THE TOLERANCE OF WINTER WHEAT TO TRI-ALLATE

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Summary

Results indicate that wheat sown in late autumn or winter tolerates tri-allate at 1.4 kg/ha, a rate which gives a most acceptable level of control of wild oat (*Avena* spp.). Although the two times rate of 2.8 kg appears acceptable to growers if overlapping accidentally occurs, a yield reduction could be obtained compared with standard rates. Improved incorporation of tri-allate can be achieved by weighting the hindmost part of the tine-harrow leaves.

INTRODUCTION

WILD OATS influence cropping to varying degrees from Willowbridge, North Otago, to Hawarden, North Canterbury. *Avena fatua* and *Avena persicaria* are present, with *Avena fatua* most prevalent. Allen (1970) suggested that a threshold density for yield response is in the order of 35/m² in wheat and barley and 15/m² in peas. He concluded that an area of 2,800 ha would warrant treatment in any one season.

Allen (1970) reported on the value of early removal of competition of wild oats. From his work, pre-plant soil-incorporated treatments yielded significantly better than untreated more frequently than did post-emergence treatments made at the 1- to 5-leaf stage. These results confirm studies by Henry and Frieseai (1965) conducted at the University of Manitoba who established, from three years of research, that wheat exposed to 100 wild oats/m² before the crop developed to the 2-leaf stage lost 323 kg/ha—a significant reduction when it is realized that these crops averaged only 1730 kg/ha.

The use of tri-allate for the control of wild oats is well known (Hannah *et al.*, 1960). The compound has been in use in New Zealand since 1963 for application to spring-sown cereals and peas. Local tests were undertaken over two seasons to determine the following:

- (1) Whether winter wheat tolerated herbicidal rates of tri-allate.
- (2) Whether acceptable wild oat control would be obtained.
- (3) Whether practical methods of soil incorporation could be achieved.

EXPERIMENTAL

Tri-allate was tested in four locations in randomized-block designs. Plots were 80 m² in size with 4 replications for two sites, and for the remaining two plots were 20 m² in size with 8 replications.

Observational tests were performed on 20 locations. Strips were boom width with a 3 m buffer control between treatments. Of these locations, extensive tests were carried out at four sites, using all available equipment and methods in order to assess incorporation performance and the resulting weed control.

Yields were obtained by harvesting three quadrats per plot and calculating an average per square meter. Wild oat and crop counts were obtained from an average of three quadrats per plot.

Weed control was visually assessed on a 0 to 10 scale (0 = nil control, 10 = 100% control). Although all small plot trials were performed only on the variety Arawa, eight observational tests were undertaken on Aotea, three on Hilgendorf, one on Kopara, with the remainder on Arawa.

RESULTS

The results of the four small plot trials are presented in Tables 1 and 2.

TABLE 1: WILD OAT CONTROL AND CROP TOLERANCE 1969

<i>tri-allate</i> (kg/ha)	Weed Cont. 4/12/69	Plant Counts 28/8/69	Yield (kg/ha)	
			Leeston	Rangiora
0.8	7.8	94	4,480	—
1.1	8.4	85	4,540	3,430
1.4	7.2	95	4,550	3,280
1.7	8.3	84	4,400	3,480
2.2	8.1	86	4,640	3,360
Untreated control	4.9	88	4,710	3,620
Date applied			25/6/69	24/6/69
Harrow incorporated			Post-seeding	Post-seeding
Seed-bed at treatment:				
Condition			fine	cloddy
Moisture			trace	nil
Rainfall for month following treatment			25 mm	33 mm
			(—33 mm av.)	(—28 mm av.)
Av. no. wild oats/m ²			35	0
Variety			Arawa	Arawa

TABLE 2: WILD OAT CONTROL AND CROP TOLERANCE 1970

<i>tri-allate</i> (kg/ha)	Yield (kg/ha)	
	Leeston	Rangiora
0.7	3,680aA	5,510aA
1.4	3,250bB	4,890bB
2.8	2,450cC	4,760bB
Untreated control	95dD	1,720cC
CV %	10.5	5.0
Date applied	1/6/70	14/6/70
Harrow incorporated	Pre-seeding	Pre-seeding
Seed-bed at treatment:		
Condition	fine	fine
Moisture	moist	moist
Rainfall for month following treatment	62 mm	63 mm
	(+41 mm av.)	(+12 mm av.)
Av. no wild oats/m ²	2000	1000
Variety	Arawa	Arawa

DISCUSSION

Results, in terms of yields, have been variable. Tests undertaken in 1969 were possibly masked by drought conditions. No yield responses were obtained even where the wild oat infestation average was 35/m². It was interesting to note that yield reductions were of little consequence from the use of high rates under these dry conditions.

Conversely, in the 1970 tests an increase in rate reduced yields. Exceptional yield responses to wild oat control were obtained from both trials in Table 2 where extraordinarily high infestations occurred.

It is suggested that yield responses vary according to seasonal conditions, weed density and crop vigour.

Observations from four field tests suggests there are no differences between pre-plant and post-plant treatments provided seeding depth is a minimum of 50 mm, incorporation is not deeper than the seeding, and that seed-bed preparations and soil moisture conditions are optimum. However, incorporation may be inadequate with the post-seeding method. This, in addition to soil compaction problems, suggests the pre-plant application technique to be more practical.

INCORPORATION

Since tri-allate is a volatile thiocarbamate, it has been necessary to soil-incorporate to a depth of 50 mm immediately following application. While the technical reasons and problems of incorporating such herbicides have been fully expounded by Gerard (1970) and van Diepen (1970), most of which are generally recognized, few ideas were put forward on how to overcome technical problems or equipment limitations.

The distribution of tri-allate in the soil is normally uneven vertically, with a high concentration near the surface. Because of the volatility and photo-degradation factors, it is considered desirable to obtain a reasonable depth of incorporation. However, it is important to seed below the treated layer, in order to obtain a measure of depth protection, particularly if high rates are being used.

In an effort to improve the efficiency of the incorporation operation and the end results, equipment such as tandem-discs, Dutch harrows and a three-point-mounted grubber were assessed against the tine-harrows as a standard. In all cases weed control results appeared substandard when only one run of each implement was employed. On the other hand, two runs, at right-angles to each other, demonstrated acceptable weed control in all cases.

Problems still arose. Unless the soil was of a heavy nature and consolidated, it proved difficult to obtain depth control with the discs during the second run. The Dutch harrows demonstrated reasonable efficiency on very level seed-beds. Where hollows and ridges occurred, this implement would denude one area of treated soil and deposit it in hollows with the result of patchy weed control. In the hands of a skilled operator, incorporation with the grubber can be most successful.

The time factor of the operation must be considered. Incorporation with limited-width equipment such as discs and grubbers is more time-consuming by about 33 to 66% in comparison with the gang-harrows standard.

Consequently, from the tests undertaken, it has been concluded that heavy tine-harrows remain the most practical implement available for the incorporation of tri-allate.

The adding of weight to the rear of each harrow leaf is recommended to improve the efficiency of this equipment, in terms of thorough and deeper mixing. This provides more soil movement with the aid of the equipment frame and incorporation to the 50 mm level can be readily achieved. However, a reasonably fine, free-flowing soil is required at the time of the operation. Awareness of incorporation problems by the operator is essential to overcome indifferent results in the form of striping. For example forward speed greater than 11 k/h could cause ridging, particularly at the corners.

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