IMPROVED TRIFLURALIN WITH CONTROLLED RELEASE TECHNOLOGY

A.G. Flynn, M.R. Moerkerk and M. Hannah
Department of Agriculture and Rural Affairs, Victorian Crops Research Institute,
P.B. 260, Horsham, Vic. 3400.

Summary. Three experiments were used to compare a controlled release (CR) formulation of trifluralin with the commercial emulsifiable concentrate (EC). Firstly, the potency of the formulations were compared when mixing was delayed for 0, 2 or 24 hrs using a dose response curve. When mixed immediately the CR formulation was far more potent and this increased as mixing was delayed. Secondly, soil treated with trifluralin EC was sealed in punnets under glass to reduce gas loss. This treatment greatly improved the potency when mixing was delayed for 48 hrs probably due to a reduction in volatilization . Thirdly, the potency of the formulations was plotted against time and the CR formulation was found to have most of its advantage at spraying although there was evidence of improved potency at approximately day 80.

INTRODUCTION

Public concern regarding chemical use in agriculture has highlighted the need to maximise the efficiency of use of herbicides while minimising their impact on the environment. In some situations these concerns have already resulted in widely used herbicides being withdrawn from particular markets.

As demonstrated in the pharmaceutical field, controlled release (CR) technology can offer considerable improvements to the efficient use of chemicals (1). However, in the past the technology used in herbicides has been severely restricted by the comparatively low cost of the active ingredients which thus limits the amount that can be spent on the CR matrix. For example, if an active ingredient costs $8/kg and CR matrix adds an extra $20/kg active, then it is unlikely that the resulting product will capture a substantial proportion of the market.

Trifluralin is one of the most important herbicides used in Australia although, its requirement for incorporation has reduced its use on fragile soil types. This paper reports data from a non-commercial CR formulation and highlights some of the potential that this technology offers cropping industries.

METHODS

Experiment 1. Comparison of efficacy of two trifluralin formulations. Two trifluralin formulations, an emulsifiable concentrate (EC) and a CR formulation (B2) were applied at rates equivalent to 0, 0.04, 0.08, 0.2, 0.4 and 0.6 kg trifluralin/ha to 500 g of an acidic sandy loam in punnets (140 x 85 x 50 mm^3). The soil was pre-moistened to 10% water prior to being sprayed. The soil was thoroughly mixed at 0, 2, or 24 hrs after spraying and was then sown with 20 seeds of annual ryegrass, *Lolium rigidum*, per punnet. Emergence was assessed after 10 days of growth in a glasshouse and a series of dose response curves were fitted using a logistic analysis.

Experiment 2. Gaseous loses from trifluralin EC. The methods used were as above with the following alterations. Trifluralin EC was applied at rates equivalent to 0, 0.08, 0.16, 0.24, 0.32, 0.40 and 0.60 g trifluralin/ha. After spraying the punnets were either covered with glass and sealed with silicon grease or left exposed to the air until mixing occurred at 0, 2 or 48 hrs post spraying. After all treatments had been mixed, annual ryegrass was sown at 25 seeds per punnet and incubated in the dark 18°C ± 1°C for 10 days before being assessed as above.

Experiment 3. Effect of time on the potency of two trifluralin formulations. Trifluralin as EC or the CR formulation B2 was mixed with enough water to bring 16 kg of an air dried acidic sandy loam to 11% moisture and sprayed onto the soil as it was being mixed in a cement mixer. The rates used were 0, 40, 100, 150, 400 and 800 ug trifluralin/kg. The soil was stored in plastic tubs (340 x 310 x 135 mm^3) and covered with plastic. These containers were stored at 18°C ±1°C and 1 kg of soil was sampled every 7 to 10 days, transfered into square petrie dishes and bioassayed for trifluralin by measuring the root length of annual ryegrass. This was done by sowing 6 ryegrass seeds across the middle of the petrie dishes which were then incubated for 7 days at 24°C for 16 hrs and 16°C for 8 hrs. The root length was then measured from the point of initiation. At each sampling the soil in the tub was adjusted again to 11% moisture by misting water onto the soil surface. All treatments were replicated 5 times.

The rate (g/ha) at which a formulation gave 50% reduction of the root length was defined as the LD50 and this was plotted against time.

RESULTS AND DISCUSSION

Trifluralin potency was found to vary greatly between the two formulations with B2 having much greater potency than EC (Fig. 1). When the chemicals were mixed with the soil immediately after spraying, 80% control was achieved by 20 g trifluralin/ha as B2 compared to 125 g trifluralin/ha as EC. When mixing was delayed for 2 or 24 hrs, 80% control was achieved with 190 and 316 g trifluralin/ha with B2 and 407 and 560 g trifluralin/ha as EC. In effect not only was B2 more potent initially but its potency was far less effected by delays in mixing. In 24 hrs, 296 g trifluralin/ha was lost from B2 compared with 435 g from EC. As all the curves were found to be parallel there was no evidence to suggest that the mechanism of action of B2 in any way differed from EC.

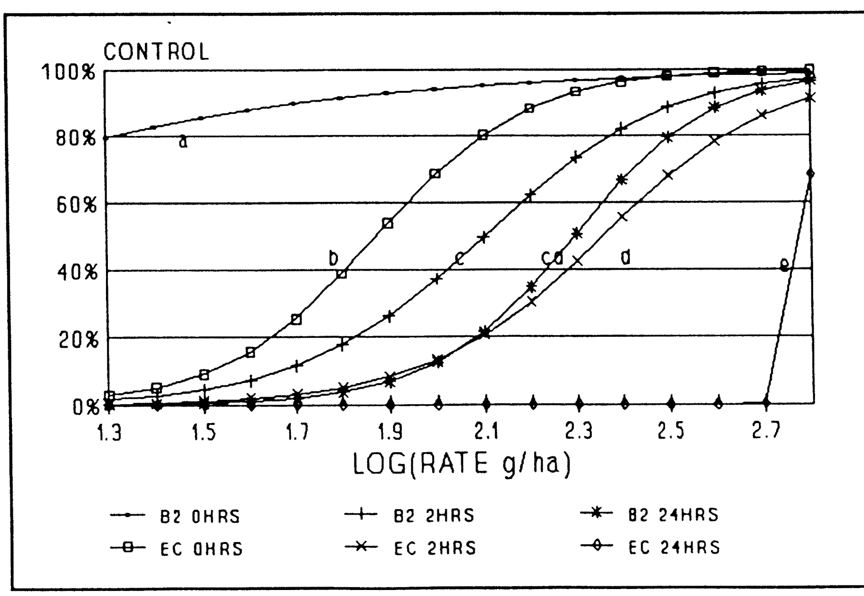

Figure 1.The relationship between rate and potency for two trifluralin formulations.

In Experiment 2, 224 g and 630 g of trifluralin/ha as EC was required to give 50 % control of annual ryegrass when the soil was mixed at 0 or 48 hrs after spraying (Fig. 2). However, when the punnets were sealed with glass to avoid gases escaping then the amount required for 50% control when mixing was delayed for 48 hrs did not differ from that mixed at 0 hrs. This data supports the hypothesis that the loss in potency due to delayed incorporation in Experiment 1 was due to volatilization and therefore, that B2 is less volatile than EC.

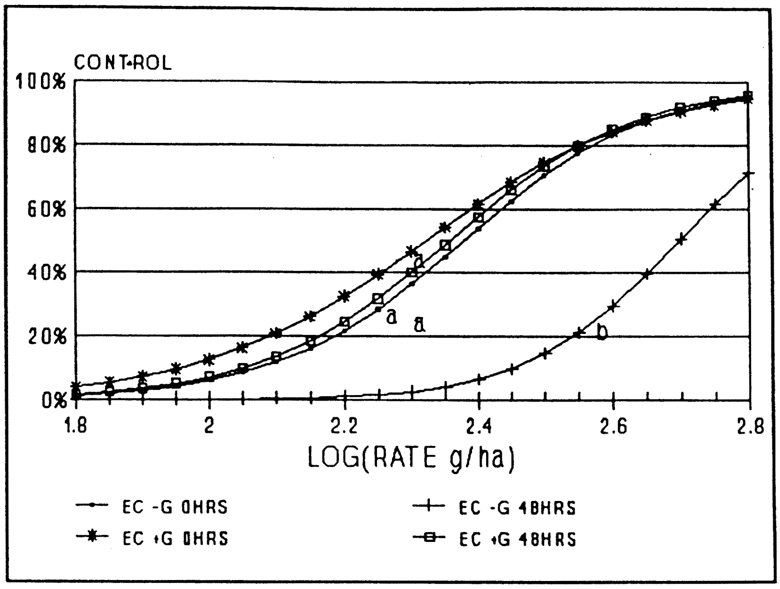

Figure 2. Effect of sealing punnets with glass on the potency of trifluralin with delayed incorporation.

The results of Experiment 3 (Fig. 3) suggest that the improved potency of B2 occurred at the time of spraying. There is no evidence of delayed release of the herbicide out of the matrix until approximately day 70 when B2 appears to have become more potent compared to EC.

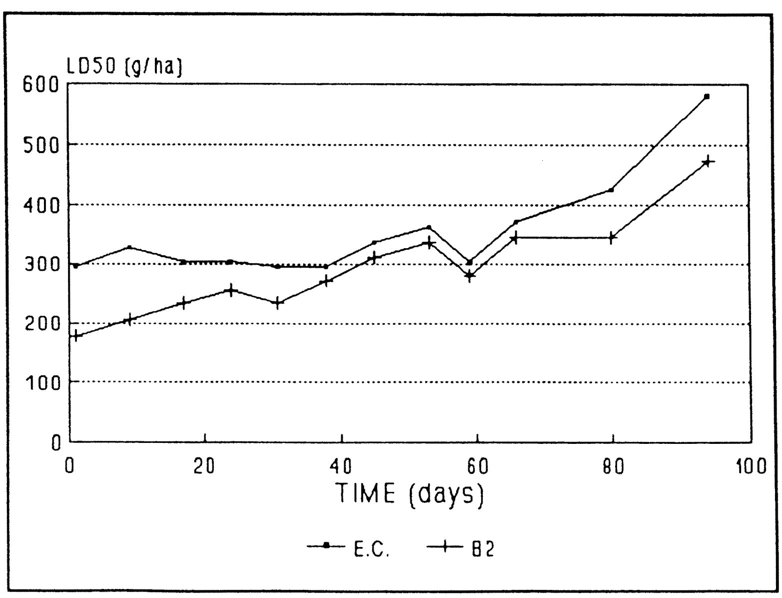

Figure 3. The effect of time on the potency of two trifluralin formulations.

Even though the data presented is too limited to make firm claims it does support the belief that CR technology does have the potential to improve the efficiency of trifluralin. It is, however, doubtful that B2 itself will have commercial uses as it is only available at low concentrations of active ingredients (1-3%) and all attempts to increase this concentration has, to date, led to problems of matrix instability.

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REFERENCES

1. Duncan, R. and Seymour, L.W. 1989 In: Controlled Release Technologies. (Elsevier Science Publishers Ltd: London).