WEED CONTROL IN BRASSICA AND FODDER BEET CROPS

By F. B. THOMPSON, Rukuhia Soil Research Station, Hamilton

SUMMARY

SODIUM NITRATE applied at post-emergence at 280 lb. per acre to brassica crops gave slight but not satisfactory weed control. Crop responses to the nitrogen and increases in yield were slight. Sodium mono-chloroacetate applied at post-emergence at 15 lb. per acre gave good control of most broad-leaved weeds, but not grassy weeds. Kale, rape, and chou moellier were resistant, swedes slightly susceptible, and soft turnips more susceptible. Yields varied according to crop susceptibility.

The possibility of post-emergence treatments superseding pre-emergence applications of TCA is discussed.

Pre-planting applications of TCA and CIPC gave good weed control in fodder beet.

The results of previous experimental work by the Department of Agriculture on weed control in brassica crops was summarised by Dawes at the Tenth New Zealand Weed Control Conference (1). He concluded that pre-emergence applications of TCA and oktone were the most reliable treatments, but these pre-emergence chemicals must be regarded as a stop gap until more suitable methods are available.

Overseas work has shown that both sodium nitrate and the sodium salt of mono-chloroacetic acid have given promising results when applied to certain crops including kale (2, 3). Preliminary trials in 1956-57 at Rukuhia Soil Research Station showed that both these materials were promising on swedes and soft turnips. More extensive trials were conducted in 1957-58 and the results of these, together with results of trials with fodder beet, are described in this paper.

Pending the adoption of an international abbreviation for the sodium salt of mono-chloroacetic acid it will be referred to in this paper by its trade name "Monoxone".

EXPERIMENTAL

The trials described were conducted on a sandy loam soil.

The crops were:

Chou moellier		Sown broadcast
Swedes	Superlative	Drilled
Soft turnips	Green Globe	Sown broadcast
Fodder beet	Pajbjerg Rex	Hand planted

The brassica plots were 25 ft. by 5 ft. and the fodder beet plots 10 ft. by 5 ft. The treatments were replicated 6 times and dry matter crop yields were determined.

SODIUM NITRATE AND "MONOXONE"

Post-emergence applications of these two materials were made to the brassica crops. Following overseas recommendations sodium nitrate was applied at 280 lb. with 1 gallon of spreader in 100 gallons of water per acre (2). The rates of "Monoxone" varied from 7½ lb. to 25 lb. in 30 gallons of water per acre.

Each material was applied at more than one stage of growth of the crop, with a view to determining whether the tolerance of both the crops and the weeds varied much with size. Since sodium nitrate is not effective when the weeds are more than a few inches high, it was restricted to earlier stages of growth than "Monoxone". The main weeds were willow weed (*Polygonum persicaria*), redroot (*Amaranthus retroflexus*), spurrey (*Spergula arvensis*), and cress (*Coronopus didymus*). The following is a summary of the effects on the weeds:

"Monoxone"

7½ lb.: This was applied at the early stages only, when the weeds had 2 to 4 leaves and were 2 to 3 in. high.

There was some reduction of weeds, particularly of willow weed, but the over-all control was not satisfactory.

15 lb.: Willow weed: Very good control when 6 to 12 in. high.
Redroot: Very good control when 4 to 8 in. high.

Spurrey: Fair reduction when 4 to 5 in. high. Satisfactory control when smaller.

Cress: Slightly reduced when 2 to 3 in. high. Satisfactory control when smaller.

25 lb.: Slightly better control than 15 lb.

Sodium nitrate, 280 lb.

Willow weed: Generally fairly good, but sometimes very poor at 2 to 5 leaf stages.

Redroot: Fairly good up to 2 leaf, but variable and generally unsatisfactory at 2 to 5 leaf stages.

Spurrey: Good control at 2 to 3 in. high.

Cress: Very poor control.

There was insufficient fat-hen (*Chenopodium album*) on the trial areas to assess the tolerances. In general it appeared resistant to both materials, but "Monoxone" at 25 lb. reduced the infestation somewhat when applied to fat-hen 3 to 6 in. high.

The yields from the various trials are summarised below:

Trial	Crop	Sown	Weed Infestation	Relative crop yield Unweeded control equals 100	
				"Monoxone"	Sodium nitrate
A	Chou moellier	5 Nov.	Very bad	187-190	133
B	Swede	27 Nov.	Moderate	115-127	111-113
C	Soft turnip	11 Oct.	Bad	73-84	129
D	Soft turnip	17 Dec.	Very slight	95-99	98-102

The chou moellier was badly infested with willow weed and redroot and was sprayed when it was up to 6 in. high and had 3 to 5 leaves. "Monoxone" at either 10 lb. or 20 lb. per acre had no adverse effect on the crop and both rates gave excellent kills of willow weed. Any surviving redroot was very stunted and smothered by the crop. There was little difference in appearance between the 10 lb. and 20 lb. plots and the increases in yield were 87 and 90 per cent respectively. Sodium nitrate slightly reduced the willow weed, but did not affect the redroot. The added nitrogen improved the crop slightly and the increase in yield was 33 per cent.

TABLE 1—EFFECT OF SODIUM NITRATE AND “MONOXONE” ON WEED CONTROL AND YIELDS OF SWEDES.

Treatment	Crop size No. of leaves	Weed rating	Yield Lb. DM/acre
Unweeded control	---	6.2	5800*
Sodium nitrate 280 lb.	3	5.7	6460*
Sodium nitrate 280 lb.	3-5	4.3	6540*
“Monoxone” 7½ lb.	3	2.5	7320†
“Monoxone” 15 lb.	3	2.0	6720*
“Monoxone” 15 lb.	6-8	1.25	7350†
“Monoxone” 25 lb.	6-8	1.5	6690*
Hand-weeded control	---	0.8	8310†

* Significantly less than hand-weeded control at 5 per cent. level.

† Significantly more than unweeded control at 5 per cent. level.

Details of the crop yields in the swede trial and the weed rating for the treatments are given in Table 1. “Monoxone” at 7½ lb. gave good control of willow weed and fair control of redroot, but weed control was better with 15 lb. and 25 lb. The increased yields compared with the unweeded control were not as great as expected with the degree of weed control obtained. This indicates that 25 lb. in particular and 15 lb. to a less extent had a toxic effect on the swedes which offset the advantages of the increased weed control. The yield data show that at the 3 leaf stage the crop was susceptible to 15 lb. of “Monoxone” but not to 7½ lb. At the 6 to 8 leaf stage it was susceptible to 25 lb., but not to 15 lb. Sodium nitrate did not give such good weed control as “Monoxone” and the yields were not significantly greater than that of the unweeded control.

TABLE 2—EFFECT OF SODIUM NITRATE AND “MONOXONE” ON YIELD OF SOFT TURNIPS.

Treatment	Crop size No. of leaves	Yield Lb. DM/acre
Unweeded control	5-7	3310
Sodium nitrate 280 lb.	5-7	4270*
“Monoxone” 7½ lb.	5-7	2790
“Monoxone” 15 lb.	5-7	2400†

* Significantly more than all other treatments at 5 per cent. level.

† Significantly less than unweeded control at 5 per cent. level.

In trial C on soft turnips “Monoxone” was toxic to the crop and reduced the yields, although there was some control of willow weed (Table 2). Sodium nitrate increased yields because of the combined weed control and response to the nitrogen. Yields were low because of the poor strike due to flooding shortly after sowing.

In the next trial (D) a heavier sowing rate was used and the crop smothered the weeds even on the control plots. The yields were all similar to the controls and are not given in detail. This indicates that in this trial the sodium nitrate was of no benefit and the “Monoxone” was not toxic. “Monoxone” was applied at 7½ lb. per acre when the turnips had 3 to 5 leaves and at both 7½ lb. and 10 lb. at the 5 to 6 leaf stage. The resistance of the crop to these rates in trial D was surprising in view of the toxicity of 7½ lb. at the 5 to 7 leaf stage in trial C. A possible explanation is that the dry, hot weather (72 to 84 degrees F.) in January when trial D was sprayed may have made the turnips more resistant,

whereas trial C was sprayed in November when the temperature was 65 degrees F.

SUSCEPTIBILITY OF BRASSICA VARIETIES TO "MONOXONE"

In an observational trial differences in susceptibility of types and varieties of brassicas to "Monoxone" were noted. Rape, kale, and chou moellier were equally resistant, swedes were intermediate, and soft turnips were the most susceptible.

The varieties of swedes differed somewhat in their susceptibility. Sensation was outstanding in its resistance and Wye was next. Calder, Crimson King, Grand Master, Superlative, and Wilhelmsburger were all equally susceptible.

Purple Globe and Purple Top Yellow were the most resistant varieties of soft turnips. The remaining 8 varieties tested were approximately similar in susceptibility to Green Globe.

The classifications given are based on one trial and are therefore tentative only. The resistant varieties of both swedes and turnips all have some purple colouration.

2,4-DB ON SOFT TURNIPS

None of the treatments described gives effective control of deep rooted perennials such as Californian thistle (*Cirsium arvense*), which is often troublesome in brassica crops. Trials were therefore conducted with 2,4-DB applied in different ways to determine whether the material would have any place in weed control in brassica crops. An amount of 1½ lb. acid equivalent per acre was applied 8 days before sowing and also at pre-emergence. Post-emergence applications when the crop had 3 to 5 leaves included ¼, ½, and 1 lb. acid equivalent. All the treatments were so damaging to the turnips that they may be dismissed as having no practical value.

FODDER BEET

In earlier trials pre-emergence applications of various materials gave good initial weed control, but before the fodder beet covered the bare ground between the rows further weeds appeared which finally smothered the crop. In view of the good weed control obtained in two successive years when TCA and CIPC were sprayed on bare ground before planting lettuces it was decided to try these treatments with fodder beet. TCA at 20 lb. per acre and CIPC at 4 lb. per acre were each sprayed on the cultivated soil before planting the fodder beet. The soil was very dry and 1 in. of rain fell within 24 hours of planting. TCA gave excellent weed control and the plots were practically weed free right through to harvest 6 months later. CIPC gave excellent control of willow weed, but a few redroot plants survived. After a few months some flat weeds, clovers, and grassy weeds, mainly crab grass (*Digitaria sanguinalis*) came in on the CIPC plots, but these did not affect the crop. The yields from the treated plots were similar to the hand weeded controls (Table 3).

TABLE 3—EFFECT OF CIPC AND TCA ON YIELD OF FODDER BEET

Treatment	Yield Tons wet wt./acre
Unweeded control	15·8
CIPC 4 lb.	20·4
TCA 20 lb.	22·9*
Hand-weeded control	21·4*

* Significantly more than unweeded control at 5 per cent. level.

DISCUSSION

Good weed control in brassica crops has been obtained with TCA at Rukuhia in 3 different years. The good results are attributed to the care taken to sow and spray with TCA only when rain is forecasted. Many farmers have had disappointing results and there have been failures in trials in other areas in spite of special weather forecasts. These failures were probably due to the very dry soil conditions when the rain did not come or to excessive rain leaching the TCA out of the top layers of soil. It appears from the over-all experience that TCA is not entirely satisfactory and there is a great need for a post-emergence treatment not so dependent on weather. "Monoxone" will probably fill the need on kale, rape, and chou moellier crops and possibly on swedes, except where the dominant weeds are resistant to "Monoxone", for instance fat-hen. "Monoxone" is preferred to sodium nitrate, because it has given better weed control, is less than half the cost, is more convenient because of the lower volume of water required, and the timing of the application is not so critical. There might be justification for sodium nitrate in areas where big crop responses to the added nitrogen can be expected. However, further experimental work should be conducted during the coming season under a wide variety of conditions before "Monoxone" is recommended for general use. Rates of 10 to 15 lb. or possibly 20 lb. are suggested for these trials.

It was noted in trial B that grassy weeds such as paspalum, crab grass, and witch grass (*Panicum capillare*) were worse on the "Monoxone" plots than on unsprayed plots. Where grassy weeds are a problem there may still be a place for TCA.

The position regarding soft turnips is less promising, because it is doubtful whether the maximum rate of "Monoxone" tolerated by the crop will be sufficient to give satisfactory weed control. Therefore, the possible use of sodium nitrate requires further investigation, particularly at earlier stages of growth to ensure better weed control, especially of redroot.

The fodder beet results were most promising and the treatments are practicable. On some farms planting out is preferred to sowing, as it obviates the trouble of thinning, and mechanical weed control although still a problem, is less difficult. In the trial the excellent result with TCA may have been fortuitous in that the inch of rain on the dry soil was apparently just right for the TCA. A similar rainfall on moist soil may have caused a failure. CIPC may therefore prove the better material in the long run. Trials are necessary, using a mechanical planter to ensure that the disturbance of the soil does not spoil the treatments.

SUMMARY AND CONCLUSIONS

1. The stage has not yet been reached when post-emergence treatments can be recommended for general use in brassica crops. For the coming season the best recommendation is still pre-emergence applications of TCA where sufficient rainfall can be assured, but TCA may be partly superseded after another season's experimental work with post-emergence methods.

2. Post-emergence applications of 15 lb. per acre of "Monoxone" gave good control of the common broad-leaved weeds (except fat-hen), but not grassy weeds in brassica crops in the Waikato district. An amount of 7½ lb. gave some control, but was not adequate, and 25 lb. was unnecessarily high.

3. Kale, rape, and chou moellier appeared sufficiently resistant to 15 lb. of "Monoxone" to enable it to be used on these crops. Swedes were susceptible to 15 lb. at the 3 leaf stage, but not at 6 to 8 leaf. Soft turnips are possibly too susceptible, unless the use of "Monoxone" is restricted

to resistant varieties. There was evidence of different varietal susceptibility in swedes and soft turnips.

4. Post-emergence applications of 280 lb. per acre of sodium nitrate did not give as good weed control as "Monoxone." Unless big nitrogen responses can be expected, there appears little justification for the use of sodium nitrate, but it may have a place if "Monoxone" proves unsuitable for soft turnips.

5. Pre-sowing, pre-emergence, and post-emergence applications of 2,4-DB to soft turnips were all too toxic to be of any practical value.

6. Pre-planting applications of 20 lb. of TCA and 4 lb. of CIPC gave good weed control in fodder beet.

ACKNOWLEDGMENTS

The co-operation of the other members of the weed section in carrying out these trials and the assistance of other staff of Rukuhia Soil Research Station in harvesting the trials is gratefully acknowledged. Thanks are due to the biometric section of the Department of Agriculture for the statistical analyses.

REFERENCES

1. S. N. Dawes. Proc. 10th N.Z. Weed Control Conf. 1957, p. 75.
2. British Weed Control Council, Weed Control hand book, 1957, p. 23.
3. Fernhurst Service News. "Monoxone" 58/56.

DISCUSSION

Q.—Has the speaker done work on increased fertiliser applications to boost crop growth to overcome weeds?

A.—It is agreed that the crop needs ample fertiliser to grow well and compete with weeds.

Q.—What are the optimum conditions for use of TCA?

A.—Enough rain 24 hours after application to wet top inch of soil. If the soil is dry about an inch would be required, but this is too much if the soil is moist.

Q.—In applying TCA and CIPC what work has been done on consolidating ground with roller after spraying?

A.—Rolling is not much use on loose, friable soils, but would be important on other clay soils.

Q.—Has PCP been used in crops?

A.—In fodder beet PCP gave good initial weed control, but it has not a sufficient residual life.

Comment: At Invermay similar results had been obtained with PCP. Fat-hen and fumitory were resistant to monoxone.

Q.—What is the recommendation for a stale seed-bed technique for fodder beet?

A.—Prepare ground, put on TCA and CIPC when rain is expected, then plant.

Q.—Have you decided on the point when there are sufficient weeds to warrant spraying in spite of any damage to the crop?

A.—A few weeds make a great difference to crop yields.