ANNUAL RYEGRASS CONTROL IN MINIMUM TILL WHEAT USING CONTROLLED RELEASE TRIFLURALIN

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Summary The efficacy of Controlled Release (CR) trifluralin for the control of annual ryegrass (*Lolium rigidum*) was evaluated in a three year field experiment with wheat established by direct drilling in North-east Victoria. CR trifluralin (based on a 26% pine rosin formulation) did not significantly ($P<0.05$) improve the control of annual ryegrass or increase wheat yields compared with the emulsifiable concentrate (EC) formulation of trifluralin.

INTRODUCTION

Trifluralin is a selective pre-emergence herbicide used to control numerous grass and broadleaf weeds in wheat, barley, triticale, and a number of broadleaf crops. It is a relatively volatile and immobile pre-emergent herbicide (Hollist and Foy 1971, Jacques and Harvey 1979), and has low solubility in water. Consequently it should be incorporated into the soil to minimize losses from volatilization and photodecomposition (Anon. 1965, Parochetti and Hein 1973). Messersmith *et al.* (1971) found that complete loss of phytotoxicity occurred after four hours of exposure to sunlight.

Trifluralin use has declined because of (a) the availability of herbicides for effective post-emergent grass control; (b) an increased adoption of minimum tillage farming; (c) concerns about damage to soil structure through cultivation and (d) the use of short coleoptile wheat varieties. The worsening problem of herbicide resistance in ryegrass, particularly resistance to the aryloxyphenoxypropionate (fops), cyclohexanedione (dims) and sulfonyl urea groups of herbicides, has seen a renewed interest in trifluralin as an effective means of controlling annual ryegrass in cereal crops.

Controlled release (CR) formulations of trifluralin have been developed using technologies such as starch encapsulation. This type of formulation does not need to be incorporated immediately on application, but it does need incorporation at some early stage so to reduce losses from volatilization and photodecomposition (White and Schreiber 1984). A formulation of trifluralin based on pine rosin[A] was used in this series of field experiments. This CR formulation has been shown to be less volatile and less phytotoxic to crops than the EC formulation. However, it does not have a longer residual effect than the EC formulation (G. Healy personal communication).

This paper reports results from field experiments designed to evaluate the efficacy of the EC and a pine rosin based (CR) formulation of trifluralin for the control of annual ryegrass in wheat established by direct drilling or following minimum tillage.

MATERIALS AND METHODS

Experiments were conducted at the Institute for Integrated Agricultural Development, Rutherglen, Victoria from 1991 to 1993, at three different locations. The soils were different phases of Stillards loam (Poutsma and Skene 1961, Imhof and Maher 1985), with Northcote (1979) classifications Gn 2.43 to Dy 3.33 (1991), Dy 3.22 (1992) and Dy 3.33 (1993). The designs were a randomized complete plot block with four replicates.

Herbicides were applied with a propane powered, 2 m boom spray at a pressure of 200 kPa. Water rates were 83, 89 and 64 L ha^{-1} for 1991, 1992 and 1993 respectively. The herbicide treatments were: EC trifluralin at 400 and 800 g a.i. ha^{-1} (1 and 2 × R, where R is the manufacturers' recommended rate), a commercial formulation of trifluralin plus oryzalin (Yield®) at 200+200 and 287.5+287.5 g a.i. ha^{-1} (1 × R cultivated and 1 × R direct drilled) and CR trifluralin at 300; 400; 600 and 800 g a.i. ha^{-1} (not yet commercially available). Tillage treatments were: direct drilled (DD) and minimum till (MT). The minimum till plots were scarified immediately after spraying and sown within four hours of herbicide application.

Annual ryegrass cv. Wimmera was sown at a rate of approximately 30 kg ha^{-1} at right angles to the wheat plots pre-cultivation and herbicide application. Wheat cv. Matong was sown, following herbicide application, at rates of 85 kg ha^{-1} in 1991, 1992 and 100 kg ha^{-1} in 1993 with 65 kg ha^{-1} double super. All plots were sown using a narrow point (50 mm) drill with 178 mm row spacing.

Populations of ryegrass were counted on 13/09/91, 17/09/92, and 24/08/93 using 8 × 25 × 25 cm quadrants. A Hege small plot harvester was used to harvest the wheat.

[A] **Footnote.** Developed by Monash University, Nufarm Australia Ltd. and Daratech, Melbourne.

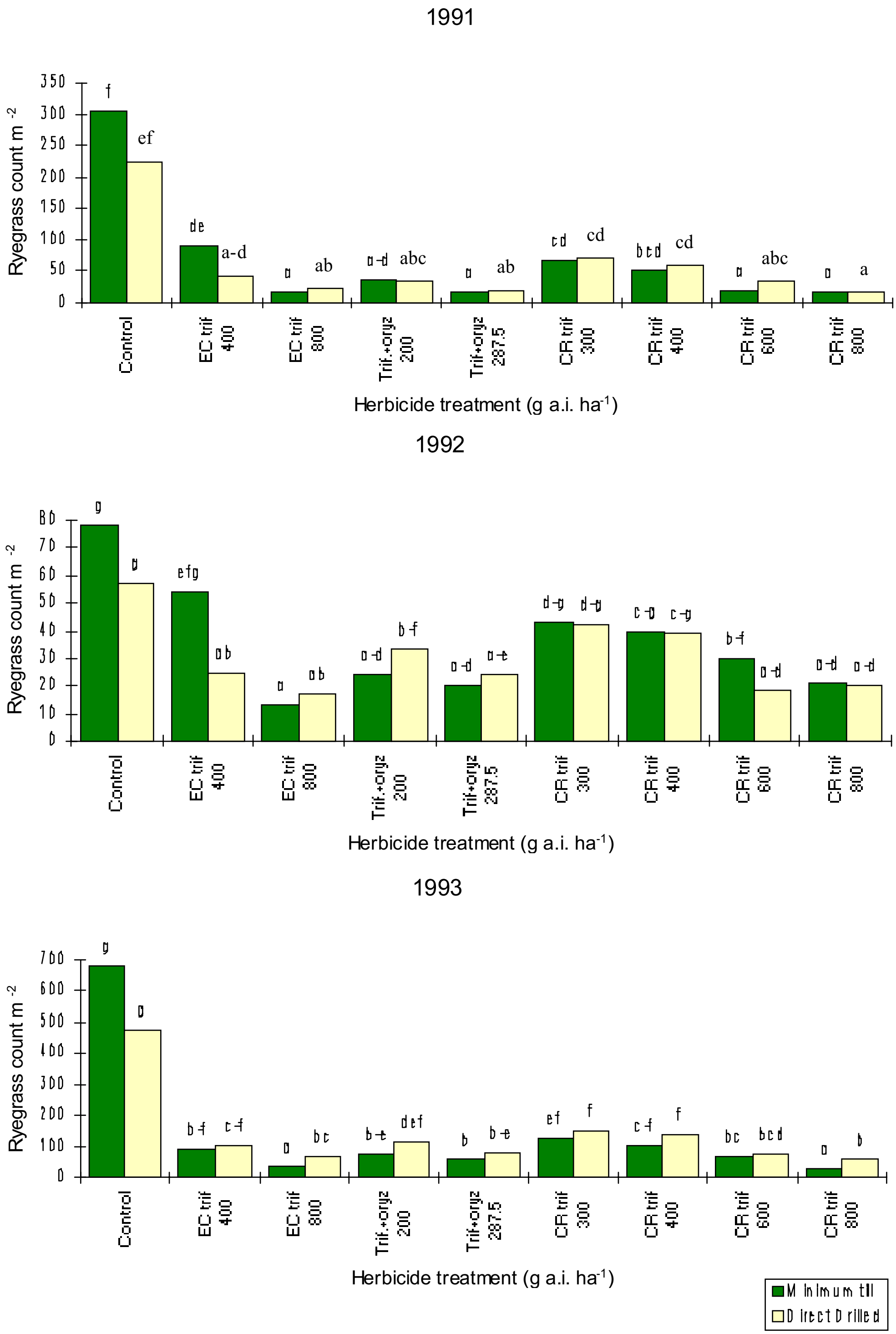

Figure 1. Ryegrass plant counts per m² after herbicide application 1991, 1992 and 1993. Letters indicate significance, those with one or more letters are not significantly different at P<0.05 (for each year).

Table 1. Wheat yield results from pre-sow application of Yield, EC and CR trifluralin.

Year	1991		1992		1993	
Cultivation treatment	MT	DD	MT	DD	MT	DD
Herbicide treatment (g a.i. L^{-1})						
Control	1.94	2.09	2.49	2.25	3.07	3.36
EC trifluralin 400	2.68	2.50	2.97	2.53	4.42	4.25
EC trifluralin 800	2.87	2.90	1.73	2.72	4.74	3.96
Yield™ 200	2.74	2.51	3.04	2.76	4.74	4.50
Yield™ 287.5	2.73	2.85	2.41	2.99	5.18	4.41
CR trifluralin 300	2.84	2.49	1.92	2.86	4.64	4.09
CR trifluralin 400	2.64	2.27	3.21	2.68	4.86	4.13
CR trifluralin 600	2.69	2.76	2.27	3.30	4.86	4.40
CR trifluralin 800	2.99	2.75	3.15	2.84	4.47	4.87
LSD (P<0.05)	0.37		0.96		0.87	

RESULTS AND DISCUSSION

The effect of herbicide treatments on ryegrass populations and subsequent wheat yields is shown in Figure 1 and Table 1. The most effective treatment for ryegrass control over all three years was EC trifluralin at 800 g ha^{-1} with MT. Slightly less control of ryegrass was achieved by the equivalent CR trifluralin rate. Application of CR trifluralin showed there were no significant differences (P<0.05) between the MT treatments and the corresponding DD treatments for both ryegrass control and wheat yield. Wheat yields for both tillage treatments showed no significant differences between the EC and CR trifluralin in all three years. Trifluralin + oryzalin (Yield™) was included as a comparative herbicide as it is a commonly used treatment for pre-emergent ryegrass control in direct drilling. Both EC and CR trifluralin compared favourably with both ryegrass control achieved and yield of wheat.

Ryegrass populations were variable over the duration of the experiment, as were the resultant wheat yields. Generally, any crop with more than 40 ryegrass plants per metre squared is worth spraying if the expected crop yield is about 1.5 t ha^{-1} (Pearce 1973). Even if the crop is thinned by herbicide application, the benefits of spraying can outweigh the losses in terms of reducing competition for light and nutrients and the reduction in the ryegrass seed bank for the following crops.

The control of ryegrass achieved in 1992 was not concordant with the 1991 and 1993 results. Lower levels of control were possibly due to a delay in herbicide application between sowing of the ryegrass seed (on 11 May) and spraying (on 19 May). Subsequent rainfall, totalling 51.2 mm, between sowing the ryegrass and herbicide application may have allowed the ryegrass to germinate and thus escape the effects of a pre-emergent herbicide that acts on the germinating seed. Ryegrass populations were generally lower than in 1992 than with 1991 and 1993 because the site was waterlogged.

The wheat yields following application of CR trifluralin at 400 g a.i. ha^{-1} to direct drilled wheat in all three years were not significantly different (P<0.05) from the control. The wheat yields were less variable than the level of ryegrass control achieved. Further research would be required to determine how the wheat was compensating for higher ryegrass populations, and whether the yield losses were caused by the herbicide, the tillage practices or the presence of ryegrass.

In response to the increasing incidence of herbicide resistance ryegrass, the ability to use trifluralin as a tool for controlling annual ryegrass with minimal disturbance is becoming increasingly important. Currently, trifluralin is considered a low risk herbicide for selecting herbicide resistant populations of ryegrass (Sykes *et al.* 1990). As trifluralin has a different mode of action to the aryloxyphenoxypropionates and cyclohexanediones, it has a useful role to play in the management of herbicide resistant ryegrass.

Control of ryegrass achieved by equivalent rates of EC and CR formulations of trifluralin were similar in all three years. Further research may warrant inclusion of two control plots, one free of ryegrass and another, as in this trial, including ryegrass, this would give a clearer indication of the effects of phytoxicity caused by trifluralin and the effects of ryegrass competition on wheat growth and yield.

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