WEED CONTROL IN BRASSICA CROPS

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Summary

Results are presented of trials to determine the tolerances of brassica crops and of weeds to several herbicides. Yield data are given from trials in which crops were grown in competition with weeds.

Post-emergent applications of nitrofen, "Tordon"*, desmetryne and dicamba all gave satisfactory results when applied to choumoellier and kale. The margins of selectivity are discussed. Brassica root crops would probably be too susceptible to these treatments.

Pre-emergent applications of nitrofen, at high rates, gave good weed control without crop damage. "Tordon" failed to control *Polygonum persicaria*.

INTRODUCTION

THE NUMBER of papers published in the *Proceedings of the N.Z. Weed and Pest Control Conference* in recent years, which deal specifically with weed control in brassica crops, indicate the importance of the subject. The emphasis has been placed on different chemicals at various times, according to what new materials have been available. Previous work was reviewed by Mason (1963) who reported that nitrofen was promising.

In the experiments described in this paper, the principal materials studied were nitrofen, "Tordon", desmetryne and dicamba. "Tordon" is of interest because brassicas show some resistance and a number of difficult-to-kill weeds, such as Californian thistle (*Cirsium arvense*), are susceptible (Pengelly, 1963). Research in England has indicated that desmetryne is the most suitable member of the triazine group for weed control in brassicas and that dicamba has some promise (Elliott, pers. comm.).

EXPERIMENTAL

The data presented are based on yields from 4 crop tolerance trials in weed-free areas and 7 trials in which the crops were grown in competition with weeds. Observations were made on 9 trials to determine the tolerances of weeds to herbicides and also on several other crop trials. All were field trials and the majority were conducted on sandy loam at Ruakura Agricultural Research Centre, Hamilton. The plots were usually 3½ to 5 ft wide and 12 to 18 ft long with 4 or 5 replications. All rates of application are expressed as pounds active ingredient per acre. The odd figures for the "Tordon" treatments are due to a recent announcement by Dow Chemical to the effect that "Tordon" contains 1.73 and not 2.4 lb active ingredient per gallon. Treatments were applied in 30 gal of water. Details of the treatments are given in Tables 1 to 4 inclusive.

* Trademark of Dow Chemical International S.A.

In most of the trials the crops were sown in drills 7 in. apart in November, 1963. The white-fleshed turnips (Green Globe variety) were harvested 11 or 12 weeks later. The choumoellier (marrow-stemmed kale) and the kale were harvested after 17 to 20 weeks. The choumoellier was the medium stemmed variety and the kale seed was supplied by the Weed Research Organisation, Oxford, as part of a series of trials conducted in co-operation with English research workers. January and February, 1964, were very dry and at one stage the crops were wilting. Yields are therefore low.

RESULTS

CROP TOLERANCE

The results of the pre- and post-emergent trials are given in Tables 1 and 2, respectively.

TABLE 1: TOLERANCES OF TURNIPS AND CHOUMOELLIER TO PRE-EMERGENT WEEDKILLERS

<i>Treatment</i> (lb)	<i>Turnips Choumoellier</i>	
Trifluralin 4	T	T?
Trifluralin 8	S**	S**
"Tordon" 0.36	T?	T

T = Yields not significantly less than those of the controls.

T? = Yields almost significantly less than controls and probably would be if controls were less variable.

S** = Yields significantly less than controls at the 1% level.

TABLE 2: TOLERANCES OF TURNIPS AND CHOUMOELLIER TO POST-EMERGENT WEEDKILLERS

<i>Treatment</i> (lb)	<i>Turnips (bulbs only)</i>				<i>Choumoellier</i>	
	3-4 leaf	4-6 leaf	6-8 leaf	Mean	2-3 leaf	4 leaf
Nitrofen 2	T	S*	T	T	T	T
Nitrofen 4	T?	S**	T?	S**	T	T
Nitrofen 8	T?	S**	S*	S**	S**	T
"Tordon" 0.18	S**	S**	S**	S**	T	T
"Tordon" 0.36	—	—	—	—	T	T
Desmetryne 0.13	T	T	S**	S**	—	—
Desmetryne 0.25	S*	S*	S**	S**	T	T
Desmetryne 0.38	T?	S**	S**	S**	S**	T
Dicamba 0.50	—	—	—	—	T	T

T = Yields not significantly less than those of the controls.

T? = Yields almost significantly less than controls and possibly would be if controls were less variable.

S* and S** = Yields significantly less than the controls at the 5% and 1% levels respectively.

CROPS GROWING WITH WEEDS

Tables 3 and 4 give the results of 4 trials with crops growing in weedy areas. The crops were sown on November 4, 1963. The pre-emergent treatments were applied 5 days later and the post-emergent treatments one month later when the crops had 3 to 4

TABLE 3: WEED POINTINGS AND YIELDS OF CHOUMOELLIER AND KALE FROM POST-EMERGENT TREATMENTS

Treatment (lb)	Choumoellier			Kale		
	Weed Control* 10 days	Stems/acre 87 days	Yield (tons D.M./acre)	Weed Control* 10 days 81 days B.L.	Stems/acre Grasses	Yield (tons D.M./acre)
Nitrofen 1	5.0	4.8	1.20abcAB	2.4	1.4	9.2
Nitrofen 2	6.0	6.8	1.42a A	5.4	3.0	9.6
Nitrofen 4	5.6	4.6	1.12abcAB	5.8	3.0	7.6
"Tordon" 0.09	8.0	6.6	1.28ab AB	7.8	8.8	2.4
"Tordon" 0.18	8.0	7.2	1.24abcAB	8.0	9.0	3.8
"Tordon" 0.36	8.6	6.8	1.01 bcAB	8.6	9.2	1.6
Desmetryne 0.13	6.0	5.2	1.25abcAB	4.8	2.6	9.6
Desmetryne 0.25	7.4	7.6	1.46a A	6.2	4.6	9.4
Desmetryne 0.50	9.0	8.2	1.32ab AB	9.2	7.0	6.6
Dicamba 0.06	6.6	6.6	1.25abcAB	5.7	7.2	3.4
Dicamba 0.13	8.0	7.0	1.39a A	8.0	8.2	4.4
Dicamba 0.25	8.6	6.0	1.35a AB	8.4	9.4	2.6
Hand-weeded				10.0	10.0	
Control (unweeded)		0.8	1.68a	0.4	10.0	9.3ab
C.V. %		19.8	18.4		28.2	23.9

* Weed control: 0 = No control, 10 = complete control. The days refer to the period between treatment and date of weed control assessment.

† Results for one level only of statistical analyses are quoted because the two levels are so similar.

TABLE 4: WEED RATINGS AND YIELDS OF CHOUMOELLIER AND KALE AFTER PRE- AND POST-EMERGENT APPLICATIONS OF WEEDKILLERS

Treatment (lb)	Weed Control* 17 Weeks	Choumoellier Stems/acre ('000)	Yield D.M./acre (tons)	Weed Control* 17 Weeks	Kale Stems/acre ('000)	Yield D.M./acre (tons)
Nitrofen 10 Pre	9.6	159A†	2.55aA	8.8	88ab†	2.26a A
"Tordon" 0.05 Post	8.6	178A	2.40abAB	8.0	106a	1.81ab AB
"Tordon" 0.18 Pre	3.4	157A	1.36efF	5.0	88ab	1.23 bcd BC
"Tordon" 0.36 Pre	2.8	155A	1.39efEF	6.4	76ab	1.28 bcd BC
"Tordon" 0.72 Pre	1.8	158A	1.18fFG	3.2	65 bc	0.84 cd C
"Tordon" 1.44 Pre	2.4	87 B	0.75gG	5.0	48 c	0.74 d C
Desmetryne 0.5 Pre	3.6	157A	1.71cdeCDEF	4.2	83ab	0.98 cd BC
Dicamba 0.06 Post	4.6	156A	1.93cdBCDE	5.4	95ab	1.46 bc ABC
WL 5792 1.0 Post	4.8	184A	1.97bcBCD	4.8	93ab	1.03 cd BC
Monochloroacetic acid 10.2 Post	7.0	167A	2.13abcABC	6.8	105a	1.78ab AB
Trifluralin 4 Pre	5.4	163A	1.98bcABCD	6.2	84ab	1.45 bc ABC
Trifluralin 8 Pre	8.2	154A	2.39abAB	7.0	90ab	1.76ab AB
Hand-weeded		166A	2.01bcABCD			
Control (unweeded)	2.4	189A	1.55defDEF	3.6	95ab	0.81 cd C
C.V. %		17.7	16.7			

* Weed control: 0 = no control, 10 = complete control. Assessments made 17 weeks after sowing.
† Results for one level only of statistical analyses are quoted because the two levels are so similar.

leaves and were 4 to 6 in. in height and diameter. The principal weed was redshank (*Polygonum persicaria*) which had 4 to 6 leaves and was 2 to 4 in. high and 3 to 6 in. in diameter. Most of the other weeds were 3 to 6 in. high except spurrey (*Spergula arvensis*) which was up to 6 in. high. In the kale trial in Table 3, there was a severe infestation of witch grass (*Panicum capillare*) on plots where the redshank had been controlled. The choumoellier and kale in Table 3 were harvested on March 5 and February 26, respectively. The dates for the corresponding trials in Table 4 were March 17 and March 3. In the latter trials hand-weeding was delayed and consequently the yields are not high. The crop yields, particularly those in Table 4, are closely related to the degree of weed control.

In another trial, "Tordon" was applied at 0.05 and 0.18 lb to choumoellier, to determine whether Californian thistle could be controlled but there was also a very thick infestation of redroot (*Amaranthus hybridus*). The treatments were delayed to enable the thistles to emerge and were applied when the crop and weeds were about 9 in. high. The lower rate of "Tordon" gave good control of the thistles but there was sufficient survival of the redroot to suppress the yields which were as follows:

Treatment (lb a.i./acre)	Yield (tons D.M./acre)
Control (unweeded)	0.98 B
"Tordon" 0.05	1.10 B
"Tordon" 0.18	1.81 A

In a trial at Te Awamutu, a crop of choumoellier was being smothered by redshank, redroot and fathen (*Chenopodium album*) about 1 ft high. The following treatments were applied at this late stage to determine whether the crop could be salvaged:

Nitrofen: 1, 2, and 4 lb.

"Tordon": 0.09, 0.18 and 0.36 lb.

Dicamba: 0.06, 0.13 and 0.25 lb.

No yields were taken but observations indicated that "Tordon" at the intermediate rate was the best treatment and saved the crop. "Tordon" at 0.09 lb gave a good result except for the survival of the fathen. If fathen were absent or if the treatment had been applied earlier, this treatment would have been satisfactory.

In another trial in which fathen in choumoellier was treated at an early stage, nitrofen at 2 lb gave good results.

In other trials nitrofen alone at 1, 2 and 4 lb was compared with nitrofen 1 lb plus "Tordon" at 0.09 lb. When applied to white fleshed turnips at the 6- to 7-leaf stage the mixture caused rotting of the bulbs. Nitrofen alone at 1 lb gave good control of fathen which was 1 in. high at the time of spraying. In rape and swede trials the mixture of nitrofen plus "Tordon" gave excellent control of fathen which was less than ½ in. high without damaging the crops. None of the treatments of nitrofen alone gave such good control of the fathen without some crop damage. "Tordon" alone was not applied in these trials and possibly it would have been just as good as the mixture.

WEED TOLERANCE TO PRE-EMERGENT TREATMENTS

Nitrofen: The only rate used, 10 lb, gave good weed control.

"Tordon": Rates up to 1.44 lb failed to control redshank.

WEED TOLERANCE TO POST-EMERGENT TREATMENTS

Nitrofen: 1 lb gave good control of redshank up to 2 in. but 2 lb was better. Larger weeds were resistant to these rates.

"Tordon": 0.05 lb controlled redshank, fathen, nightshade (*Solanum nigrum*) and redroot up to about 4 in. high. These weeds, except nightshade which was not present, were all controlled by 0.09 lb when up to 10 in. high. In some trials there was poor control of redshank when it was about 1 in. high. Since pre-emergent applications of "Tordon" gave poor control of redshank, the poor result from early post-emergent treatments may be due to emergence of weeds after spraying.

Desmetryne: Results on redshank were variable. 0.25 lb, and to a lesser extent 0.13 lb, gave good control of fathen up to 6 in. There was no control of cress (*Coronopus didymus*).

DISCUSSION AND CONCLUSIONS

NITROFEN

The pre-emergent application of 10 lb which was one of the best treatments would be too expensive for use in brassica crops on farms but it may have a place in more valuable crops such as in market gardens. Lower rates might give satisfactory weed control.

As a post-emergent treatment, 2 lb gave good weed control provided it was applied when the weeds were very small—i.e., not more than about 2 in. The margin of safety is probably less than 4-fold for choumoellier and less than 2-fold for white fleshed turnips.

"TORDON"

Since pre-emergent treatments fail to control redshank, they are of limited use in brassica crops.

As a post-emergent treatment, 0.05 lb gives good control of most weeds up to 4 in. high, and some control of larger weeds. Since, with the exception of one observational trial, choumoellier tolerated 0.36 lb at the 2- to 3-leaf stage and upwards, there is a wide safety margin. Turnips were susceptible to 0.18 lb. Lower rates were not used in the tolerance trial and it is, therefore, doubtful if there would be sufficient margin of selectivity.

The results suggest that "Tordon", at about 0.1 lb, would be useful in controlling a wide range of broadleaved weeds in choumoellier, kale and rape, and that it would be more versatile than nitrofen in that the time of application would not be so critical. The good control of Californian thistle with 0.05 lb is of interest because up till now there has been no satisfactory method of dealing with thistles in brassicas. Possibly the leafy brassicas could be used as cleaning crops in areas badly infested with Californian thistles, particularly if followed by a pasture treated with butyric acid hormones in the early stages. A trial along these lines is in progress at Ruakura and particular attention is being paid to the effects of the "Tordon" on the establishment of the clovers in the following pasture.

DESMETRYNE

In the choumoellier and kale trials reported in Table 3, desmetryne at 0.25 lb was one of the highest yielding treatments, and 0.5 lb gave results not significantly less than the highest yields. However, there is little margin of selectivity since the results in

Table 2 indicate that choumoellier in the early stages is susceptible to 0.38 lb (6 oz). There is even less margin with turnips as this crop was susceptible to 0.25 lb.

DICAMBA

Good overall weed control was obtained with 0.13 lb (2 oz) and high yields were obtained in the choumoellier trial reported in Table 3. The yields with half and double this rate were also high. In the corresponding trial with kale, the yields were reduced, presumably as a result of the severe infestation of witch grass which followed the good control of redshank. Since choumoellier tolerated 0.5 lb (Table 2) there is a good safety margin. Further information is required, particularly regarding the tolerance of root crops, before the value of this material can be assessed.

TRIFLURALIN

The pre-emergent application of 8 lb gave very good weed control and was one of the highest yielding treatments in both choumoellier and kale (Table 4), in spite of the susceptibility reported in Table 1. Weed control was inadequate with 4 lb. Possibly an intermediate rate of, say, 6 lb might prove satisfactory but there would be little safety margin. Thompson (1963) reported that choumoellier tolerated 8 lb when dry weather followed the application, but heavy rain at this stage resulted in reduced crop yields.

GENERAL

The good yields obtained with some treatments, in spite of the fact that tolerance trials indicate that the crops are susceptible, suggest that the advantages of good weed control more than compensate for some crop damage. Further trials are required to evaluate the most promising treatments over a wide range of conditions.

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