TRIALLATE AND TRIFLURALIN ARE NOT EFFECTIVE WITH MINIMAL INCORPORATION IN BLACK EARTHS IN SOUTHERN QUEENSLAND

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Summary Triallate and trifluralin have been used extensively on the Darling Downs in southern Queensland to cheaply and effectively control wild oats, paradoxa grass and wire weed in winter cereals. The shift to reduced tillage farming has restricted the use of these incorporated herbicides. While these herbicides have largely been replaced with post-emergence herbicides, some farmers have persisted in the use of these herbicides even using them with minimal incorporation. Research in southern Australia suggested that these herbicides could be used in reduced tillage farming and be incorporated by the sowing operation. Following variable results by farmers in southern Queensland there was a need to evaluate if these products could be used effectively in reduced tillage farming with limited incorporation. Triallate (0.8–1.0 kg a.i. ha^{-1}) and trifluralin (0.4–0.6 kg a.i. ha^{-1}) were applied at seven sites to either standing stubble or stubble that had already been cultivated with a chisel plough and incorporated once with a chisel plough. Wild oat, paradoxa grass, and wire weed plants were counted throughout the crop cycle. Triallate reduced wild oats populations by 63–80% at only three of six sites. Trifluralin reduced wire weed populations in two of three sites by 84–88% and paradoxa grass in one of two sites by 44%. The poor performance of these herbicides was irrespective of whether they were applied to standing or incorporated stubble. These data indicate that the effectiveness of triallate and trifluralin is insufficient for their use in heavy black earths of southern Queensland when used in reduced tillage systems with minimal incorporation.

INTRODUCTION

The Darling Downs region of southern Queensland is a winter and summer cropping area, with the majority of the soils consisting of heavy black earths and grey clays. Winter cereals, such as wheat, barley and chickpea, and summer crops, such as sorghum and sunflowers, are the major crops.

Triallate has been extensively used in southern Queensland for effective control of wild oats (*Avena* spp.) in winter cereals. Trifluralin was commonly used to control grasses in sunflowers, and summer legumes, and for the control of paradoxa grass (*Phalaris paradoxa*) and wireweed (*Polygonum aviculare*) in wheat, barley and chickpeas. These herbicides, when incorporated into stubble free seedbeds, have proved very effective. Incorporation, though, is incompatible with conservation farming systems where crop residues are preferred to be retained. This system is increasing in significance in the cropping areas of southern Queensland. Martin *et al.* (1989) showed that triallate could be incorporated by sowing with minimal losses in southern Australia. Also, Bateman and Walker (1985) showed that trifluralin was effective on the lighter krasnozem soils of southern Queensland with minimal incorporation. However, farmers cropping the heavy grey and black clay soils of the Darling Downs achieved variable results with these herbicides using minimal incorporation techniques.

This paper reports on a series of experiments conducted to evaluate the effectiveness of triallate and trifluralin in conservation farming on the Darling Downs region of southern Queensland.

MATERIALS AND METHODS

Seven sites were laid down over two years on the clay soils of the Darling Downs (Table 1). Triallate (0.8 and 1.0 kg a.i. ha^{-1}) and trifluralin (0.4 and 0.6 kg a.i. ha^{-1}) were applied with a 2.1 m boom attached to a chisel plough for minimal incorporation. The herbicides were applied either to standing stubble or to plots where the stubble had been reduced by one working with the chisel plough. Crops were planted 3–21 days later, except at site 4 which was left fallow after herbicide application.

Stubble levels were recorded at each site using a photographic technique described by Molloy and Moran (1991). Wireweed and paradoxa grass counts were taken throughout the life of the crop, and wild oat plant counts were made prior to harvest. Yield was determined at the cropped sites using a small plot harvester. Factorial analyses were carried out on the weed data using Ö(x + 0.5) transformations.

RESULTS

Soil types, weeds present and type of stubble varied between sites (Table 1). Chickpeas were planted at three sites, wheat at one and barley at two. Passing the chisel plough through the plots reduced the stubble levels from five to 24%. Standing stubble levels (before some plots

were reduced prior to herbicide application) ranged from 44 to 79%.

Wild oats were present at six of the seven sites (Table 1), although their populations were low (<1 plant m^{-2}) at sites 1, 2, 3 and 4 (Table 2). Wild oat populations were significantly reduced by both triallate and trifluralin at sites 2, 3 and 5. Control at these sites ranged from 65 to 81%. Trifluralin and triallate were similar in their effectiveness, which increased slightly with rate. The herbicides were ineffective at the remaining three sites.

Wire weed was present at sites 1, 2 and 3 (Table 1), but populations with less than 1 plant m^{-2} (Table 3). Trifluralin significantly reduced the populations of wire weed at sites 1 and 3, where control was in excess of 80%.

Paradoxa grass was present at sites 3 and 7 (Table 1). Trifluralin reduced paradoxa grass by 93 and 97% at sites 3 and 7 (Table 3).

DISCUSSION

Triallate and trifluralin were not consistently effective at all sites. The level of control observed at sites, where a significant reduction in wild oats was observed, would not be sufficiently high to be acceptable to farmers. The more recent post-emergence herbicides such as diclofop, fenoxaprop, and tralkoxydim, would be more effective and therefore more acceptable to growers.

These results differ from those of Martin *et al.* (1989) who found much higher levels of control using triallate although at the slightly higher rate of 1.2 kg a.i. ha^{-1}. In the experiments reported here, no differences were observed between herbicide rates, although trends showed the higher rates of both triallate and trifluralin to be more effective on all the weeds.

Incorporation by the chisel plough is at best shallow, and this incorporation method left the soil with a very cloddy surface, far from that recommended for these products. The less than satisfactory levels of weed control, obtained in these experiments, are probably the result of the combined effects of rough soil surface, dry conditions and interception of the chemical by the crop residue. Bateman and Walker (1985) showed good grass control in peanuts with trifluralin on the red soils of the South Burnett could be obtained at up to 50% stubble

Table 1. Description of sites, soil type, stubble type, crop planted and stubble level.

Site and locality	Soil type[A]	Weeds present[B]	Stubble type	Crop	Stubble cover levels (%)	
					Standing stubble	Reduced stubble
1. Dalby	Ug 5.13	WO, WW	barley	chickpeas	45	35
2. Kupun	Ug 5.13	WO, WW	barley	wheat	45	39
3. Kaimkillenbun	Ug 5.11	WO, PG,WW	millet	chickpeas	70	60
4. Dalby	Ug 5.15	WO	wheat	no crop	51	27
5. Kaimkillenbun	Ug 5.13	WO	wheat	barley	79	62
6. Kaimkillenbun	Ug 5.15	WO	barley	barley	54	49
7. Warra	Ug 5.13	PG	wheat	chickpeas	47	30

[A] Northcote classification.

[B] WO = wild oat, WW = wireweed, PG = paradoxa grass.

Table 2. Effect of trifluralin and triallate on wild oat numbers. Data in parentheses are transformed using $\sqrt{(x + 0.5)}$.

Herbicide and rate (kg a.i. ha^{-1})	Weed numbers (m^{-2})					
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
trifluralin 0.4	0.10 (0.77) a	0.23 (0.85) a	0.03 (0.73) a	0.95 (1.20) a	2.73 (1.80) a	5.79 (2.51) a
trifluralin 0.6	0.08 (0.76) a	0.14 (0.80) a	0.04 (0.73) a	0.36 (0.93) a	2.16 (1.63) a	5.79 (2.51) a
triallate 0.8	0.15 (0.81) a	0.13 (0.79) a	0.03 (0.73) a	0.41 (0.96) a	1.86 (1.53) a	4.02 (2.13) a
triallate 1.0	0.12 (0.79) a	0.15 (0.81) a	0.04 (0.73) a	0.54 (1.02) a	1.66 (1.47) a	3.63 (2.03) a
untreated	0.13 (0.80) a	0.78 (1.13) b	0.11 (0.78) b	0.64 (1.07) a	6.80 (2.70) b	4.39 (2.21) a
LSD (P=0.05)	– 0.09	– 0.15	– 0.04	– 0.52	– 0.37	– 0.83

Values followed by the same letter are not significantly different from the untreated plot at P=0.05.

Table 3. Effect of trifluralin on wire weed and paradoxa grass numbers. Data in parentheses are transformed using Ö(x + 0.5).

	Weed counts (m^{-2})				
	Wire weed			Paradoxa grass	
Herbicide and rate (kg a.i. ha^{-1})	Site 1	Site 2	Site 3	Site 3	Site 7
trifluralin 0.4	0.11 (0.78) a	0.00 (0.71) a	0.17 (0.89) ab	0.03 (0.72) a	0.19 (0.83) a
trifluralin 0.6	0.05 (0.74) a	0.03 (0.73) a	0.06 (0.74) a	0.23 (0.85) b	0.06 (0.75) b
untreated	0.31 (0.90) b	0.01 (0.72) a	0.49 (1.0) b	0.41 (0.95) c	1.93 (1.56) c
LSD (P=0.05)	– (0.10)	– (0.05)	– (0.20)	– (0.09)	– (0.30)

Values followed by the same letter are not significantly different from the untreated at P=0.05.

cover. However this could result from the red soils flowing very well around the tynes of the incorporating implement. It is probable that the surface texture of the soil could be the most critical factor in the effectiveness of incorporating herbicides such as these in minimum till situations.

Interception of spray by stubble did not effect triallate efficacy. It is likely that this interception did have some effect (Carlson 1980), but this was not evident here.

In south-east Queensland there is a high probability of dry conditions after herbicide application. Beetsman and Deming (1976) showed that dry soil surfaces caused deactivation of triallate, despite the fact that triallate is absorbed onto the soil particles (Smith 1970). Martin *et al*. (1989) attributed poor control with triallate to dry conditions after sowing. Thus efficacy of these herbicides using the incorporation methods described, or with incorporation by sowing must be suspect on these heavy clay soils.

The results achieved with trifluralin on wire weed were surprisingly good. The levels of control of this weed on these soils would probably be acceptable to growers. However in the light of the more variable results achieved with triallate (a herbicide of known lesser volatility) on wild oats, it is doubtful if farmers would be willing to risk the use of this product in this way.

The results of experiments reported in this paper support no recommendation on the use of these herbicides in stubble mulch cropping using these or similar in corporation methods on the heavy clay soils of the Darling Downs region of south Queensland.

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