SUMMARY OF TRIALS FOR THE CONTROL OF BARLEY YELLOW DWARF VIRUS

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Summary

From 1958 to 1969 there were 186 trials for the control of barley yellow dwarf virus (BYDV) in wheat. For each year, the main results and conclusions are outlined briefly. For autumn-sown wheat the trials have demonstrated that, by late sowing, the autumn aphid flights and the yield reducing effects of BYDV can be avoided. BYDV in early autumn-sown wheat can be controlled by an organophosphorus (O.P.) spray during the period June to September or by O.P. granules with the seed or topdressed later. For spring-sown wheat in the North Island, O.P. granules applied at sowing plus an O.P. spray 8 weeks later often resulted in yield increases. The response varied from season to season, and from one variety to another. There is evidence that not all winged cereal aphids were carrying BYDV.

INTRODUCTION

BARLEY YELLOW DWARF VIRUS (BYDV) was first recorded in New Zealand in 1953 (Smith, 1955, 1958). The relative importance of this disease was not recognized until further trial work was completed in the 1958-9 and 1960-1 seasons (Smith and Allen, 1962). In the 1962-3 season, many trials demonstrated the importance of BYDV in wheat crops and the control achieved by spraying with organophosphorus (O.P.) insecticides to eliminate the cereal aphid (*Rhopalosiphum padi*), the main vector of this virus disease.

The epidemiology of barley yellow dwarf virus is intimately associated with the activity of the cereal aphid and thus supporting studies on the biology and ecology of this aphid have been essential in order to interpret trial results. Lowe (1967) has provided aphid flight data for Lincoln for eight years from 1959 to 1966. This has shown that the spring aphid flights begin in September and end in December (with a peak in November). There are few flying in January and February and then the autumn flight is mainly in March and April but sometimes can last till mid-June. The intensity and duration of cereal aphid flights vary from year to year and this has an important influence on the BYDV outbreaks that occur. However, it cannot be assumed that all winged cereal aphids will be viruliferous (*i.e.*, carrying BYDV). In practice, the proportion that are viruliferous is likely to vary from year to year and from autumn to spring flights. This variation is due, no doubt, to the percentage infection and amount of BYDV in the plants that are acting as a source of winged aphids. After the arrival of winged aphids in cereal crops, there are two phases to the development of BYDV. The first is the introduction of virus into the crop. This is the primary infection and initial foci are formed within

crops. The second stage is the spread of virus within the crop. This is usually by wingless aphids which multiply and move within crops carrying virus from infected to healthy plants (this is the secondary spread of infection).

In the light of this introduction, this paper summarizes many trials and attempts to draw some general conclusions from all the data available. Since the 1962-3 season, there have been many trials in both the North and South Islands to further our understanding of the nature of this disease problem and the value of organophosphorus (O.P.) insecticides for controlling cereal aphids and thus BYDV.

1958-9, 1960-1 AND 1961-2

PLANT DISEASES DIVISION TRIALS AT LINCOLN

In each of these seasons, there was one trial to assess the value of demeton-S-methyl (DsM) sprays during the winter for the control of aphids and BYDV. In each season, there were increased yields following treatment: 1959-60 — 20% increase; 1960-1 — 33%; and 1961-2 — 37%. The most interesting trial was that in 1960-1, in which Aotea wheat was sown in early May and sprayed on October 6. In January, 1961, the BYDV infection in untreated plots was 80%, but 10 to 20% in treated. The yields were 50 bu and 66 bu per acre, respectively. It is apparent that in this trial there had been some primary infection from autumn flights, that some secondary spread had occurred before October 6, but that most had occurred after this date.

The results for these seasons are from Smith and Allen (1962).

1962-3 TRIALS

Lowe (1967) showed that flights during the autumn of this season were heavy and continued till mid-June. Wheat crops sown in early May would have emerged before the flights had ceased and become infested. Initial foci of aphids and BYDV would have become established. During the winter of 1962, a number of wheat crops were infested with aphids, and trials with O.P. sprays were initiated by Government and commercial personnel.

The main conclusions from these trials were that BYDV can have a very severe effect on wheat trials; that BYDV infection in autumn-sown crops can be prevented by spraying during the winter with an O.P. insecticide; and that there were little differences between sprays applied in July, August, September and October (note P.D.D. trials, 1, 2, 3 and 7). The sprays applied in October (P.D.D. trials 7 and 8) prevented much BYDV infection, indicating that aphids were still active and multiplying throughout October. The time in the spring when peak aphid populations occur in autumn-sown wheat will be very much dependent on weather conditions. Thus, in some years October sprays may be successful in preventing BYDV infection, but not in other years. The results from 1962-3 trials indicate that sprays were best applied in August or early September.

In North Island spring-sown wheat trials, O.P. granules at sowing gave a 31% increase in yield, and one DsM spray on November 17 increased yield by 27%. These trials were of value in the planning of future trial work.

Some of these trials have been described in detail (Allen, 1963; Smith, 1963a and 1963b; Smith and Wright, 1964; and Leonard, 1964).

TABLE 1: TRIALS IN 1962-3 FOR THE CONTROL OF BYDV IN WHEAT

Location, Variety and Date of Sowing	Chemical	Treatment		Date Applied	Yield (bu /acre)		Yield Increase (%)
		Rate (oz a.i./acre)			Untreated	Treated	
PLANT DISEASES DIVISION TRIALS							
1 Lincoln College, Aotea, 7/5/62	DsM dimethoate	3		22/6/62	55	75	35
		3.2		10/9/62	66	86	31
2 R. Morrish, Lincoln, Aotea, early May	DsM mevinphos	1.5		14/9/62	34	48	41
		1.5		14/9/62	34	43	23
	thiometon	1.5		14/9/62	34	41	17
3 Bailey, Springston, Aotea	DsM	1.5		30/8/62	49	62	30
	DsM	3.0		30/8/62	49	61	27
	dimethoate	2.4		30/8/62	49	50	2
4 G. Wright, Springston, Arawa	DsM	3		30/8/62	34	44	29
	dimethoate	5		30/8/62	34	45	32
	thiometon	3		30/8/62	34	58	70
	mevinphos	3		30/8/62	34	43	26
5 Lincoln College, Arawa	dimethoate	4		12/9/62	40.7	55.2	35
6 Lincoln College, Hilgendorf 61	dimethoate	4.8		18/7/62	39	60	52
	dimethoate	4.8		30/8/62	39	60	52
	dimethoate	4.8		9/10/62	39	39	—
	dimethoate	4.8		18/7/62 + 30/8/62	39	60	52

8	D. Marshall, Springston, variety trial, eleven varieties—overall effect	DsM	0.5	7/10/62	25	43	47
		DsM	0.75	7/10/62	25	43	47
		DsM	1.0	7/10/62	25	43	47
		DsM	1.5	7/10/62	25	41	64
		DsM	1.5	7/10/62	32	50	55
		DsM	2.5	10/10/62	39	45	15
9	Crop Research, Aotea, 23/5/62	DsM	3	22/6/62 + 7/9/62	55.2	65.9	19
DEPARTMENT OF AGRICULTURE TRIALS							
1	Spear Bros, Takapau, Aotea, spring-sown	Phorate at sowing	16		49 lb	67 lb	36.7 (or 9 bu)
2	Hobson, Gabo, spring-sown	Phorate at sowing	8		58 lb	73 lb	25 (or 7.5 bu)
3	Fairacres, Sanson, Mengavi, mid-October	DsM	2.5	17/11/62	36.5	46.5	27
4	Christchurch, Aotea, May	dimethoate	4.8	20/7/62	50.4	67.6	34
		dimethoate	4.8	19/9/62	50.4	64.3	28
		dimethoate	4.8	20/7/62 + 19/9/62	50.4	66.8	33
		Lindane, 8 oz, applied as above gave similar results					

TABLE 2: SUMMARY OF THE RESULTS FROM A TOTAL OF 22 TRIALS IN 1962-63 USING INSECTICIDES FOR BYDV CONTROL, 19 IN CANTERBURY AND THREE IN THE NORTH ISLAND

<i>Trials by</i>	<i>No. of Trials</i>	<i>Yield from Untreated Areas (bu)</i>	<i>Average Increase (bu/acre)</i>	<i>Yield Increase (%)</i>
H. C. Smith	9	42	13	31
W. Leonard	2	51	15	29
C. C. McLeod	1	37	0	0
F. C. Allen	1	47	16	34
E. May	2	44	16	36
A. Coughlan	3	31	9	29
R. S. McKenzie	1	6	34	560
M. S. Foreman	3	38	17	45
Total	22			
Averages		39.1	14	35.8

1963-4 TRIALS

PLANT DISEASES DIVISION TRIALS

Nine field trials were sown between May 7 and 31 using disulfoton and phorate (at 1 and 2 lb a.i. per acre) granules applied with the seed. There were no differences in aphid populations and yields between treated and untreated plots.

DEPARTMENT OF AGRICULTURE TRIALS

(a) Ten variety trials were sown during May, 1963 in various localities (mainly in Canterbury), and half the replications were sprayed once with DsM (3 oz a.i.) at end of July or early August. There were no significant differences in yield between sprayed and no treatment plots.

(b) Eleven autumn-sown farmers' crops were sprayed either in July or September or on both occasions. None of the sprayed treatments differed significantly from the check plots, owing in at least 6 cases to the crops being late-sown and avoiding aphid flights.

Six spring-sown farmers' crops were sprayed either in October or November or both times. There were no significant yield differences except at Ashcott where a spray on October 22, 1963, increased yield seven bushels but a spray on November 26, 1963, had no effect.

(c) Phorate or menazon granules were applied at sowing to eight autumn-sown wheat trials and some were sprayed later with DsM. In no case was there a yield increase following treatment. This was mainly because seven of the trials were sown in late May or June (and so avoided aphid flights).

In three spring-sown trials, there were no yield increases following the use of phorate drilled with the seed.

(d) There were four spring-sown variety trials in which half the replications were treated once with DsM. At Marton (sown 27/9/63), a spray on 13/11/63 increased yield from 70.9 bB to 77.4 aA. There were no differences in the other three trials.

(Note: All yields throughout this paper are expressed in bushels per acre.)

TRIALS BY HENRY H. YORK & CO. LTD.

Three trials were laid down in 1963 on spring-sown wheat using 0.3, 0.5 and 1 lb a.i. of disulfoton (per acre) drilled in with the seed. There were only a few aphids and hence little BYDV in Bulls and Masterton trials. However, at Glen Orua, good aphid control was achieved with the high rate of disulfoton, there was less virus, and the yield increase was 23% (Smith *et al.*, 1964).

1964-5 TRIALS

DEPARTMENT OF AGRICULTURE TRIALS

(a) In twelve autumn-sown variety trials, half the replications were sprayed once with DsM. There were no responses following treatment.

(b) Three spring-sown variety trials in Otago-Southland were treated but there were no significant increases. There were no increases in two similar trials in the North Island.

(c) Nine wheat crops in Canterbury were treated with DsM either in early August, or early October, or on both occasions. In seven trials, there were no significant differences, but in two there were small increases in yield.

In Marlborough, there were four trials. In two, no responses following treatment; in one there was a response after a spray in early August, but not following a spray in late September; and in the last a response following a spray in late September but not after a spray in mid-November.

In the North Island, in two trials at Takapau (sown early September), there was only in one a small response after treatment on October 23, but not after treatment in late December.

In all these trials, a DsM spray (at 3 oz a.i.) had been compared with phorate as a topdressing. Wherever the spray had increased yield, granules as a topdressing were also effective.

(d) Rates and placement of granules. Five trials compared phorate and disulfoton (each at 4, 8 and 16 oz) either drilled with the seed or topdressed later. There was a significant response in only one trial — and this occurred with both chemicals and with both methods of application

TRIALS BY HENRY H. YORK & CO. LTD.

(a) Spring-sown Aotea. Disulfoton granules (8 oz a.i.) topdressed on the crop 19/11/64 increased yield by 6.7%, the DsM spray (2.5 oz a.i.) caused an 11.2% increase.

(b) Spring-sown Kenia barley. Disulfoton granules (8 oz) topdressed on 25/11/64 caused a yield increase of 6.3%, a DsM spray — 4.4%.

1965-6 TRIALS

DEPARTMENT OF AGRICULTURE TRIALS

(a) Fourteen autumn-sown variety trials were treated twice with DsM (3 oz) — in early August or early September and again in mid-October. In only one trial was there a highly significant response to spraying, the differences being: untreated 46.2 bB, treated 59.0 aA. This was at Rotherham in a crop sown 11/5/65.

(b) Four spring-sown variety trials were sprayed twice. In two trials, there was no effect from spraying, but at Kairanga untreated yielded 68.6 bB, treated 77.6 aA, and at Marton — untreated 79.5 bB, treated 88.7 aA. In these two trials there were different variety responses following treatment — the range at Kairanga was + 3.1 (Raven) to + 16.8 (Aotea) and at Marton + 0.2 (Gamenya) to + 15.3 (Raven).

(c) Three trials compared disulfoton as a topdressing with DsM as a spray on spring-sown wheat. In only one was there a very small response after spraying.

(d) Five trials compared disulfoton (at 4, 8 or 16 oz) either with the seed or subsequently topdressed on spring-sown wheat. The only response achieved was a small increase in two trials with 16 oz drilled with the seed.

(e) Nine trials were laid down on farmers' crops, DsM sprays being applied either in August early September period, or in late September-mid-October period. In this series, the most important result was that in six of these trials there were significant responses following the first sprays, but no response to the second spray, which was too late to be of benefit. The aphid numbers present and yield data for some of these trials have been published (Mulholland *et al.*, 1967; Stephen, 1967).

1966-7 TRIALS

DEPARTMENT OF AGRICULTURE TRIALS

(a) Only one out of 14 autumn-sown variety trials was treated with DsM but there were no yield differences.

(b) Spring-sown variety trials — North Island. There were three trials, in which half the plots were sprayed twice with DsM (on 10/11/66 and 8/12/66).

There were no significant differences at Marton but at Masterton and Sanson there were highly significant variety $\times$ spraying interactions. This is surprising since the highest aphid populations were in the Marton trial. Although not statistically significant, four of the varieties in the Marton trial yielded 11 bu or more following the spray treatment. There were marked differences between varieties in their response to treatment. In general, Raven, Triple Dirk, Gamut, Falcon and Heron were most susceptible to the effect of BYDV, while Gamenya was least affected (Table 3).

(c) Five trials were laid down on farmers' crops in Canterbury. DsM (3 oz a.i.) was applied on four occasions and in various combinations to give 16 treatments. In only one trial (at Rotherham) were there small but significant yield increases following sprays applied on June 23, July 27, August 22 and September 28. Thus any time from June to August was effective. Spraying twice gave a small response over spraying once, but no significant interactions included the September spray (Stephen, 1967).

(d) Control of BYDV in spring-sown wheat in North Island. There were two trials which have been reported in full by Blackmore (1967). At Marton there were no significant yield increases, while at Palmerston North yields were increased by all sprays and combinations of disulfoton with

TABLE 3: MEAN YIELDS (IN BU/ACRE) FROM THREE* SPRING-SOWN VARIETY TRIALS (NORTH ISLAND) THAT WERE TREATED† FOR BYDV CONTROL

Variety	Yield from		Mean Response to Spraying
	Unsprayed Plots	Sprayed Plots	
1. Raven	65.3	75.3	10.0
2. Gamenya	63.0	67.1	4.1
3. Triple Dirk	55.6	65.3	9.7
4. Falcon	54.4	63.2	8.8
5. Gamut	48.5	59.3	10.8
6. Mendos	51.5	57.7	6.2
7. Heron	40.4	50.5	10.1
Averages	54.1	62.6	8.5

*The trials were at Masterton (sown 28/9/66), Marton (sown 30/9/66) and Sanson (sown 3/10/66). In the Masterton and Sanson trials, there were highly significant variety $\times$ spraying interactions.

†A DsM spray (3 oz) was applied twice to each trial — on 10 or 11/11/66 and again on 8/12/66.

the seed plus sprays. It was concluded from both trials that the amount of BYDV present bore no relationship to the aphid populations present, indicating that many of the winged cereal aphids were not carrying virus. The best treatments were disulfoton granules with the seed + sprays A and B (30 and 43 days after sowing) 66.5, granules + spray C (55 days) 66.4, as compared with disulfoton alone 57.4 and check plots 54.6 bushels.

(e) Control of cereal aphids and BYDV in autumn-sown wheat. There were two interesting trials at Rotherham and Waikari. Both were successful. The use of disulfoton granules with the seed in early May, or top-dressed on the crop on 28/9/66 gave significant yield increases in both trials. A DsM spray on 28/9/66 gave similar yield increase but not when applied on 1/11/66 (Stephen, 1967).

PLANT DISEASES DIVISION TRIAL

Details have been published (Mulholland and Jessep, 1967). The conclusions were: (a) Early-sown wheat can be protected against cereal aphids by O.P. granules drilled with the seed. (b) This protection had prevented BYDV infection and yields were increased in the April and May-sown treated plots. (c) In the May plots it was apparent that low numbers of cereal aphids could have a profound effect on yields if not controlled.

In two barley trials, O.P. granules drilled with the seed in October, 1966 did not affect yields.

1967-8 TRIALS

DEPARTMENT OF AGRICULTURE TRIALS

(a) Spring-sown variety trials (North Island). Two of the four trials showed significant yield increases as a result of treatment, one trial showed

a significant depression in yields, while the fourth gave variable variety responses but no overall response either way. Wheat varieties did differ in their response to treatment, and their responses varied from one trial to another. There did not appear to be any consistent pattern in variety response. Aphids were present in low numbers in all trials.

TABLE 4: RESULTS FROM SPRING-SOWN VARIETY TRIALS (NORTH ISLAND) TREATED WITH 1 LB DISULFOTON AT SOWING PLUS A DEMETON-S-METHYL (3 OZ) SPRAY

	<i>Feilding</i>	<i>Marton</i>	<i>Masterton</i>	<i>Takapau†</i>
Sown	15/9/67	22/9/67	12/10/67	22/8/67
Sprayed	23/11/67	26/11/67	12/12/67	8/11/67
Growth stage when sprayed	Feekes 9-10	Feekes 10-10.1	Feekes 7-10	Feekes 6-7
<i>Variety</i>	<i>Response to Treatment (bu)</i>			
Gamenya	— 5.7	+ 0.2	+13.7*	—1.8
Aotea	—	—	+ 15.0*	—
Raven	—10.7*	+11.7	+ 7.6	—4.3
Triple Dirk	+ 0.8	+ 7.5	+17.8*	—1.8
Gamut	+ 3.3*	+ 8.2	+ 17.0*	—3.0
Falcon	+12.0**	+10.0	+ 20.1*	—1.2
Heron	+ 4.8	+ 4.3	+ 7.4	+0.3
Hil. 61	—	—	+12.2**	—
Mean all var.	+ 0.8	+ 7.5*	+13.7**	—2.0*
CV	6.9%	6.0%	6.3%	4.0%

†This trial no disulfoton granules at sowing.

(b) Control of BYDV in spring-sown wheat (North Island). There were five trials using O.P. granules and combinations of granules with sprays. In three trials (Kairanga, Marton and Takapau), there were no significant yield increases following treatment. At Marton, there was a moderate aphid population in untreated plots — and yet yields were not increased with insecticides. This indicates again that many winged aphids in the spring may not be carrying virus.

In one trial at Bulls, there were high aphid numbers at the end of November, and yields were increased from 72.8 to 79.8 bu (+ 7.0) by using disulfoton granules at sowing. In spite of aphids there was not a large depression in yield, indicating again that many aphids were not carrying virus.

A fifth trial at Milson showed an increase from 64.9 to 69.6 bu (+ 4.7) following disulfoton at sowing and one DsM spray.

(c) Control of BYDV in autumn-sown wheat — Canterbury. There were two trials similar to 1966-7 (e), at Loburn and Waikari. In neither trial was there an increase in yield following treatment.

PLANT DISEASES DIVISION TRIAL

The trial at Lincoln compared five times of sowing and four treatments on each sowing. There were no significant differences in yield be-

tween treatments. Differences in BYDV infection were apparent in the early April-sown plots but these were nullified by grain aphid in late spring. There were no differences in yield between plots sown on May 19, June 9 and June 28, 1967.

1968-9 TRIALS

DEPARTMENT OF AGRICULTURE TRIALS

(a) Spring-sown variety trial (North Island). Half the replications were treated with disulfoton at sowing + DsM spray later. There were 6 trials in all, and at Masterton and Takapau there were yield increases following treatment.

(b) Barley trials. There were two trials in the Waikato — but neither responded to treatment. The mean yields were excellent, 104 bu, and 122 bu.

There was a trial on Zephyr barley at Masterton. Disulfoton granules (2 lb a.i.) were broadcast over the area before drilling on 18/10/68. The mean difference between untreated and treated areas was 8.4 bu (highly significant).

PLANT DISEASES DIVISION TRIAL

Wheat was sown on May 20, July 3 and August 8 and each sowing contained, as treatments, disulfoton granules at sowing, topdressed in October and these combined. There were no responses following these treatments. The mean yields from the different sowings were May 20 — 26.9 (extensive bird damage), July 3, 40.3, and August 8, 41.8 bu.

TABLE 5: SUMMARY OF TRIALS FOR CONTROL OF BYDV IN WHEAT

	1958-9	Season					
		1960-1		1961-2			1962-3
Autumn-sown wheat:							
Sprays applied in winter or spring for BYDV control	1/1*	1/1		1/1			21/22
	1963-4	64-5	65-6	66-7	67-8	68-9	Totals
Variety Trial + Insecticide:							
Autumn-sown	0/10	0/12	1/14	0/1	—	—	1/37
Spring-sown	1/4	1/5	2/4	2/3	2/4	2/6	10/26
Autumn-sown Wheat:							
Sprays for BYDV control	0/11	4/13	7/9	1/5	—	—	12/38
Granules + sprays	1/6	—	—	2/2	0/2	—	3/10
Granules	0/12	1/5	—	1/1	0/1	0/1	2/20
Spring-sown Wheat:							
Sprays for BYDV control	1/6	1/3	—	—	—	—	2/9
Granules + sprays	—	—	1/3	1/2	1/4	—	3/9
Granules	1/6	—	2/5	—	1/1	—	4/12
Totals	4/55	7/38	13/35	7/14	4/12	2/7	37/161

*Numerator — number of trials in which yields were increased by treatment.

Denominator — total numbers of trials.

GENERAL CONCLUSIONS FROM TRIAL RESULTS

Table 5 gives the overall summary of BYDV trials in New Zealand and shows the number of trials in which yields were increased by treatment.

AUTUMN-SOWN WHEAT, SOUTH ISLAND

Control by Insecticides

With early autumn-sown wheat crops, the primary stage of infection with BYDV occurs in May and early June when aphids are still flying. Centres of infection and of aphids become established within crops. Secondary spread is of major importance and occurs in August, September and October when the wingless aphids are multiplying and moving about the crop and transmitting virus to healthy plants. This delay between primary and secondary infection provides an opportunity for an organophosphorus insecticide to be applied and aphids eliminated from the crop. In this way secondary spread and the yield-reducing effects of BYDV are prevented. The O.P. insecticides can be applied and were effective either:

- (1) As sprays in June, July, August or September. Note P.D.D. trial results 1962-3, and also Agriculture trials 1965-6 (e) and 1966-7 (c).
- (2) As granules drilled in with the seed. Note P.D.D. trial 1966-7 and Agriculture trials 1966-7 (e).
- (3) As granules topdressed in August or September. Note Agriculture trials 1966-7 (e) and 1964-5 (c) and (d).

Thus the current recommendation is for a thorough inspection of wheat crops in late July (particularly those early-sown). If aphids are found, then the crop should be treated, preferably before September 1. Late sprays, particularly after the end of September, have been found to be not as effective as those applied earlier (Stephen, 1967).

In some trials, there have been differences between varieties in their response to treatment with O.P. sprays. In the 1965-6 (a) trial at Rotherham, the responses following treatment with DsM were: Aotea, + 15.5; Hil.6.1, + 15.0; 747.01, + 13.5; 849.01, + 6.4; 946.01, + 17.9; and 996.01, + 8.6. The overall response was + 12.8, and the CV 2.9%.

Control by Late Sowing

When wheat is sown in late May or June, the aphid flights have ceased by the time the wheat has emerged. Thus the damaging effects of cereal aphid infestations and of BYDV have been avoided.

This is best illustrated by the autumn-sown variety trials (Table 5) where only one trial responded to insecticide out of a total of 37 treated. The lack of results in some trials for BYDV control has been because they were late-sown. The effect of spring flights of the cereal aphid on wheat crops sown in June has yet to be resolved. Observations to date indicate that they may be of little consequence and that grain aphid is likely to be more of a problem.

SPRING-SOWN WHEAT, NORTH ISLAND

With spring-sown cereal crops, the likelihood of primary infection with BYDV is continuous throughout the spring aphid flight but depends on the number of winged cereal aphids which are carrying virus. Secondary

spread of BYDV can occur as soon as cereal aphid populations have developed within the crop but again is dependent on the number of primary centres of BYDV which may have become established. Thus, primary and secondary infection can occur simultaneously and the need is for good insecticidal control for about eight to ten weeks from sowing till early December.

TABLE 6: SUMMARY OF TRIALS FOR THE CONTROL OF BYDV IN SPRING-SOWN WHEAT IN THE NORTH ISLAND

	Season							Totals
	1962-3	63-4	64-5	65-6	66-7	67-8	68-9	
Variety trial + Insecticide	—	1/3	0/2	2/4	2/3	2/4	2/6	9/22
Sprays for control	1/1*	1/4	1/2	—	—	—	—	3/7
Granules at sowing or granules at sowing + sprays	2/2	1/6	—	2/6	1/2	2/5	—	8/21

*Numerator — number of trials in which yields were increased by treatment.

Denominator — total number of trials.

The important points learnt from the 50 trials in the North Island are:

- (1) There is great variation from one year to the next in the number of successful trials and the extent of the yield increases obtained.
- (2) There have been large variations in the number of aphids present in trials and these have not been related to BYDV infection and subsequent yield increases. In some cases, aphids have been present and have been controlled effectively but yields have not been increased. This indicates that many winged cereal aphids in the spring are not carrying BYDV and hence little BYDV damage has occurred (note Agriculture trials 1966-7 (e), 1967-8 (b)).
- (3) In some trials, the yield increase has been slight and much less than expected from the aphid population present (note trial at Bulls 1967-8 (b)).
- (4) The most effective method of controlling aphids and BYDV has been O.P. granules at sowing plus an O.P. spray at about 8 weeks after sowing. The granules at sowing provide only limited protection and their effect is minimized by the vigorous extension growth of the wheat at about 6 weeks after sowing. (Agriculture trials 1966-7 (d), and 1967-8 (a) illustrate these points.)
- (5) Wheat varieties differ in their susceptibility and this can be assessed to some extent when variety trials are treated for BYDV control. Variety responses were not consistent and often differed markedly from one trial to another and from year to year. In general, most Australian varieties are very susceptible to BYDV, but Gamanya is often the variety that is least affected. (Agriculture trials 1966-7 (b), 1967-8 (a).)
- (6) Of the 50 trials on wheat in the North Island, there have been 23 west of the main range (in 12, yields were increased by treatment); and 27 trials were in the east (in 8, yields were increased).

BARLEY TRIALS

There have been only a few trials to test the value of using O.P. granules for the control of BYDV in barley. In most trials, BYDV has not been a problem and yields have not been increased. The only yield increase reported is that at Masterton in the 1968-9 season. Further trials on barley do not seem warranted in spite of suggestions that grain quality may be improved following treatment.

ACKNOWLEDGEMENTS

In addition to the references, much of this information is from the unpublished records of the Wheat Specialist committee. Of the 186 trials reported, 149 were by Department of Agriculture, 26 by Plant Diseases Division, and 11 by commercial interests. (It will be obvious that firms have initiated many trials but these have not been reported or have been terminated for various reasons.)

I am grateful to P. B. Lynch for permission to use unpublished Department of Agriculture results. The work of their many field officers is appreciated, in particular of C. C. McLeod, R. C. Stephen, W. Crawford and L. W. Blackmore, to name but a few of those engaged on trials for the control of BYDV.

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