CONTROL OF APHIDS IN CEREALS

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Summary

A single winter or early spring application of an aphicide to autumn-sown wheat effectively controlled the spread of barley yellow dwarf virus. Control was reflected in substantial yield increases. Trials with spring-sown wheat, on the other hand, emphasized the problems associated with control of the disease in spring-sown crops. The short residual life of insecticides favoured for aphid control must be considered in relation to the successive flights that can be expected over the spring months. A method of control has thus been formulated for autumn-sown crops, but more work will be necessary before the same can be done for spring-sown crops.

INTRODUCTION

SERIOUS OUTBREAKS of barley yellow dwarf virus (BYDV) in the seasons 1960-61 and 1962-63 stimulated intensified research into this disease and its insect vector. Included in this paper are results of trials on autumn-sown wheat in 1962-63 and on spring-sown wheat in 1963-64. The rates of chemicals are expressed in terms of active ingredient per acre.

AUTUMN-SOWN TRIALS

Two trials were established near Christchurch on an Aotea wheat crop sown in May, 1962, following a potato crop. A single rate of insecticide was used in each trial, one trial employing a high rate of organophosphate and the other a low cost chlorinated hydrocarbon. Materials used were dimethoate at 12 oz and lindane at 8 oz, the times of application being: 1, July 20; 2, July 20 and September 19 (two applications); 3, September 19.

Applications were made in 20 gal of water per acre at 30 lb/sq. in. pressure.

Dimethoate treatments were replicated four times, the lindane ones three times, in randomized blocks.

CONDITIONS AT SPRAYING

In July, the crop was about 6 in. tall and, following a period of frequent rains, aphid density varied from one per square yard to one per plant. In September, the crop was at the jointing stage, being about 12 in. tall, while aphid numbers had increased to between 5 and 20 per plant.

RESULTS

Statistical analysis of yields corrected to 14% moisture, gave the results set out in Table 1. Levels of significance are set out according to Duncan's test.

TABLE 1: YIELDS FROM AUTUMN-SOWN WHEAT

<i>Treatment</i>	<i>Yield Bushels per acre</i>	<i>% Screenings</i>
TRIAL 1:		
Dimethoate 12 oz, Jul.	67.6a A	2.9 b B
Dimethoate 12 oz, Jul. and Sep.	64.3a A	3.6 b B
Dimethoate 12 oz, Sep.	66.8a A	4.1 b B
Control	50.4 b B	9.5a A
TRIAL 2:		
Lindane 8 oz, Jul.	60.0 b A	9.5abA
Lindane 8 oz, Jul. and Sep.	68.7a A	7.1 bA
Lindane 8 oz, Sep.	63.2ab A	8.9abA
Control	51.0 c B	10.5a A

Viewed before harvest the sprayed plots stood in sharp contrast to the untreated ones. This was particularly true of the dimethoate trial and suggested that a plot width of less than 12 ft could safely be used. The absence of a space between plots made the sharpness of the line even more remarkable.

SPRING-SOWN TRIALS

Three trials were drilled near Christchurch with Hilgendorf wheat in late August, 1963. The previous crop was barley. The details of the trials were as follows:

1. Phorate and menazon each at 4, 8 and 16 oz per acre drilled with the fertilizer.
2. Menazon at 8 oz per acre, drilled with the seed as a sub-treatment in association with main treatments of menazon and demeton-S-methyl, each at 3 oz per acre sprayed in November.
3. Time of application of demeton-S-methyl at 3 oz per acre.

APHID INCIDENCE

The autumn of 1963 produced massive flights of the cereal aphid (*Rhopalosiphum padi*) but the winter was unusually harsh and prolonged and the spring build-up was considerably delayed. Cereal aphids trapped by the Entomology Division, Department of Scientific and Industrial Research, Lincoln, in the spring, 1963, were at least a month later in reaching peak numbers compared with the previous year. It was early November before any aphids were detected in the trial site and the population had reached a density of only about 1.5 aphids per plant when spray treatments were applied in late November. Numbers per plant varied from nil to 35, the aphids being concentrated mainly in colonies.

In Trial 3 sufficient plots were drilled to provide for three times of application. However, the crop had reached such an advanced stage of growth when the first spraying was carried out that only the one application was made. Spraying in both Trials 2 and 3 was done in late November when the crop was in the "boot" stage of growth.

RESULTS

When spraying was done in November, plots which had had insecticide at drilling were infested to the same extent as untreated ones. Thus, about three months after incorporation of insecticides in the soil, their effect had been dissipated.

Inspection just before harvest revealed about 15% of plants with symptoms of BYDV infection, this being general over all plots, in all three trials.

The grain was harvested and analysis of results showed no significant differences statistically, between any treatments in any of the three trials. This result is in line with other Department of Agricultural trials in the South Island and contrasts with real differences yielded by North Island trials. Positive results in the North could be due to an earlier spring build-up in aphid numbers after a more clement winter and early spring.

DISCUSSION AND CONCLUSION

AUTUMN-SOWN WHEAT

The magnitude of the loss in yield which can be caused by BYDV is indicated by the results from the autumn-sown trials, but thanks to information yielded by these and other field trials (Allen, 1963; Smith, 1963) coupled with a knowledge of the biology of the insect concerned (Lowe, 1962; Allen, 1963) effective control measures have been devised to deal with attacks on autumn-sown crops.

Autumn-sowing of wheat in New Zealand is virtually restricted to the South Island and in those districts the movement of winged cereal aphids follows a well-defined pattern of autumn and spring flights. Drilling of crops can therefore be delayed until the autumn flights have ended, while crops which do become infested can be cleared of aphids with one of the organophosphate aphicides commercially available.

Spring flights appear to have little or no effect on the yield of autumn-sown crops. The rapid development of plants in the spring could be rendering them unpalatable to the aphid, or perhaps the crop soon passes the stage where virus infection influences yield.

There are, of course, other approaches to the control of BYDV but meanwhile it is sufficiently well understood to permit the successful operation of a warning service to advise on control in autumn-sown crops at least.

SPRING-SOWN CROPS

The problem in spring-sown crops is not nearly so straightforward. These are at a susceptible stage of growth for two to three months during which they could be repeatedly infested by successive aphid flights. The recommended aphicides have only a short residual life and give only limited protection against reinfestation.

Insecticides are being used for soil treatment but do not appear to give sufficiently long-lived control. More information is required on materials which present no residue problem but can be formulated for release over a period of time. Granular formulations top-dressed after crop emergence might give the control required. The timing of applications to the growing crop also needs further investigation. The Department's field research programme for the coming year includes trials aimed at helping to elucidate these problems.

REFERENCES

- Allen, F. C., 1963: *Proc. 16th N.Z. Weed Control Conf.*, p. 96.
Lowe, A. D., 1962: *Proc. 15th N.Z. Weed Control Conf.*, p. 280.
Smith, H. C., 1963: *Proc. 16th N.Z. Weed Control Conf.*, p. 102.

ACKNOWLEDGEMENT

Thanks are due to T. J. Smallridge for assistance with field work and to the Biometrics Section, Department of Agriculture, Wellington, for statistical analyses.