THE EFFECT OF TIMING AND RATE OF APPLICATION OF TRALKOXYDIM ON WILD OAT AND RYEGRASS CONTROL AND CROP TOLERANCE IN WHEAT

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Summary. Trials to determine the effect of rates and timing of application of tralkoxydim for efficacy on wild oats and ryegrass and tolerance of wheat were carried out in the field at York, Avondale and Wongan Hills, Western Australia in 1988 and 1989. In some situations, tralkoxydim has a narrow margin for crop safety which is determined by rate and timing of application, surfactant use and choice of cultivar. The recommendation of 150 g/ha applied at Zadok's 14/21 is a compromise and scope exists for using lower rates at an earlier crop growth stage. Results are discussed in relation to crop yield potential and growing conditions, use of adjuvants and optimisation of weed control while minimising cost to the user.

INTRODUCTION

Registration of tralkoxydim for control of wild oats (*Avena fatua)* and ryegrass (*Lolium rigidum*) in wheat in Western Australia has been delayed until 1990 because of doubts regarding the margin of crop safety at rates of 150-200 g/ha. The current Western Australian recommended rate is 100-150 g/ha with wetting agent only. Early application to wheat (Zadok's 12-13) at 150-200 g/ha and particularly with addition of oil has resulted in severe crop effects which carried through to significantly reduced yields in weed-free crop tolerance trials in 1986 to 1988 (R.W. Madin and D.G. Bowran, unpublished data). Differences in cultivar tolerance existed. It was suggested by ICI Crop Care, the manufacturers of tralkoxydim, that later timing of application (Zadok's 14/21) would overcome the crop damage experienced in Western Australia.

Because efficacy had never been a problem with tralkoxydim it was felt that lower than currently recommended label rates may also be appropriate to reduce the likelihood of crop phytotoxicity and to make the treatment more economical. This is in keeping with the thinking of Martin *et al.* (1) who developed a model for estimating the optimal economic rate of tralkoxydim for control of wild oats in wheat. Using ICI's own data they established that the economically optimal rates of herbicide application are generally below label recommended rates.

This paper reports on crop tolerance trials with tralkoxydim conducted in 1988 and 1989 and on an efficacy trial in 1989 which examined rates and timing of application.

METHODS

Tolerance of wheat cultivars. Wheat cvv. Gutha, Gamenya, Kulin, Blade and Spear were tested at Avondale in 1988. Treatments applied were tralkoxydim at 150 and 200 g/ha either alone, with 0.25% wetting agent or with 0.15% oil all applied at Zadok's 12.5-13. Additional treatments were diclofop-methyl alone, with 0.25% wetting agent or 1% D-C-Trate together with an untreated control. In 1989, Wheat cvv. Kulin and Aroona were tested at Avondale and cv. Reeves at Wongan Hills. Treatments applied at both sites were; tralkoxydim 100, 150 and 200 g/ha with either oil or wetting agent and at crop growth stages Z12, Z21 and Z24. Additional treatments were diclofop-methyl at 563 g/ha plus wetting agent at each growth stage and an untreated control.

Trials were conducted on relatively weed-free lupin stubble at Avondale and spray-topped pasture at Wongan Hills. Each trial was free of grass weeds but broad-leaf weed control was necessary at each site using bromoxynil + MCPA. Application of the tralkoxydim and broad-leaf herbicide was kept well separated in time.

Efficacy of tralkoxydim. This experiment was carried out at York using wheat cv. Aroona. Wild oats and ryegrass were present at final densities of 217 panicles /m^2 and 40 plants /m^2 respectively on the untreated control. Treatments applied were tralkoxydim at 75, 100, 150 and 200 g/ha with either 0.15% Ulvapron or 0.25% wetting agent (WA) and at crop growth stages Z12, Z21 and Z24. Additional treatments were diclofop-methyl plus 0.25% wetting agent at 563 g/ha at each growth stage and an untreated control. The tralkoxydim plus oil treatment (200 g/ha) at Z21 and Z24 was replaced with fenoxaprop-ethyl at 900 g/ha. Broad-leaf weeds were controlled with metsulfuron + MCPA applied at Zadok's 13.

The experiments were of randomised complete block design with 3 replicates (4 in 1988). Wheat grain yields were determined from harvested areas of 1.4 x 10m at Avondale in 1988 and 1989, 1.92 x 40m at Wongan Hills and 1.06 x 40m at York. The data were analysed using analysis of variance. With the 1989 data, treatment sums of squares were subdivided into orthogonal components of linear and quadratic trends.

RESULTS AND DISCUSSION

Tolerance of wheat cultivars, 1988. Cultivar differences in tolerance to tralkoxydim at Avondale in 1988 are readily apparent (Table 1). Tralkoxydim at 150 g/ha plus wetting agent, averaged over all cultivars, resulted in a 14% yield reduction compared with the unsprayed controls. This compared with a 9% yield reduction when tralkoxydim was applied without additive and a 31% reduction when applied with oil at the 150 g/ha rate. Increased damage was seen at the 200 g/ha rate. By contrast, diclofop-methyl at 563 g/ha, applied at the same timing to the same cultivars, resulted in average yield reductions of 5, 9 and 6% respectively. A 4-5% yield reduction, averaged over all varieties due to diclofop-methyl, has been found in long term tolerance trials in Western Australia (Bowran pers. comm.).

Table 1. Tolerance of wheat cultivars to tralkoxydim and diclofop-methyl in 1988 expressed as a percentage of the unsprayed control.

Treatment	Gutha	Gamenya	Kulin	Blade	Spear
Tralkoxydim 150 g/ha	86	90	94	86	106
Tralkoxydim 200 g/ha	83	79	84	77	90
Tralkoxydim 150 g/ha + 0.15% oil	63	69	72	63	79
Tralkoxydim 200 g/ha + 0.15% oil	44	58	61	70	67
Tralkoxydim 150 g/ha + 0.25% WA	82	80	88	92	90
Tralkoxydim 200 g/ha + 0.15% WA	71	75	86	79	81
Diclofop-methyl 563 g/ha	92	84	103	91	90
Diclofop-methyl 563 g/ha + DCTrate	92	85	98	93	101
Diclofop-methyl 563 g/ha + WA	101	86	109	93	98
Control (t/ha)	3.25	3.58	4.36	3.90	4.02

This trial work and that in 1987 (unreported) prompted the initiation of the 1989 trials to investigate the importance of timing of tralkoxydim application on crop safety and weed control efficacy.

Tolerance of wheat cultivars, 1989. The two cultivars, Aroona and Kulin, differed slightly in their phenological development at each application timing because of different seeding dates. Grain yields were higher at Avondale than Wongan Hills (Fig. 1).

Grain yields for Kulin (P=0.10), Aroona (P=0.05) and Reeves (P=0.10) all declined in a linear fashion as rates of tralkoxydim increased from 100 to 200 g/ha (Fig. 1a). The decline in yield, when rate of tralkoxydim was increased from 100 to 200 g/ha, was 288 kg/ha (8%) for Kulin

and 326 kg/ha (9%) for Aroona. The yield decline for Reeves of 74 kg/ha (3%) at the lower yielding Wongan Hills site was substantially less than at Avondale.

The yield of Kulin was significantly reduced at the second timing of application while yields of Aroona and Reeves were not significantly affected by timing (Fig. 1b). There was no significant difference between the wetting agent and oil treatments for grain yield of any of the cultivars.

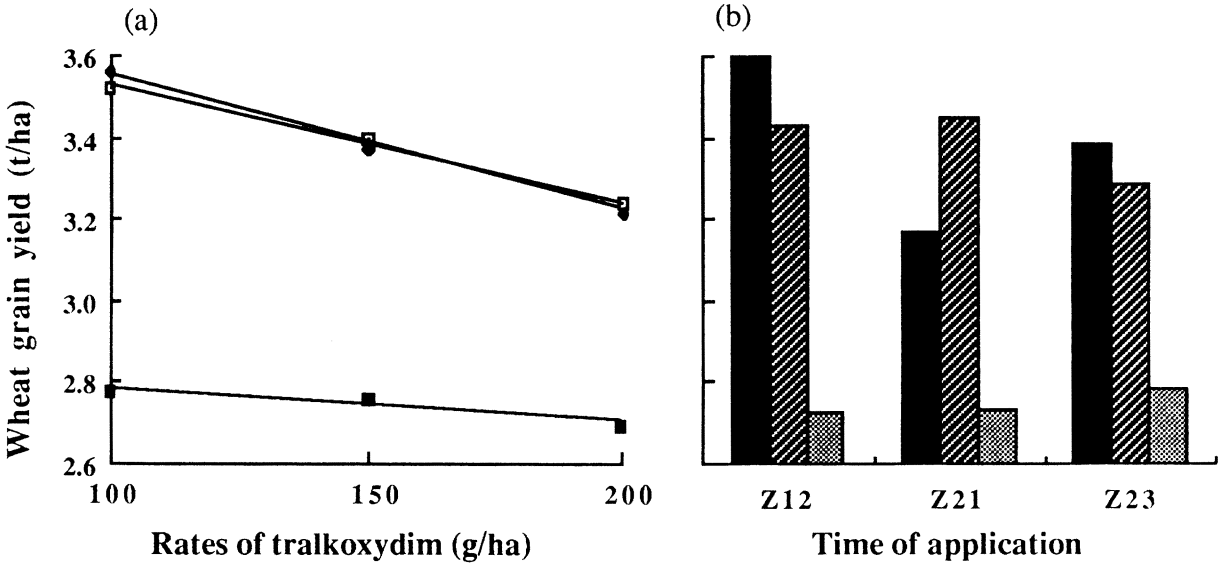

Fig. 1. (a) Effect of rate of application of tralkoxydim, averaged over times, on the grain yield of wheat cvv. Kulin (▫ ; y = 3.8 - .0029x) and Aroona (♦ ; y = 3.9 - .0033x) at Avondale and Reeves (▪; y = 2.9 - .007x) at Wongan Hills. (b) Effect of time of application of tralkoxydim, averaged over rates, on grain yield of wheat cvv. Kulin (■) and Aroona (▨) at Avondale and Reeves (▩) at Wongan Hills.

Efficacy of tralkoxydim. Superior wild oat control was achieved at the earlier application timings (Fig. 2a). Late application (Z24) gave poor wild oat control and this was reflected in lower crop yield especially at the lower rates of application (Fig. 3a). The earliest application timing with 150 g/ha and especially 200 g/ha resulted in marked crop damage similar to that seen in the 1988 tolerance trial. This damage was exacerbated by the addition of oil although crop recovery was remarkable. Good efficacy and no crop damage was exhibited with 75 g/ha and 100 g/ha at the earliest timing (Z12) irrespective of oil addition. The recommended rate of 150 g/ha plus wetting agent at Z21 gave good efficacy without crop damage but was no better than lower rates used at the earlier timing. Good ryegrass control was achieved at the higher rates applied up to Z21 (Fig. 2b).

The rate of tralkoxydim required to maximise wheat grain yield increased with later application timings (Fig. 3a). The highest grain yields were obtained when tralkoxydim was applied at 75 to 100 g at Z12 and at 100 to 150 g at Z21. All rates of tralkoxydim at Z24 gave significantly lower yields than these treatments.

In terms of wild oat and ryegrass control there were no significant differences between wetter and oil additives. However, grain yield was significantly higher with wetter compared to oil at Z12 but at Z21 there was no difference between additives (Fig. 3b). This is a reflection of the increased crop damage with higher rates of tralkoxydim plus oil at the early timing. Although significantly higher yields were obtained with oil compared with wetter at Z24 this did not compensate for the yield disadvantage of late application of tralkoxydim.

Tralkoxydim efficacy and crop safety is very dependent on rate and timing of application. Good efficacy and crop safety can be achieved at 100 g/ha when applied early at the Z12 stage however this rate does not satisfactorily control large wild oats. Rates of 150 to 200 g/ha can

cause crop damage which may be reflected in reduced yields. There was no advantage in addition of oil at the recommended application time. Addition of oil at Z12 reduced grain yields compared to wetting agent at the higher rates of application.

Wheat grain yields declined in a linear fashion as rate of tralkoxydim increased from 100 to 200 g/ha. At Avondale this reduction was 8 to 9% and at Wongan Hills it was 3%. Wheat appeared to be more tolerant of higher rates of tralkoxydim at lower yielding sites at Chapman and South Pindar (Bowran pers. comm.). The recommedation of 150 g/ha applied at Zadock's 14/21 is a compromise and scope exists for using lower rates early. Farmers should be encouraged to apply tralkoxydim at the recommended rate and timing with wetting agent in accordance with the current Western Australian label rather than using oil to improve efficacy of late application. Tralkoxydim has good activity on ryegrass provided rate and timing are correct.

Several years trial work has shown tralkoxydim to be a very efficient wild oat herbicide. Under Western Australian conditions it has a narrow margin for crop safety which appears to be largely determined by the timing of application, use of additive and growing conditions of the crop and cultivar. Under our conditions, the greatest potential for damage appears to be with early sown crops of high yield potential, such as wheat sown into lupin stubble, with ideal growing conditions at the time of tralkoxydim application. These same conditions often result in some degree of crop damage from diclofop-methyl, particularly when oil is added. By contrast, sites of lower yield potential generally show less crop damage and often the higher rates of tralkoxydim application are required to achieve satisfactory wild oat and ryegrass control. However, higher rates of tralkoxydim may not be economic in lower yielding crops (1). We believe that the current West Australian label recommendation will give reliable control of wild oats and ryegrass in wheat crops with satisfactory crop safety under most conditions.

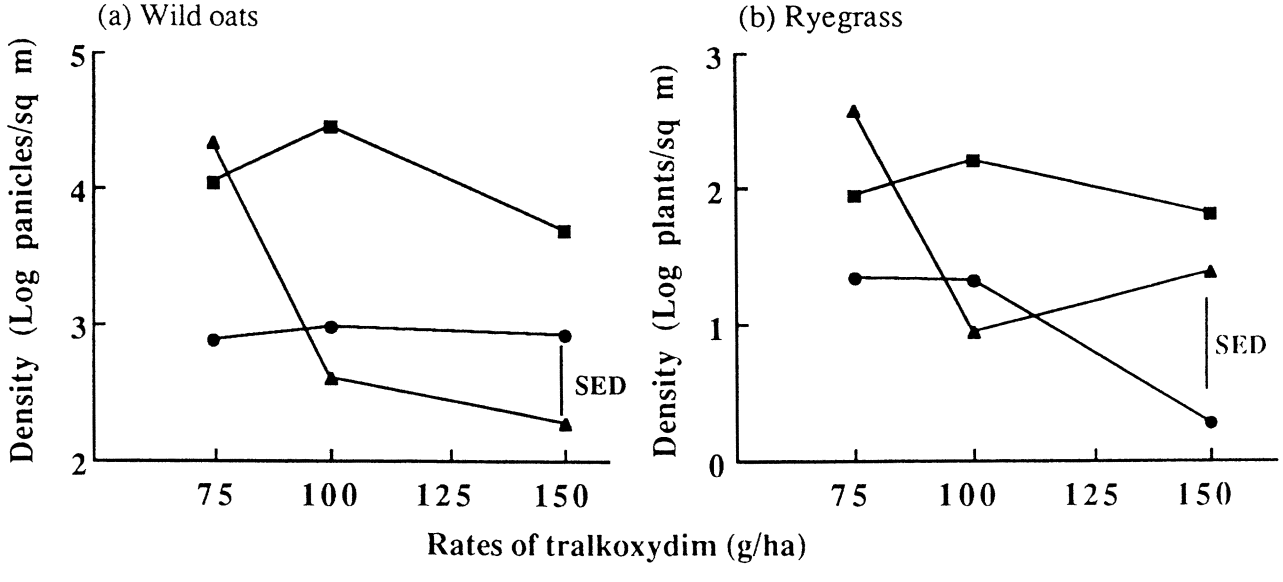

Fig. 2. Effect of rate of application of tralkoxydim on (a) wild oat panicle density and (b) ryegrass plant density when applied at crop growth stages of Z12 (●), Z21 (▲) and Z24 (■).

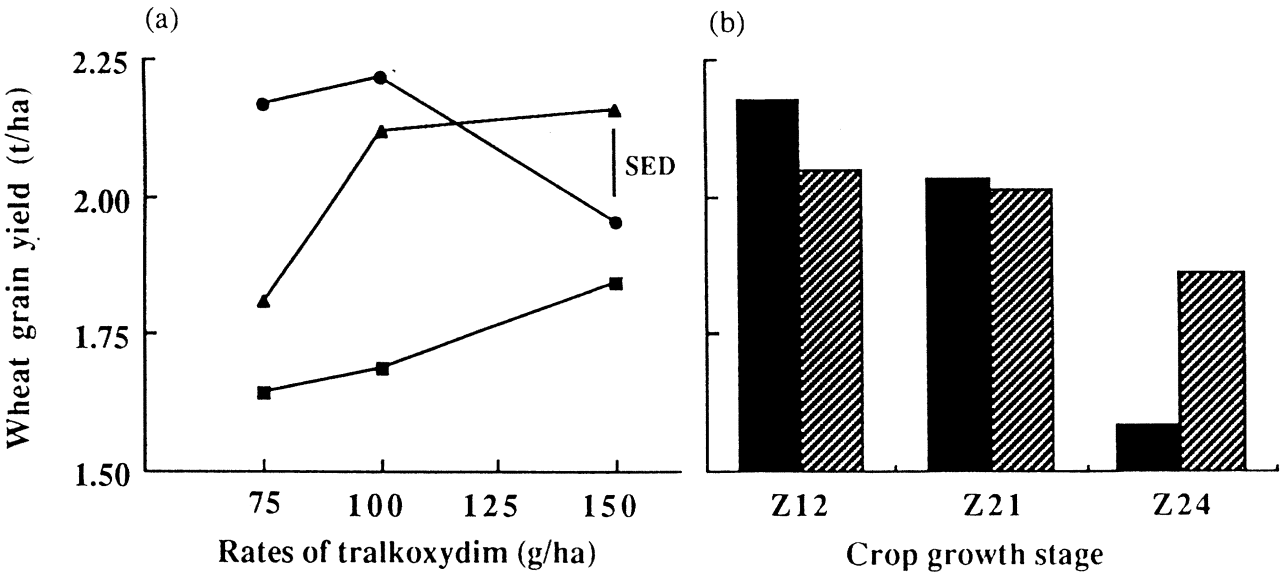

Fig. 3. (a) Effect of rate of tralkoxydim on wheat grain yield when applied at crop growth stages of Z12 (●), Z21 (▲) and Z24 (■) and (b) effect of timing of tralkoxydim and addition of wetting agent (■) and oil (▨) on wheat grain yield.

ACKNOWLEDGEMENTS

The authors wish to thank J. Buckley for assistance in conducting this work and the support of ICI Crop Care.

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