DEVELOPING HERBICIDE TREATMENTS FOR SQUASH

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SUMMARY

In three field trials squash (*Cucurbita maxima*) yields were not affected by alachlor 2.25 kg ai/ha, asulam 4 kg ai/ha, chloramben 4 kg ai/ha nor by cyanazine 1.5 kg ai/ha when applied to dry soil directly after sowing. However, when tested under wet seedbed conditions, cyanazine was safe only at 0.75 kg ai/ha. Both alachlor and cyanazine gave useful control of a range of weed species.

INTRODUCTION

New herbicides have been tested optimistically in cucurbit crops for many years but no commercially available herbicide provides a high level of crop safety and good activity against a wide range of weed species. In early work at Levin most of the active herbicides damaged the crop and at the present time only alachlor and chloramben are suggested tentatively for use in pumpkins, squash, cucumbers, gherkins and marrows (Cox *et al* 1984). Herbicide suggestions from other work in New Zealand (Wilson 1975, Wilson 1979) are similarly circumspect and the only other promising herbicide, chlormethazole, has since been removed from the market for toxicological reasons.

At the present time, export prospects for buttercup squash are bright. In 1983 the amount exported was 14,500 tonnes, valued at \$8.3 million (Anon, 1983). There is considerable optimism that this trade will expand further. Thus there is an unsatisfied requirement for reliable herbicide programmes for this and the other cucurbit crops. These trials describe current efforts to meet the need.

In these trials several well established herbicides were re-examined to check crop tolerance and to investigate the usefulness of mixtures. The safety of soil acting herbicides applied no closer than 10 cm from the seed position was also tested. Two herbicides, pendimethalin and metazachlor, were clearly too damaging and are not included in this description. A triazine, cyanazine, which had showed unexpected tolerance in preliminary work was included in several trials and checked against other triazines to see if a firm recommendation was feasible.

Details of crop tolerance and weed control are reported from five trials conducted during the 1982-83 and 1983-84 seasons. Three were yield trials and two were small plot trials in which vegetative growth was recorded and assessed.

METHODS

Trials 1, 2 and 3

Seed was sown 15 mm deep 30 cm apart in single rows in beds 1.5 m wide. Alternate beds were left uncropped, giving a theoretical population of 11,000 plants per hectare. The uncropped bed was either maintained as bare soil by means of an application of 1 kg ai/ha of simazine (Trials 1 and 2) or it was sown with oats (Trial 3) to provide some protection against the wind in the early stages of squash plant growth.

Trials 1 and 2 were sown on 8 December, 1982 and harvested in early April 1983. Herbicide treatments (Table 1) were applied the day after sowing in a spray volume of 350 litres/ha, except for chloramben which was broadcast in granular form. In Trial 1 the application was overall but in Trial 2 a 10 cm wide band over the row was protected from herbicide by means of a plastic sheet laid on the soil surface during spraying. Trial 3 was sown on 22 November 1983, sprayed overall, seven days after sowing, and harvested in mid-March 1984. Weed vigour and populations were assessed in all three trials before removal from all plots by hoeing about four weeks after crop emergence. Crop plant counts, vigour and yields of fruit were recorded.

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TABLE 1: Total yields of mature squash (t/ha) in three trials.

Herbicide*	Rate kg ai/ha	Trial 1	Trial 2	Trial 3
alachlor	1.5	9.8	-	8.8
alachlor	2.25	8.9	7.4	9.9
asulam	2.0	7.2	-	-
asulam	4.0	9.1	5.8	-
chloramben	2.5	10.8	-	10.5
chloramben	4.0	9.3	6.0	8.5
alachlor + chloramben	1.5 + 2.5	7.2	6.1	9.3
alachlor + asulam	1.5 + 2.0	10.0	6.3	-
cyanazine	0.75	11.9	-	9.8
cyanazine	1.5	12.8	6.7	3.4
untreated		8.6	5.1	10.1
MSD 1%		ns	ns	3.1
cv %		46	35	23

* Sprayed overall in Trials 1 and 3. In Trial 2 a 10 cm strip over the row was not treated.

TABLE 2: Mean fresh weights of squash plants (g) growing under different seedbed conditions in Trials 4 and 5.

Herbicide	Rate (kg ai/ha)	Trial 4 Dry seedbed	Trial 5 Moist seedbed
cyanazine	0.75	791	405
cyanazine	1.5	756	151
prometryn	0.75	729	333
simazine	0.5	767	42
untreated		555	453
MSD 1%		285	82
cv %		18	14

TABLE 3: Weed vigour, % of untreated, (means of Trials 1, 2 and 3).

Herbicide	Rate (kg ai/ha)	AMpow	CAbur	COdid	POper	SEvul	SONig	STmed	All Species
alachlor	1.5	0	64	70		87	26	87	51
alachlor	2.25	8	25	47	39	65	19	81	36
asulam	2.0	100+				25			84
asulam	4.0	50	56	72	57	12		71	62
chloramben	2.5		39	85	38	100+		50	74
chloramben	4.0	17	24	72	71	100+	75		59
alachlor + chloramben	1.5 + 2.5	0	13	61	0	90	29	86	42
alachlor + asulam	1.5 + 2.0	12	23	51	7	8			35
cyanazine	0.75	83	0					46	48
cyanazine	1.5	100+	0	35	18	0			33

AMpow = *Amaranthus powellii* CAbur = *Capsella bursa-pastoris* COdid = *Coronopus didymus* POper = *Polygonum persicaria* SEvul = *Senecio vulgaris* SONig = *Solanum nigrum* STmed = *Stellaria media*

Trials 4 and 5

Treatments compared in these two trials are listed in Table 2. Trial 4 was sown on 20 January 1983 with seed spaced 60 cm apart in four-row beds 1.5 m wide and sprayed the following day. Weed counts were taken on 11 February and fresh weights of plants were recorded on 16 March. Trial 5 was sown on 8 March 1983, with seed spaced at 45 cm in the row and sprayed three days later. Weeds were assessed on 25 March and squash plants were weighed on 29 April.

Seedbed conditions for each trial were recorded. Trials 1 and 2 received 25 mm of irrigation water immediately after sowing (before spraying) and 65 mm of rain fell three days later with the seedbed remaining moist through the time of crop emergence. Trial 3 was similarly irrigated after sowing; after one week of dry weather 72 mm of rain fell over the next three days with 52 mm during the following week.

At the time of sowing Trial 4 the soil surface was dry and 'fluffy'. Herbicides were sprayed the following day and no rain fell during crop emergence. After 18 days 25 mm of irrigation water was applied. The seedbed of Trial 5 was moist and 100 mm of rain fell during the 18 days following sowing and spraying.

RESULTS**Crop**

Squash yields were generally lower in Trial 1 compared to Trial 2, but there were no significant differences between treatments in either trial (Table 1). In Trial 3, cyanazine 1.5 kg ai/ha severely reduced yield.

Treatment effects on fresh weights of young squash plants in Trials 4 and 5 were quite different although treatments applied were identical. Under dry conditions in Trial 4 there were no significant effects between any treatments. In Trial 5, where conditions were wetter, all treatments except cyanazine 0.75 kg ai/ha caused a significant reduction in growth, the severity increasing in the order: prometryn 0.75, cyanazine 1.5, simazine 0.5 kg ai/ha.

Weeds

In untreated plots annual weed populations averaged 310, 310, 760, 349 and 937/m² in Trials 1, 2, 3, 4 and 5 respectively. In Trials 1, 2 and 3 all treatments except asulam, chloramben and the low rate of alachlor reduced weed growth by more than 50% (Table 3). Cyanazine and alachlor were generally effective although cyanazine did not control redroot (*Amaranthus powellii*) and alachlor was weak against groundsel (*Senecio vulgaris*) and chickweed (*Stellaria media*). In Trial 4, cyanazine was generally more effective than prometryn at equivalent rates (Table 4). None of the treatments gave any control of black nightshade (*Solanum nigrum*). All four treatments gave almost complete control of most species in Trial 5, especially chickweed, black nightshade and spurrey (*Spergula arvensis*). Prometryn was less active than cyanazine and simazine against scrambling speedwell (*Veronica persica*) and twin cross (*Coronopus didymus*) but achieved at least 60% reduction in their growth.

DISCUSSION

In three trials alachlor, asulam, chloramben and cyanazine did not affect squash yields but in Trial 3 cyanazine 1.5 kg ai/ha caused a severe yield reduction. This trial was treated when the soil was moist and it is known that cyanazine moves readily in moist soil, similarly to atrazine (eg. Bell 1970).

Two trials conducted to further test the tolerance of squash to cyanazine, and compare it with other triazines, demonstrated that edaphic conditions can affect the extent of herbicide activity. The herbicides caused no damage in a fairly dry, but commercially acceptable, seedbed to which irrigation was applied two and a half weeks after sowing and spraying. But under naturally wetter conditions, when the germinating plants presumably absorbed toxic amounts of herbicide, severe damage was caused by all treatments except cyanazine at 0.75 kg ai/ha.

Another possible contributing factor could be the interval between sowing and spraying, which was only one day in Trials 1 and 2; and 7 and 3 days in Trials 3 and 5 respectively. Normally squash seedlings take about nine days to emerge and it is possible

that the shorter gap between spraying and emergence also allowed greater uptake of the chemical. It may be that before sufficient dissipation of the chemical occurred in the soil water phase the emerging shoot was able to take up phytotoxic amounts.

Although these experiences emphasize the narrow margins of tolerance of the effective weed killers it is clear that cyanazine at the low rate, has a useful place in squash growing, at least as useful as alachlor. If excessive moisture can be avoided and the seedbed is sprayed directly after sowing, higher rates of cyanazine may be safe. More experience is needed, but it is also possible that higher rates of asulam could be useful in combination with alachlor or cyanazine.

TABLE 4: Weed vigour, % of untreated in Trial 4

Herbicide	Rate (kg ai/ha)	SParv	STmed	CABur	SOnig	CHalb	All Species
cyanazine	0.75	8	33	0	100	60	31
cyanazine	1.5	0	33	0	100	40	31
prometryn	0.75	25	33	67	100 +	60	50
simazine	0.5	50	67	33	100	80	56

SParv = *Spergula arvensis* STmed = *Stellaria media* CABur = *Capsella bursa-pastoris*
 SOnig = *Solanum nigrum* CHalb = *Chenopodium album*

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