CONTROL OF WEEDS IN SQUASH

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SUMMARY

Field trials were conducted over three growing seasons on two soil types in the Waikato to evaluate herbicides and their combinations for weed control in squash (*Cucurbita maxima* cv. 'Baby Delica'). No single herbicide treatment controlled a broad enough weed spectrum to provide adequate weed control. Alachlor in combination with chloramben or asulam gave good weed control and crop safety. The mixture of alachlor and chlormethazole also looked promising but its crop tolerance was variable. Metolachlor gave good results in some trials and could be useful in combination with the above herbicides. None of the herbicides tested as early post-emergence treatment for control of broadleaf weeds were tolerated by squash.

INTRODUCTION

Early research programmes on the agronomy of squash in the Waikato showed that the major problem faced in these trials was weed competition throughout the growing season (Hacking 1981). Based on the earlier work at Levin and Pukekohe only alachlor, chloramben and chlormethazole were tentatively recommended for weed control in squash (Cox 1982, Wilson 1979), but the latter two were not commercially available at the time. The margin of crop safety with alachlor was small, particularly in lighter soils (Wilson 1979) and more information was required on crop tolerances.

The trials reported here were started in 1982 to test a number of herbicides, which have given promising results in New Zealand or overseas, for crop tolerance and weed control under Waikato conditions. Many of these herbicides would not control the whole weed spectrum of our region and therefore the usefulness of various mixtures was also evaluated. When the new formulations of chloramben and chlormethazole became available for experimental purposes, these were also assessed in the last two trials.

MATERIALS AND METHODS

Five trials were conducted between 1982 and 1985 on two different soil types near Hamilton. Trials 1, 2 and 4 were on a Horotiu sandy loam soil with organic C of 10.8% and a pH of 5.9. Trials 3 and 5 were on a Hamilton clay loam soil with 5.2% organic C and a pH of 5.5. All trials were planted in early November with a Nodet Gougis precision seeder. The squash (var. Baby Delica F.l. hybrid) seeds were planted at 30 cm spacing in rows 1.5 m apart in a stale seedbed. Plot size was 3 x 10 m and treatments were arranged in a randomised block design with four replications.

The herbicide treatments were applied overall in a spray volume of 300 litres/ha at a pressure of 210 kPa with a hand held precision sprayer. Trifluralin was applied before seeding and incorporated to a depth of approximately 5 cm. All other treatments were applied pre-emergence within 5 days of planting, except for methabenzthiazuron, bentazone and dinoseb amine in Trial 1 and chlormethazole in Trials 4 and 5 which were used as early post-emergence treatments, about 4 weeks after planting.

The number of squash plants in each plot and the herbicide damage to them was assessed about 1 month after planting. Weed dry matter determinations were made by harvesting duplicate 0.1 m² samples from each plot about 2 months after planting. Visual weed assessments were also made regularly throughout the duration of the trials. Squash yields were determined from a single harvest of the whole plot at maturity.

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RESULTS AND DISCUSSION

Weed control

The weed pressure was very high in all the trials, but more so on the Horotiu sandy loam soil (Trials 2 and 4), as evident from the weed dry matters of the untreated plots (Table 1). The main weeds were willow weed (*Polygonum persicaria*), black nightshade (*Solanum nigrum*) and redroot (*Amaranthus powellii*). Although grass weeds, particularly summer grass (*Digitaria sanguinalis*) and smooth witchgrass (*Panicum dichotomiflorum*) were present in each trial, their numbers were not high in most cases. The weed dry matter for most treatments in Table 1 consisted mainly of black nightshade and willow weed. Cyanazine also failed to control redroot. Weed control in general was poor in Trial 3 as no rain fell for 3 weeks after spraying.

When used alone, only metazachlor provided very good weed control, although chloramben, metolachlor and trifluralin gave acceptable control in some cases. Chlorthal-dimethyl, chlormethazole, cyanazine and alachlor (also oryzalin, propachlor and bensulide in Trial 1) all lacked a sufficiently wide spectrum of weed control as single treatments. Mixtures of various chemicals with alachlor gave much improved control of weeds (Table 1), although some of these were damaging as discussed later.

TABLE 1: Effects of herbicide treatments on weeds.

Treatment	Rate (kg ai/ha)	Weed dry matter (kg/ha)			
		Trial 2 (6.1.84)	Trial 3 (20.12.83)	Trial 4 (17.12.84)	Trial 5 (17.12.84)
hand weeded	-	0	0	0	0
alachlor	2.0	300	910	690	390
alachlor	3.0	380	1030	440	210
alachlor + asulam	2.0 + 4.0	410	730	100	300
alachlor + chlormethazole	2.0 + 2.0	-	-	420	180
alachlor + chlormethazole*	2.0 + 2.0	-	-	0	0
alachlor + chloramben	2.0 + 4.0	-	-	20	90
alachlor + cyanazine	2.0 + 1.0	-	-	40	120
alachlor + chlorthal-dimethyl	2.0 + 8.0	-	-	150	60
metolachlor	2.0	690	510	-	-
metolachlor	3.0	290	500	240	330
metolachlor + chlormethazole	2.0 + 2.0	-	-	270	190
metazachlor	1.5	30	110	70	30
chlormethazole	2.0	-	-	1400	700
cyanazine	1.0	590	580	1200	450
cyanazine	1.5	570	480	1860	550
trifluralin	1.0	910	60	210	-
chlorthal-dimethyl	10.0	470	940	-	-
chloramben	4.0	10	550	600	170
untreated	-	2420	1040	4700	3140
MSR**		3	3	2	15

* Applied as an early post-emergence treatment

** Minimum significant ratio (5%), zeros excluded from analysis.

- Treatment not included

Crop tolerance

Squash yields were generally lower on the Hamilton clay loam than on the Horotiu sandy loam (Trials 2 and 4). Total yields in Trial 3 varied between 18 and 22 t/ha but are not presented in Table 2 because all treatments had to be hand weeded in December and no significant differences in yields were recorded.

Two treatments which were consistently damaging to squash were pendimethalin and metazachlor, a response reported also by Cox and Ingle (1984). However, despite

the crop damage levels of between 25 and 60%, metazachlor still produced fair yields in two out of five trials. The 2 kg ai/ha rate of alachlor did not damage squash, but it did not provide as good weed control as that recorded in Pukekohe trials (Wilson 1975, 1979). At 3 kg ai/ha, the damage levels were between 20 and 45% and the yields were generally lower than the 2 kg ai/ha rate. Metolachlor gave results similar to alachlor in that 2 kg ai/ha was not enough for weed control and 3 kg ai/ha was damaging to the crop with the damage being greater in the Hamilton clay loam soil (Table 2). Crop tolerance to cyanazine was variable, even within a plot. The 1.5 kg ai/ha rate resulted in a 15-40% kill of squash seedlings.

TABLE 2: Total yield of mature squash in three trials.

Treatment	Rate (kg ai/ha)	Squash yields (t/ha)		
		Trial 2 (19.4.84)	Trial 4 (20.2.85)	Trial 5 (21.3.85)
hand weeded		39.9	31.8	13.4
alachlor	2.0	30.2	19.9	11.5
alachlor	3.0	25.0	19.4	5.7
alachlor + asulam	2.0 + 4.0	24.9	28.1	7.3
alachlor + chlormethazole	2.0 + 2.0	-	16.7	13.3
alachlor + chlormethazole*	2.0 + 2.0	-	8.1	0.4
alachlor + chloramben	2.0 + 4.0	-	26.3	14.6
alachlor + cyanazine	2.0 + 1.0	-	12.4	10.6
alachlor + chlorthal-dimethyl	2.0 + 8.0	-	22.1	10.6
metolachlor	2.0	26.2	-	-
metolachlor	3.0	34.5	23.9	6.9
metolachlor + chlormethazole	2.0 + 2.0	-	16.8	11.7
metazachlor	1.5	33.0	16.7	8.7
chlormethazole	2.0	-	22.7	7.2
cyanazine	1.0	36.7	21.6	9.0
cyanazine	1.5	32.4	17.9	8.9
trifluralin	1.0	19.3	22.6	-
chlorthal-dimethyl	10.0	28.2	-	-
chloramben	4.0	33.3	21.3	8.1
SED		4.6	3.9	3.0
CV%		23	28	45

* Applied as an early post-emergence treatment

- Treatment not included

From the results of the first three trials it appeared that the best prospect of achieving satisfactory weed control was with the low rate of alachlor combined with one of the other "safe" pre-emergence herbicides. In Trials 4 and 5 during the 1984-85 season, good weed control and crop yields were obtained with the combination of alachlor with chloramben or asulam (Tables 1 and 2). The mixture of alachlor and chlormethazole, which gave excellent results in Pukekohe (Wilson 1979) also resulted in good yields in the Hamilton clay loam (Trial 5) but was damaging in the Horotiu sandy loam soil (Trial 4), with an average damage score of 28%. The same trend was also recorded with metolachlor + chlormethazole in the two soils. The combination of alachlor and cyanazine was very damaging in both soils.

The early post-emergence treatments of dinoseb amine, bentazone and methabenzthiazuron tested in Trial 1 killed the squash seedlings within a few days. The post-emergence application of chlormethazole in Trials 4 and 5 also caused severe burning, resulting in the death of most plants. Thus there still appears to be no safe and effective post-emergence herbicide for control of broadleaf weeds in squash.

It appears that controlling weeds in squash is a difficult task under Waikato conditions and a single herbicide treatment would rarely be adequate. Alachlor was

found to be a useful chemical but must be combined with another herbicide to cover the weed spectrum. Both chloramben and asulam gave satisfactory results in combination with alachlor, but results with alachlor + chlormethazole were variable. However, in view of the excellent results obtained with this mixture in Pukekohe, it warrants further testing. Metolachlor also looks very promising and its combinations with some of the above mentioned herbicides also need further investigation.

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Chemical Appendix

alachlor	(Lasso)	asulam	(Asulox)
bensulide	(Prefar)	bentazone	(Basagran)
chloramben	(Amiben)	chlormethazole	(Probe)
chlorthal-dimethyl	(Dacthal)	cyanazine	(Bladex)
dinoseb amine	(ICI Dinoseb)	metazachlor	(Butisan S)
metolachlor	(Dual)	oryzalin	(Surflan)
pendimethalin	(Stomp)	trifluralin	(Treflan)