three tapered hoppers holding 20 lb of granules. The feed mechanism of interchangeable fluted rollers is in a casting at the base of the hoppers. Each fluted roller is held in position by a grub-screw on a long steel driving-shaft driven by a V-belt from a trailing ground wheel, at the side of the drill. A range of pulley wheels is provided to vary the roller-shaft speed, and with different widths of fluted rollers this provides a large range of feed rates. Clear plastic tubes carry granules to each coulter and to the soil with the seed.

SAMPLING

Spring

On October 4, 1 ft samples for determining tiller number and green and dry weights were cut from a single row at 7 ft intervals down the length of the plots, excluding 6 ft buffers at either end. Both trials were sampled.

Pre-harvest

Immediately prior to harvest, a more intensive sampling of the Trial B plots for April, May and June sowings was carried out. Eight samples, each of 3 ft of a single row, were taken at random from each plot. The tillers and heads were counted and total grain weights recorded. Individual head weights were recorded from the April sowing (Trial B) only.

Aphid Counts

Aphid counts were taken from all treatments of each sowing at intervals throughout the growing season. These counts were the total number of aphids from ten whole plants per plot. If no aphids were present in the

Fig. 1: April-sown plots, Trials A and B, showing number of plants infested with aphids per 80 plants examined and the resultant yields.

first 80 plants of a particular sowing, then the second half of the trial was not counted. The number of plants infected with aphids was also recorded for all samplings. Altogether, nine counts were taken from both April sowings, six from May sowing, four from the June sowing and one from the spring (August) sowing.

RESULTS

Only April and May sowings showed obvious virus symptoms in untreated plots and these were visible from August onwards.

SAMPLING

Spring

At the first sampling of the April-sown plots, the three rates of insecticide had produced no significant effect on tiller numbers or green and dry weight production (Table 1). Figures shown are an average for 3 ft of single row calculated from the 1 ft samples taken. The standard errors of the control averages of tiller number and dry weight were 3.6, and 3.4 g, respectively.

Pre-harvest

At the pre-harvest count, differences in tiller number were highly significant, in favour of untreated plots (Table 2). Figures shown are an average for 3 ft of single row. In June-sown plots, there were no differences in tiller numbers. In April-sown plots, head weights and weight of grain were both significantly greater where the insecticide was applied. Grain weights from the May sowing showed a non-significant increase for treated plots. When whole plot yields were analysed, however, the increase of 8½ bushels per acre was shown to be highly significant. Similarly, in the June sampling, there were no differences between treated and untreated samples in grain weight, but whole plot yields showed that untreated plots were significantly better than treated, by 4 bushels per acre (Table 3).

Aphid Counts

Disulfoton granules applied with the seed in April at each of the rates 0.7 lb, 1.1 lb and 1.8 lb gave excellent control of aphids, both

in total numbers of aphids and total plants infested (Fig. 1). Sowings that emerged after aphid flights had ceased received no protection in the spring—i.e., several months after application of the insecticide. In this trial, use of granules for aphid control with June and August sowings did not result in any increase in wheat yields.

TABLE 1: APRIL-SOWN PLOTS, SAMPLED OCTOBER 4, 1966, EXPRESSED AS AN AVERAGE FOR 3 FT OF ROW

		<i>Trial A</i>			<i>Trial B</i>	
		<i>Control</i>	<i>0.7 lb</i>	<i>1.1 lb</i>	<i>Control</i>	<i>1.8 lb</i>
No of tillers		126	130	126	131	118
Green weight (g)		353	415	394	336	357
Dry weight (g)		76	82	77	73	71

TABLE 2: APRIL AND MAY SOWINGS OF TRIAL B. PRE-HARVEST SAMPLING EXPRESSED AS AN AVERAGE FOR 3 FT OF ROW

		<i>April Sowing</i>			<i>May Sowing</i>		
		<i>Control</i>	<i>1.8 lb</i>	<i>L.S.D.</i> <i>5%</i>	<i>Control</i>	<i>1.8 lb</i>	<i>L.S.D.</i> <i>5%</i>
No of tillers		115**	101	9.1	112*	99	10.1
No of heads		108*	94	10.7	106*	95	9.4
Head weight (g)		97	114*	15.0			
Weight of grain (g)		73	92**	8.6	85	93	N.S.

*—Significant difference at 5% level.

**—Significant difference at 1% level.

L.S.D.—Least difference for significance at 5% level.

TABLE 3: YIELDS EXPRESSED AS BUSHEL PER ACRE FROM ALL TREATMENTS OF TRIALS A AND B

<i>Sowing Date</i>			<i>Treatment per acre</i>	<i>Yield</i>	<i>L.S.D.</i>
Trial A		April 7	Control	52.2	3.3
			0.7 lb	55.5*	
			1.1 lb	61.1**	
Trial B		April 7	Control	49.6	2.6
			1.8 lb	57.4**	
		May 6	Control	53.9	
			1.8 lb	62.5**	
		June 3	Control	61.8**	
			1.8 lb	57.7	
		August 15	Control	37.5	
			1.8 lb	36.1	

*—Significant difference at 5% level.

**—Significant difference at 1% level.

L.S.D.—Least difference for significance at 5% level.

DISCUSSION

Under the conditions of this trial it would appear that only two of the factors measured, apart from aphid counts, were indicative of increased yield in disulfoton treated wheat—*i.e.*, total head weight and weight of grain. The trials showed that there were fewer tillers and heads on treated plots but that each head was heavier, either through having more grains per head or having heavier grains.

Statistically, the 3 ft samples from the May sowing failed to show a significant increase in yield, even though at harvest treated plots out-yielded untreated plots significantly. Infestation by aphids and subsequent virus infection was very uneven in May-sown plots and this increased the sample error within plots.

No significant differences were found between any of the factors measured in the June sowing. The decrease in yield shown in this sowing may have been caused by a deleterious effect of the insecticide, used at a rather high rate in the absence of virus infection. If this effect occurred in the April and May sowings, it was offset by a gain in yield when aphids and virus were controlled.

Cereal aphids as vectors of barley yellow dwarf virus, are responsible for considerable reductions in wheat yields. Even one or two aphids per plant in the autumn can cause significant yield reductions. The practice of using granules has an advantage over spraying because the chemical can be applied at sowing time and no extra operation is necessary.

At present there is no information to show that yields can be improved by sowing granules with spring wheat.

Leaf-rust which was present in many wheat crops in the Lincoln district severely damaged the August-sown wheat and must be responsible in part for the lower yield recorded.

If this method of aphid control proves satisfactory in future trials, widespread use of granules in wheat will depend on development of a suitable granules applicator for use with standard drills. This aspect is being investigated by the Agricultural Engineering Institute at Lincoln College.

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