Evaluation of new herbicides for capsicums and chillies

Phillip R. Frost and Tim L. Hingston
Serve-Ag Research, PO Box 690, Devonport, Tasmania 7310, Australia

Summary Effective weed management strategies are limited for capsicum and chilli producers. Current weed management practices include the use of plastic mulch, selective grass herbicides, handweeding or tillage. There are currently no herbicides registered for broadleaf weed control in capsicums or chillies.

Potential new herbicides were screened and efficacy, crop safety and residue data was generated. A total of 13 trials were conducted over three seasons throughout major Australian production regions. The most effective herbicides identified from this work were pendimethalin, clomazone and oxadiargyl, which all gave best results when applied pre crop transplanting. All three products provided effective pre emergent control of a range of common broadleaf and grass weeds across a number of sites.

Clomazone, oxadiargyl and pendimethalin applied at double the proposed use rates, on soils with very low levels of organic carbon and clay, did not cause any crop phytotoxicity. Yield and quality of capsicum and chillies was also not affected by these herbicides.

Keywords capsicum, chilli, oxadiargyl, pendimethalin, clomazone, plastic, herbicide.

INTRODUCTION

Capsicums and chillies are grown from transplants commercially throughout Australia, although most of the production is in Queensland. Effective weed management strategies are limited for capsicum and chilli producers. Current weed management practices include the use of plastic mulch, selective grass herbicides, handweeding or tillage. There are currently no herbicides registered for broadleaf weed control in capsicums or chillies. The development of effective broadleaf weed herbicides, to be used as part of an integrated weed management program in capsicum and chilli production in Australia, is essential.

MATERIALS AND METHODS

A total of 13 replicated small plot trials were conducted over three seasons throughout major Australian production regions. Trials were conducted in North West Tasmania, Perth (Western Australia), Atherton (North Queensland) and Bowen (North Queensland). Small plot trials were sprayed with flat fan nozzles, generally applying water rates of between 200 and 300 litres/ha at an application pressure of between 200 and 300 kPa. In all data presented here, oxadiargyl, pendimethalin and clomazone were applied pre transplant, within two days of transplanting. Plot sizes were between 10 and 30 m^2. Assessments were conducted as whole plot subjective ratings using the European Weed Research System (EWRS) scales for weed control efficacy (1 = total weed control, 9 = no effect on weeds) and crop tolerance (1 = healthy plant, 9 = crop killed) (Puntener, 1981). Weed density counts were conducted using randomly placed quadrats and results presented as percent control compared to the untreated control. Crop yield measurements were conducted by harvesting 10 plants per plot and classifying fruit into marketable and non-marketable categories, based on factors such as size and colour.

RESULTS

Table 1. EWRS crop safety ratings for herbicides applied pre transplant.

Herbicide	Rate (g a.i. ha^{-1})	Average EWRS crop rating (no. sites)
untreated control		1.0
clomazone	480	1.1 (15)
oxadiargyl	400	1.4 (17)
pendimethalin	990	1.1 (17)

Table 2. Crop yield data from trial conducted in Bowen for Chilli (cv. Blister).

Herbicide	Rate (g a.i. ha^{-1})	Marketable fruit per 10 plants	
		Number	Weight (Kg)
untreated control		175	8.7
clomazone	960	191	8.8
oxadiargyl	800	180	8.9
pendimethalin	1980	175	9.1
p-value (0.05)		0.8641	0.8214

Table 3. Crop yield data from trial conducted in Bowen for Capsicum (cv. Warlock).

Herbicide	Rate (g a.i. ha^{-1})	Marketable fruit per 10 plants	
		Number	Weight (Kg)
untreated control		40	10.0
clomazone	960	42	9.9
oxadiargyl	800	40	9.5
pendimethalin	1980	40	9.8
p-value (0.05)		0.0178	0.2431

Crop safety The three herbicides oxadiargyl, pendimethalin and clomazone, applied pre transplant showed high crop safety over a number of sites with average EWRS crop ratings of 1.1, 1.4 and 1.1 respectively (Table 2). Yield data from a trial in Bowen showed these herbicides had no affect on marketable yield of either capsicum (cv Blister) (Table 2) or Chilli (cv. Warlock) (Table 3). This trial was conducted on a light textured soil with a cation exchange capacity of 5.9 cmol kg^{-1}.

Sulfentrazone, flumioxazine, carfentrazone, oxyfluorfen, metribuzin, isoxaflutole and imazamox were also screened, but they were not further evaluated due to crop safety issues.

Table 4. Herbicide efficacy on common grass weeds ELEIN (*Eleusine indica*, crowsfoot grass) and DIGAD (*Digitaria ciliaris*, summer grass).

Herbicide	Rate (g a.i. ha^{-1})	Average % Control (No. Sites)	
		DIGAD	ELIEN
untreated control		0	0
clomazone	240	100 (1)	91 (2)
clomazone	480	100 (3)	100 (3)
oxadiargyl	400	91 (3)	84 (3)
pendimethalin	660	99 (1)	93 (2)
pendimethalin	990	99 (3)	95 (3)

Weed efficacy The three herbicides pendimethalin, clomazone and oxadiargyl all showed activity on common grass and broadleaf weeds in capsicum and chilli crops. Both clomazone at 480 g a.i./ha and pendimethalin at 990 g a.i. ha $^{-1}$ provided near complete control of *Eleusine indica* (crowsfoot grass) and *Digitaria ciliaris* (summer grass). Oxadiargyl at 400 g a.i. ha $^{-1}$ provided 91% (summer grass) and 84% (crowsfoot grass) control but was not as effective as pendimethalin and clomazone on these weeds (Table 4).

Oxadiargyl at 400 g a.i. ha^{-1} was generally more effective than clomazone at 480 g a.i. ha^{-1} and pendimethalin at 990 g a.i. ha^{-1} for controlling broadleaf weeds (Tables 5 & 6), although all products provided control of a range of weeds.

Table 5. Herbicide efficacy on common weeds AMACH *Amaranthus hybridus* (green amaranth), CHEAL *Chenopodium album* (fat hen) and POROL *Portulaca oleracea* (pigweed).

Herbicide	Rate (g a.i. ha^{-1})	Average % Control (No. Sites)		
		AMACH	CHEAL	POROL
untreated control		0	0	0
clomazone	240		69 (2)	56 (1)
clomazone	480	50 (3)	94 (2)	100 (2)
oxadiargyl	400	90 (3)	99 (2)	100 (3)
pendimethalin	660		88 (2)	
pendimethalin	990	95 (3)	95 (2)	100 (3)

Table 6. Herbicide efficacy on common weeds SOLNI (*Solanum nigrum*, black nightshade), SONOL (*Sonchus oleraceus*, sow thistle) and TRBTE (*Tribulus terrestris*, caltrop)

Herbicide	Rate (g a.i. ha^{-1})	Average % Control (No. Sites)		
		SOLNI	SONOL	TRBTE
untreated control		0	0	0
clomazone	240	12 (2)	78 (1)	
clomazone	480	51 (5)		34 (3)
oxadiargyl	400	95 (5)	100 (1)	74 (3)
pendimethalin	660	52 (2)		
pendimethalin	990	70 (5)	44 (1)	66 (3)

Herbicide residues in fruit Analysis of clomazone and pendimethalin residues in capsicum fruit showed that when applied pre transplant, these herbicides were not detected at a limit of quantification of 0.01 mg/kg at two sites.

DISCUSSION

Trial data at 13 sites over three seasons has shown clomazone, pendimethalin and oxadiargyl provide control of a number of problem weeds while being safe to capsicum and chilli crops. A variety tolerance trial was conducted at Bowen in North Queensland on a light

textured soil with a cation exchange capacity of 5.9 cmol kg^{-1}. This site presented a worst case scenario for crop safety with soil applied herbicides and the herbicide rates used in this trial were approximately double those required for control of susceptible weeds. Despite this, the products showed high crop safety with no effect on marketable yield of capsicum or chilli.

Clomazone, pendimethalin and oxadiargyl can potentially be used to manage weeds under plastic mulch, in inter-rows between plastic mulch or within rows in crops grown without plastic mulch. Effective herbicide options may even assist growers to reduce their reliance on plastic mulch in capsicum and chilli crops in some situations.

These products can not be used in commercial crops until permits or registrations are obtained from the Australian Pesticides and Veterinary Medicines Association. The information generated from this project maybe used to support these applications.

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