DIFENZOQUAT FOR WILD OAT CONTROL IN CEREALS

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Summary

Difenzoquat at rates of 0.75, 1.00, and 1.25 kg/ha gave a high level of wild oat (*Avena* spp) control equivalent to that achieved by benzoylprop-ethyl. Significant yield responses were recorded following difenzoquat application to wheat (*Triticum* spp.) which together with barley (*Hordeum distichon*) was tolerant to the rates used.

INTRODUCTION

Allen (1962; 1972) has reviewed the wild oat (*Avena* spp.) problem in New Zealand and emphasised the seriousness of the weed in certain areas. The presence of wild oats in cereal crops reduces yields, increases harvesting problems and causes the rejection of crops grown for seed.

Difenzoquat has been widely tested for wild oat control since 1971 and has been found to be effective against several species of wild oats including *Avena fatua* and *A. ludoviciana* (Shafer 1974), the two species of importance in New Zealand.

Overseas work has established the need for a wetter to be used in conjunction with difenzoquat (Shafer 1974) and 'Teric GN9' was used in the initial New Zealand trials. In 1974 'Agral LN' was substituted as this had the same active ingredient and was readily available in New Zealand. During 1973 and 1974 four trials on wheat (*Triticum* spp.) and two on barley (*Hordeum distichon*) were conducted throughout Canterbury.

EXPERIMENTAL METHOD

Wheat trials were established in wild oat infested paddocks and the treatments applied in relation to crop stage. In all cases benzoylprop-ethyl was used as the standard chemical.

The selection of barley sites proved more difficult as many crops in wild oat areas were sown following soil treatment with trifluralin and it was necessary to arrange for paddock areas to be left untreated by this chemical which did not allow site selection according to intensity of weed population.

All trials were arranged in randomised blocks replicated four times with plot sizes large enough to allow mechanical harvesting. Plots were sprayed with a hand held boom connected to a pressurised knapsack and water rates ranged from 220 to 316 litres/ha. The surfactant was added to the difenzoquat spray mixture at the rate of 5 ml/litre of 'Teric GN9' or 7 ml/litre of 'Agral LN'. Times of application treatments were made according to crop stage. Wild oat stage was noted and in the tables the stage shown is that of the majority. The range of chemical rates was greatest on the earliest applications, on the assumption that weed control at this stage may have been possible with the lower rates of difenzoquat. As growth progressed lower rates were rejected but one rate was common to each application time. Benzoylprop-ethyl was applied at the rate and time recommended.

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Other herbicides were applied at the same time as required in the remainder of the paddock although it was ascertained on each occasion that the timing would not interfere, according to available information, with the chemicals under test.

Observations were made following difenzoquat application to determine initial effects on wild oats and crops. Visual assessments of wild oat control were made during the season but the major control figures were obtained by counts taken at harvest when wild oat stems or panicles were counted. In one trial, a distinction was made between wild oats flowering above the crop and those flowering within the crop. Yields were determined by harvesting a measured area with a mini-header and total grain weighed. Samples of grain from each plot were collected to allow moisture content and one thousand grain weight determination. All yields were corrected to 15% moisture content.

RESULTS

Two to three weeks after difenzoquat application wild oats were noticeably stunted and had yellow patches on the leaves. In only two cases were any effects on the crop observed. These consisted of slight leaf yellowing which was restricted to the lower leaves of individual plants, the number of which amounted to less than 5% of total plant population. Both occurrences of crop discolouration resulted from application at Feekes 2 when night temperatures were low.

In 1973 difenzoquat was applied to Kopara wheat at Feekes 2 when wild oats were up to 5 leaf stage. Difenzoquat at 0.75, 1.00, and 1.25 kg/ha produced wild oat control equivalent to that achieved by benzoylprop-ethyl although there were visual differences in effect. At harvest counts of wild oat panicles/m² produced the following result:

	Panicles:	<i>above crop</i>	<i>below crop</i>	<i>total</i>
untreated		51	14	65
difenzoquat		20	10	30
benzoylprop-ethyl		2	35	37

Yield increases of 13 and 14% were recorded for the difenzoquat rates of 0.75 and 1.0 kg/ha.

Another trial on Hilgendorf wheat at Feekes 2 attained 90% control initially but the germination and establishment of fresh wild oat plants reduced the control level to 70% by harvest compared to 95% by benzoylprop-ethyl applied at Feekes 7.

Wild oat control assessments and grain yields from the two major trials A and B are shown in Tables 1 and 2. In Trial A there were highly significant differences (1% level) in wild oat control between times of application. Superior results from difenzoquat at 0.75 and 1.00 kg/ha were achieved from spraying when the majority of the wild oat population had reached or passed the five leaf stage instead of the three leaf stage. Difenzoquat at 1.25 kg/ha when applied at the three leaf stage however did give control statistically equivalent to that of the lower rates applied at the five leaf stage. In both trials A and B wild oat control by difenzoquat was equivalent to that achieved by benzoylprop-ethyl.

In both the 1974 wheat trials difenzoquat at all rates gave yield increases over untreated which were highly significant and in one case difenzoquat gave yield increases significantly greater than that from benzoylprop-ethyl.

TABLE 1: TRIAL A ON WHEAT (Kopara 73)

Location: Lincoln, North Canterbury.

Soil Type: Templeton and Wakanui.

<i>Date of application</i>	<i>Wild oat control</i>		
<i>Crop stage: Wild oat stage</i>	<i>24.12.74</i>	<i>27.1.75</i>	<i>Yield 27.1.75</i>
<i>Treatment kg/ha</i>	<i>% control</i>	<i>stems/m²</i>	<i>% of untreated</i>
untreated control	0	121 aA	100 dC
28.8.74. Feekes 1 to 2: 3 leaves.			
difenzoquat 0.5	5	78 bB	142 cB
0.75	15	104 abAB	153 bcAB
1.00	35	80 bB	181 abAB
1.25	64	38 cC	188 aA
18.9.74. Feekes 3 to 4: 5 leaves.			
difenzoquat 0.75	23	37 cC	158 bcAB
1.00	62	17 cC	181 abAB
1.25	67	14 cC	176 abAB
18.10.74. Feekes 6 to 7: 1st Node.			
difenzoquat 0.75	68	15 cC	160 bcAB
benzoylprop-ethyl 1.80	86	14 cC	158 bcAB
CV %		30.9	9.2
control yield 2512 kg/ha			

TABLE 2: TRIAL B ON WHEAT (Kopara)

Location: Willowbridge, South Canterbury.

Soil Type: Willowbridge.

<i>Date of application</i>	<i>Wild oat control</i>		
<i>Crop stage: Wild oat stage</i>	<i>4.12.74</i>	<i>8.2.75</i>	<i>Yield 8.2.75</i>
<i>Treatment kg/ha</i>	<i>% control</i>	<i>stems/m²</i>	<i>% of untreated</i>
untreated control	0	84	100 cB
1.10.74. Feekes 3 to 5: 5 leaf.			
difenzoquat 0.5	93	3	268 aA
0.75	98	4	250 aA
1.00	100	3	235 aA
1.25	100	2	268 aA
21.10.74. Feekes 7: tillering complete.			
benzoylprop-ethyl 1.80	100	3	159 bB
control yield 2280 kg/ha			

In trial A yield responses from 0.75 kg/ha difenzoquat were equivalent from each time of application despite different levels of ultimate wild oat control. Similarly yields from 1.00 and 1.25 kg/ha did not vary with application time. Although not significantly different there was a trend in the yields favouring the difenzoquat rate of 1.00 kg/ha in preference to that of 0.75 kg/ha.

Due to low wild oat numbers two trials on Research barley could be treated only as tolerance projects. Yields from applications of difenzoquat at rates of 0.5 to 1.5 kg/ha were not significantly different from those of the untreated control although 1.5 kg/ha did show a tendency to reduce yield.

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DISCUSSION

Difenzoquat gave a high yield of wild oat control which was equivalent to that obtained from benzoylprop-ethyl. The best long term results were achieved following application to a wild oat population in which the majority of plants were at the five leaf stage. Difenzoquat did control wild oats at an earlier stage of development but as the chemical did not have any residual effect further plants germinated and established before crop competition was intense enough to prevent them. At the later application stages when the crop was also further developed, the smothering effect from the dying wild oats and the growing crop ensured that very few new wild oats established.

Although there were no significant differences between difenzoquat at 0.75 kg/ha and 1.00 kg/ha there were indications that the higher rate was slightly superior in terms of yield response (Table 1). The barley results indicated tolerance at levels required for wild oat control and, although there was an apparent trend for yields to drop at the highest rates, barley overseas has been found to withstand 5 kg/ha (Shafer 1974).

As difenzoquat can be applied at any stage of crop development it allows the wild oat stage to be considered in relation to control thus if a very vigorous population occurs early it can be dealt with immediately before competition damage to the crop becomes too serious. Conversely a late germination can be treated, which may be important in a seed crop.

Wild oat populations in trials were normally at the optimum stage (majority of plants at five leaf stage) for treatment when the crop was at Feekes 3 to 4 and control at this stage allows freedom from competition at a very important crop development phase.

Other factors to be considered are crop damage from vehicles during the spraying operation. If the herbicide can be applied at early growth stages (Feekes 2 to 5) crop recovery from physical damage should be greater than if it occurs at Feekes 6 to 7. Trial work already underway is investigating the possibility of difenzoquat/hormone mixtures to give wild oat and flat weed control in one operation, something which is not widely practised at present.

CONCLUSION

Difenzoquat at 1.0 kg/ha gave a high level of wild oat control. It may be applied at crop stages Feekes 2 to 7, but ideally at Feekes 3 to 5, or alternatively when the majority of the wild oat population reaches the five leaf stage.

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