

WEED CONTROL IN FIELD BRASSICAS

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Summary

Trial results are described which indicate that choumoellier is reasonably tolerant to dacthal, trifluralin, nitrofen, "Tordon"*, dicamba, desmetryne and sodium chloroacetate, but that turnips are adversely affected by the last four materials listed and swedes by the last three. When used at adequate rates, all materials except dacthal gave satisfactory weed control.

INTRODUCTION

IN PAPERS presented at the 1963 N.Z. Weed Control Conference, Mason and Thompson described results from the preliminary testing of some new weedicides for use in brassica crops. During the past cropping season trial work to compare and evaluate these materials further has continued at the Department of Agriculture's Experimental Area, Marton. Three trials were conducted. The first was purely a crop tolerance study conducted on a weed-free area of uniform fertility. In the second trial, a similar range of weedicides, with minor variations, was applied to brassicas in a weedy area to compare the materials under conditions of normal usage. The third trial was a preliminary evaluation of the recently introduced herbicides "Tordon" and dicamba.

EXPERIMENTAL

All trials were laid down on Marton clay loam with treatments applied across parallel sowings of turnips (N.Z. green globe), swedes (Doon Spartan) and choumoellier (Med. stem). Treatments, which are quoted throughout this paper in terms of active ingredient per acre, were applied in 40, 45 or 50 gal of water per acre in replicated, randomized blocks.

Experimental details are given in Table 1, and the treatments applied in the three trials are shown in Tables 2, 3, and 4.

TABLE 1: SOWING, SPRAYING AND RAINFALL DATA

	<i>Trial A</i>	<i>Trial B</i>	<i>Trial C</i>
Seed sown	Nov. 23, 1963	Jan. 15, 1964	Jan. 15, 1964
Sprayed:			
pre-em.	Nov. 25, 1963	Jan. 16, 1964	—
post-em. (2-5 leaf)	Dec. 16, 1963	Feb. 10, 1964	Feb. 10, 1964
post-em. (4-6 leaf)	Dec. 24, 1963	—	—
post-em. (6-8 leaf)	—	Mar. 2, 1964	—
Soil at pre-em. spraying	Fairly dry	Wet	—
Rain after spraying (in.):			
pre-em (0-5 days)	0.25	0.75	—
pre-em. (0-10 days)	0.75	0.75	—
post-em. (0-2 days)	Nil	Nil	Nil

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TABLE 2: TRIAL A: RELATIVE PLANT NUMBERS AND TOTAL D.M. PRODUCTION

Treatment (per acre)	Turntips		Swedes		Choumoellier	
	No.	Yield	No.	Yield	No.	Yield
Dacthal 8 lb pre-em	105a A	100a A	101a A	91ab AB	97a A	103a A
Trifluralin 8 lb pre-em.	84 bAB	89 b AB	97a A	86 b AB	90a A	94ab ABC
Nitrofen 1 lb post-em (2-5 leaf)	111a A	96ab AB	101a A	87 b AB	95a A	103a A
Nitrofen 2 lb post-em. (2-5 leaf)	107a A	86 b B	101a A	89 b AB	96a A	92abcABC
Nitrofen 4 lb post-em. (2-5 leaf)	109a A	88 b AB	87a A	81 b B	99a A	82 bc BC
Desmetryne 4 oz post-em. (4-6 leaf)	85 bAB	65 d CD	81a AB	57 c C	74 b B	81 c C
Desmetryne 6 oz post-em. (4-6 leaf)	66 c B	58 d D	57 b B	40 d D	70 b B	81 c C
Sodium chloroacetate 12.5 lb post-em. (4-6 leaf)	95abA	74 c C	101a A	84 b B	98a A	91abcABC
Control	100abA	100a A	100a A	100a A	100a A	100a AB
C.V. %	14.4	8.4	15.5	9.9	9.3	10.4
Control yields (plant numbers & D.M. tons/ac)	88,200	3.57	88,200	5.37	127,500	4.42

TABLE 3: TRIAL B: RELATIVE PLANT NUMBERS, TOTAL GREEN YIELD AND WEED CONTROL ASSESSMENTS

Treatment (per acre)	Turnip No.	Turnip Yield	Swede No.	Swede Yield	Choumoellier No.	Choumoellier Yield	Weed control (% kill)						
							Redroot	Nightshade	Fathen	Sow-thistle	Spurrey	Californian thistle	
Dacthal 8 lb pre-em	96	109	108	119	101	124	50	70	100	50	100	0	
Trifluralin 8 lb pre-em.	93	114	101	168	91	175	97	40	100	100	100	0	
Nitrofen 1 lb post-em. (2-5 leaf)	103	112	117	124	100	123	60	70	60	0	0	0	
Nitrofen 2 lb post-em. (2-5 leaf)	98	113	121	155	104	157	80	90	80	0	50	0	
Nitrofen 4 lb post-em. (2-5 leaf)	97	127	126	180	105	164	97	95	100	0	90	0	
Desmetryne 6 oz post-em. (6-8 leaf)	69	69	81	77	89	141	95	50	97	100	90	0	
Sodium chloroacetate 12.5 lb post-em. (4-6 leaf)	95	91	107	115	96	130	100	95	0	0	80	0	
"Tordon" 2.2 oz post-em. 6-8 leaf)	97	90	124	173	102	167	97	100	100	50	60	100	
Unweeded control	100	100	100	100	100	100	0	0	0	0	0	0	
Control yields (plant numbers & D.M. tons/ac)	101,600	10,95	83,600	6,63	90,500	6,45	—	—	—	—	—	—	

Trial A, the crop tolerance study, was practically weed-free, but a fairly heavy weed infestation occurred throughout the area occupied by Trials B and C. Weeds present included seedlings of redroot (*Amaranthus hybridus*), nightshade (*Solanum nigrum*), fathen (*Chenopodium album*), spurrey (*Spergula arvensis*), sow-thistle (*Sonchus oleraceus*) and some flatweeds (*Crepis capillaris*) and shepherd's purse (*Capsella bursa-pastoris*), all with 3 to 6 leaves when early post-emergent applications were made on February 10, 1964, and 6 to 10 in. high at the time of late applications on March 2, 1964. Regrowth Californian thistle (*Cirsium arvense*) and some dock (*Rumex obtusifolius*) also occurred, increasing in height from 6 in. to 10 in. between the two times of post-emergent application.

Crop growth in Trial A was at all times satisfactory, but that of B and C came almost to a standstill during a period of hot dry weather extending from January 21 to February 27.

RESULTS

Turnips in Trial A were harvested on February 18, 1964, choumoellier on April 1, 1964, and swedes on April 23, 1964. All crops in Trials B and C were sampled on April 29-30, 1964. Relative plant numbers and yields for the three trials are given in tables 2, 3 and 4. Dry matter production was determined and yield data statistically analysed for Trial A only.

TABLE 4: TRIAL C: RELATIVE PLANT NUMBERS AND TOTAL GREEN YIELD

Treatment	Turnip		Swede		Choumoellier	
	No.	Yield	No.	Yield	No.	Yield
"Tordon" 2.90 oz 2-5 leaf	82	55	107	99	95	103
"Tordon" 1.45 oz 2-5 leaf	95	74	104	97	102	103
Dicamba 2.90 oz 2-5 leaf.....	42	39	87	61	91	95
Dicamba 1.45 oz 2-5 leaf.....	89	64	96	74	102	101
Weeded control	100	100	100	100	100	100
Control yields (plant numbers & tons/ac)	96,000	15.92	96,700	12.34	88,200	10.83

DISCUSSION

Allowing for the influence of the relatively dry soil conditions on the pre-emergent treatments in Trial A, the results from this trial should give a reliable indication of crop tolerances to the herbicides tested. In the weedy conditions of Trial B, the value of efficient crop weedicides was demonstrated. These effects were most clearly apparent in the yields of choumoellier and swedes which, because of their slower initial growth, were more readily dominated by uncontrolled weed growth. Through their more vigorous early growth and rapid ground cover, turnips were able to compete much more successfully with the weeds and treatment of this crop produced only relatively modest yield gains compared with those obtained in choumoellier and swedes. Trial A showed that most of the materials tested cause some yield depression, but, except where very poor crop tolerance was established, these effects became insignificant in the presence of fairly strong weed competition, and yield increases in Trial B were directly proportional to weed control efficiency.

In both trials, dacthal, which is known to require high soil moisture for activation, had no significant effect on any of the brassicas tested. However, an earlier trial (Thompson, 1963) showed that, with very wet post-application conditions, dacthal significantly reduced yields. In Trial B the overall weed control achieved by this material was poor and resulted in only minor yield increases. Control of fathen and spurrey was fairly good, but some nightshade and much redroot survived.

Trifluralin is a much more active herbicide than dacthal where soil moisture is limited, and although in dry conditions it has little effect on brassicas, in moist soil it is rather more damaging to these crops than dacthal. In Trial A, trifluralin seemed to cause reduction of about 10% in the yield and numbers of all brassicas with little evidence of significant differences in tolerance between the three crops. It gave excellent results in Trial B, with complete control of all weeds except nightshade, and crop yields among the best obtained.

Nitrofen was fairly well tolerated by all brassicas and in particular had little effect on plant numbers which generally were similar to or above control. Dry matter yields were, however, usually reduced by approximately 10% and 20% at 2 lb and 4 lb, respectively. Tolerance did not seem to vary much among the brassica types treated. Control of all weed species by 1 lb of nitrofen was inadequate and that by 2 lb barely satisfactory, probably owing to the increased resistance of weed growth brought about by the three weeks of hot dry weather which preceded treatment. 1 lb increased yields of swedes and choumoellier by 20 to 25% and 2 lb by 50 to 60% over the very depressed control figure. Near complete control of most weeds was achieved by 4 lb, and crop yield increases were satisfactory.

Although desmetryne is specifically recommended for use in choumoellier, in the tolerance trial it caused highly significant reductions in numbers and yield at both 4 and 6 oz. In Trial B, however, as a result of good control of redroot and fathen, choumoellier yields were increased by 40%, although numbers appeared reduced. In both trials numbers and yield of the other brassicas were severely reduced.

Sodium chloroacetate 12.5 lb followed the expected pattern of effect; brassica numbers were not reduced and choumoellier yields were little affected, but turnips, and to a less extent swedes, suffered appreciable yield reductions. The control of redroot and nightshade was very good but as usual fathen was completely resistant.

Even at the low rates of "Tordon" used in these trials the characteristic effects were still evident in the foliage of the more sensitive brassicas when the crops were harvested several months after treatment. Choumoellier was the most resistant brassica, suffering only very minor treatment effects and giving yields slightly superior to those of weeded control. Although 2.90 oz caused fairly marked reactions in swede foliage there was no yield reduction by either rate and bulbs were generally free from serious deformity. Turnip growth was considerably affected by "Tordon", and yields, particularly at the higher rate, were much reduced. Rates of 2.90 oz, and to a less extent the lower rates, caused appreciable distortion and cracking of turnip bulbs. Brassica numbers were generally not adversely affected by "Tordon" except for a 20% reduction in turnips by the highest rate. "Tordon" at 2.90 oz gave excellent control of all weed species present, with only odd sow-thistle surviving. Sow-thistle was the principal survivor at 1.45 oz, with some stunted redroot and spurrey but general weed control was entirely

satisfactory. The excellent control of Californian thistle and dock obtained by all rates of "Tordon", with no evidence of regrowth at the time of harvest, is of particular interest as control of these perennials in growing brassica crops has previously been impossible. Of equal importance is the high degree of efficiency shown against some of the most troublesome annual weeds of brassica crops, namely, fathen, redroot and nightshade. There was some evidence of resistance by spurrey, but the infestation was inadequate to permit valid conclusions. No information about "Tordon" effects on redshank has been obtained, but the reaction of related species indicates that it will be susceptible. Applied at 2.20 oz to the fairly advanced weed infestation in Trial B, "Tordon" gave excellent control of all major weed species present without adverse effect on choumoellier or swede yields, although that of turnips was much reduced.

All brassicas except choumoellier were much less tolerant of dicamba. Both turnips and swedes suffered serious yield reductions by this material and quite unacceptable distortion and damage to bulbs. Plant numbers, especially of turnips, were markedly reduced. Dicamba gave generally poorer weed control than "Tordon", with sow-thistle, groundsel (*Senecio vulgaris*), nightshade and to a less extent redroot the resistant species. Control of Californian thistle and dock was generally satisfactory, but slower and less complete than that achieved by "Tordon", with evidence of regrowth by dock at the time of harvest.

To summarize:

For reasons indicated earlier in this report, dacthal, desmetryne, sodium chloroacetate and dicamba seem unlikely to achieve wide acceptance for use in field brassica crops, and trifluralin, because of its disadvantages as a pre-emergent weedicide, is likely to find only limited use in competition with reliable post-emergent materials.

Nitrofen applied at an early stage of growth has given very good results on most of the important weeds of brassica crops but rates of 2 lb or less have proved inadequate except in the most favourable conditions, and 4 lb seems necessary to ensure control in the unfavourable conditions of dry weather, or where weeds have developed even slightly beyond the seedling stage.

"Tordon" appears to have considerable promise for weed control in choumoellier and swede crops, but turnips are not sufficiently tolerant to permit its use unless lower rates can be employed. It seems that the optimum rate will be about 2 oz, but for use in turnips 1 oz may give satisfactory, although not complete, weed control with minimum crop damage.

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REFERENCES

- Mason, G. W., 1963: *Proc. 16th N.Z. Weed Control Conf.*, p. 65.
Thompson, A., 1963: *Proc. 16th N.Z. Weed Control Conf.*, p. 60.