WEED CONTROL IN SNAP BEANS

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Two weed control trials in snap beans are reported. The soil-incorporated materials dinitramine, EPTC, alachlor and to a lesser extent penoxalin (formerly coded AC 92553), provided good control of black nightshade (*Solanum nigrum* complex). These materials, and also trifluralin and fluchloralin, gave very good control of redroot (*Amaranthus retroflexus* and *A. hybridus*) and fathen (*Chenopodium album* agg.). Dinitramine reduced the yield of wax beans. The pre-emergence treatments chloramben/dinoseb acetate, monolinuron/dinoseb acetate and methabenzthiazuron gave poor weed control. The latter two treatments also reduced yields. Bentazone (post-emergence) controlled black nightshade well but was damaging and reduced yields. Surface harrowing (post-sowing) reduced weed numbers two to three-fold.

INTRODUCTION

Snap beans (*Phaseolus vulgaris*) are an important process crop in Hawkes Bay with over 650 ha grown annually. Troublesome weeds in these crops are redroot (*Amaranthus retroflexus* and *A. hybridus*), fathen (*Chenopodium album* agg.) and the solanaceous weeds — nightshades (*Solanum* spp.), thornapple (*Datura stramonium*) and apple of Peru (*Nicandra physalodes*). These weeds can be avid competitors at all stages of crop growth.

In Hawkes Bay the most widely used herbicide is trifluralin, soil-incorporated. Although it controls redroot and fathen, it has given poor control of solanaceous weeds. This necessitates inter-row cultivation, and sometimes hand weeding in many crops.

Alternative herbicides for snap beans have been evaluated. Cox (1973) recommends various combinations of the pre-emergence materials dinoseb acetate, monolinuron and chloramben for wide spectrum weed control. Dinitramine, EPTC, alachlor and penoxalin (formerly coded AC 92553) have given good weed control in preliminary trials carried out by Wattie's Research Division during 1971-1973.

During the 1974-1975 season two trials were conducted to evaluate six soil-incorporated materials, with four surface applied pre-emergence herbicides and a post-emergence herbicide.

EXPERIMENTAL METHODS

The trials used a randomised four-block design with a plot size of 14 m². Both trials were carried out in commercial crops; trial I in a December planting of butter beans, and trial II in a January planting of green beans. Table 1 lists relevant experimental information.

Herbicide applications were made with a motorised knapsack sprayer delivering 450 litres/ha at 275 kPa. Soil-incorporated treatments were

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applied one day prior to sowing and incorporated with a rotary hoe. To comply with distributors' recommendations treatments 3, 4 and 7 were incorporated 7 to 10 cm deep and treatments 5, 6 and 8 4 to 5 cm deep. In trial I half the area of each plot was surface harrowed to a depth of 1 cm after sowing.

TABLE 1: EXPERIMENTAL INFORMATION

	<i>Trial I</i>	<i>Trial II</i>
Trial Location	Pakowhai, Hastings	Pukahu, Hastings
Soil Type	17-Pakowhai Silt Loam	14-Hastings Silt Loam
Sowing Date	Variety	16.1.75
7.12.74	Kinghorn Wax	Gallatin 50
Herbicide Applications:		
1. Soil-incorporated	6.12.74	15.1.75
air-temperature	20°C	26°C
2. Early pre-emergence	9.12.74	17.1.75
air-temperature	18°C	24°C
3. Late pre-emergence	9.12.74	23.1.75
air-temperature	18°C	21°C
4. Post-emergence	30.12.74	5.2.75
conditions	Fine	Fine
air-temperature	25°C	25°C
Dates of First Rain	8.12.74 - 10.12.74	21.12.74 - 24.12.74
Amount of First Rain	10 mm	18 mm
Dates of Second Rain	20.1.75 - 22.1.75	29.1.75
Amount of Second Rain	8.9 mm	11.2 mm
Weed Counts	7.1.75	18.2.75
Weed Scores	17.1.75	28.2.75
Bean Harvest	7.2.75	25.3.75

Methabenzthiazuron was applied within two days of sowing, while the monolinuron/ dinoseb acetate and chloramben/dinoseb acetate treatments were applied as close to bean shoot emergence as possible. Bentazone was applied at the first expanded trifoliate leaf stage when the weeds were at the cotyledon and two true leaf stage. Black nightshade (*Solanum nigrum* complex) was dominant in trial 1, and large numbers of redroot were present in both trials.

Detailed weed counts were made a month after sowing by sampling four 0.5 m² quadrats in each plot. In trial I two counts were made in the harrowed, and two in the nonharrowed portion of each plot. Later the plots were scored for overall weed control, and then maintained weed free until harvest. The hand-weeded controls were maintained weed free throughout the duration of the trials.

At harvest the marketable beans (length > 8 cm) were picked from 60 plants in each plot.

TABLE 2: WEED CONTROL AND YIELD MEANS

Treatment	Rate kg/ha	Timing	TRIAL I				TRIAL II			
			% Black nightshade	% Weed Control	Weed Fathen rating ¹	Yield t/ha ²	% Weed Control	Weed Fathen rating ¹	Yield t/ha ²	
1. untreated			0	0	0	6.77 e	0	0	8.5	7.14 e
2. hand-weeded			100	100	100	9.79 a	100	100	0	13.88 a
3. trifluralin	1.1	Soil-inc	49	97	93	9.49 ab	90	79	1.3	13.28 ab
4. fluchloralin	1.0	Soil-inc	84	93	95	8.47 d	84	78	1.8	12.21 d
5. dinitramine	1.0	Soil-inc	82	100	100	8.93 bc	96	100	0.8	13.45 ab
6. penoxalin	1.5	Soil-inc	70	95	93	9.46 ab	95	78	1.3	13.94 a
7. EPTC	6.0	Soil-inc	62	93	100	9.40 ab	94	95	0.8	13.55 ab
8. alachlor	3.0	Soil-inc	85	95	91	9.50 ab	93	93	1.5	13.11 ab
9. monolinuron	0.9	Pre-em	36	40	77	9.06 bc	48	88	4.8	13.31 ab
+ dinoseb acetate	2.0	Pre-em								
10. chloramben	4.5	Pre-em	22	73	63	9.69 ab	46	44	6.8	13.25 ab
+ dinoseb acetate	2.0	Pre-em								
11. methabenzthiazuron	2.1	Pre-em	13	82	54	8.76 cd	25	49	7.5	12.95 bc
12. bentazone	1.5	Post-em	84	18	75	7.97 d	14	62	7.0	12.45 cd
CV %						10.2				6.9

1. Weed rating 0-10 scale where 10 is 100% ground coverage by weeds.
2. Means within columns with common letters are not significantly different at the 5% level using Duncan's Multiple Range Test.

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RESULTS AND DISCUSSION

Table 2 summarises weed control and yield data from both trials.

Pre-sowing, soil-incorporated treatments

The soil-incorporated materials gave the best overall weed control. Redroot and fathen were controlled by all materials with dinitramine, EPTC and alachlor also controlling black nightshade well. In treatment 4 fluchloralin had given 15% control of black nightshade before bentazon was applied. EPTC, although giving only 62% control of black nightshade, greatly restricted the growth and development of those seedlings which did emerge. This is illustrated by the favourable weed rating EPTC received in trial I. Penoxalin also gave useful control of black nightshade. Fenster and Wicks (1971) have also reported good control of black nightshade using EPTC and alachlor, and poor control with trifluralin. Naish and Upritchard (1974) report 70% or more control of black nightshade with dinitramine at 0.75 kg/ha. In a preliminary trial carried out by Wattie's Research Division dinitramine, alachlor, EPTC and penoxalin gave good control of cape gooseberry.

Dinitramine reduced the yield of butter beans compared with the hand-weeded control in trial I. Alachlor was safe in both varieties used, but caused severe damage in a preliminary trial at a higher rate (4.2 kg/ha). Cox (1971) reports serious crop damage to Gallatin-50 with a lower rate of alachlor applied pre-emergence.

Pre-emergence treatments

These treatments gave poor overall weed control, being particularly weak against black nightshade. A wider range of results was obtained for redroot and fathen control. The effectiveness of the contact material dinoseb acetate was impaired through the absence of weeds at application. It was applied early in trial I, and in trial II dry seedbed conditions prevented an early weed germination. This most likely affected the other pre-emergence materials which depend on good moisture conditions in the seedbed at application or adequate rainfall soon after. Anon (1970) and Cox (1971) mention that monolinuron may not work under dry conditions.

Methabenzthiazuron reduced bean yields in both trials and monolinuron/dinoseb acetate yielded below the hand-weeded control in trial I. In both treatments the plants appeared to grow and develop normally.

Post-emergence treatments

Whilst bentazone gave good control of black nightshade it did not control redroot. Bentazone gave good control of Californian thistle (*Cirsium arvense*) in a preliminary trial. Anon. (1970; 1971) has reported good results with this material in the United Kingdom.

Bentazone applied at the expanded first trifoliate leaf stage caused chlorosis, and marginal scorch of the lower leaves. These symptoms were out-grown but the plants remained stunted and yielded lower than most other treatments. Anon. (1971) and King and Handley (1972) report similar damage which was more severe with earlier post-emergence applications. King and Handley (1972) found less damage when bentazon was applied in cool overcast conditions, rather than the hot sunny conditions experienced at application in the trials reported here.

Harrowing

Harrowing reduced the numbers of all weed species two or three fold. In the control the weed densities were 149/m² and 65/m² for the non-harrowed and harrowed areas respectively. The reductions occurred in all treatments.

CONCLUSIONS

The soil-incorporated materials have given the most reliable means of weed control in snap beans. They have provided very good control of redroot and fathen. Dinitramine, EPTC, alachlor and to a lesser extent, penoxalin, have also shown activity against black nightshade. Dinitramine and alachlor should be used with care because of possible varietal susceptibilities.

The pre-emergence materials gave poor weed control, and cannot be recommended. They rely on accurate application timing and/or are dependent on suitable moisture conditions in the seedbed at application or soon after. Bentazone was active against some troublesome weeds present and gave broad spectrum weed control when used after fluchloralin (soil-incorporated). However, the herbicide was too damaging and future work should assess both weed control and crop safety at different application times.

Harrowing, post sowing, reduced weed numbers considerably. This practice can be recommended as part of an overall weed control programme which includes a soil-incorporated herbicide.

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