

WEED CONTROL IN BRASSICA FORAGE CROPS IN SOUTH OTAGO

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SUMMARY

THE importance of brassica forage crops in South Otago is indicated and the most troublesome weeds in these crops are listed. Results of trial work in previous years are summarised. A trial is described in which pre-emergence applications of chlorpropham at $\frac{1}{2}$ lb, 1 lb, and 2 lb acid equivalent per acre, CDEC at 2 lb acid equivalent, EPTC at 2 lb acid equivalent, and a mixture of CDEC at 2 lb and chlorpropham at $\frac{1}{2}$ lb acid equivalents per acre; post-emergence applications of sodium monochloroacetate (MCA) at 15 lb per acre early and later, sodium nitrate at 240 lb per acre, and a cultivation treatment were made in order to control yarr (*Spergula arvensis*). The cultivation treatment and the pre-emergence applications of chlorpropham at $\frac{1}{2}$ lb and 1 lb acid equivalent per acre increased crop yields and gave complete control of yarr. The post-emergence applications of MCA at 15 lb early and sodium nitrate increased crop yields, but did not give complete control of yarr. CDEC and EPTC did not control yarr.

For many years the cultivation of brassica forage crops has been a major preoccupation of South Otago farmers who are forced to provide extra feed for livestock during the winter months of low pasture production. In recent years brassica forage crops have occupied some 85 per cent of the total area cultivated for all crops in South Otago. In the year 1957-58 when 58,127 acres were cropped in the Bruce and Clutha Counties, 50,246 acres were sown in the brassica forage crops swedes, turnips, rape, chou moellier, and kale, 2,730 acres were sown in other forage crops, and 5,151 acres were sown in cash crops. In general the soils and the climatic conditions of South Otago favour the production of brassica forage crops, but each year crop yields are reduced by the occurrence of several diseases, insect pests, and weeds. The most troublesome weeds that occur in South Otago brassica forage crops are spurrey or yarr (*Spergula arvensis*), fathen (*Chenopodium album*), autumn hawkbit (*Leontodon autumnalis*), redshank or willow weed (*Polygonum persicaria*), wire weed (*Polygonum aviculare*), and docks (*Rumex obtusifolius* and *Rumex crispus*). Other weeds such as Californian thistle (*Cirsium arvense*) and cut-leaved dead nettle (*Lamium hybridum*) occur also, but are of much less general importance. To control the growth of vigorous weed populations farmers have adopted suitable crop rotations and have devised techniques of along the row and inter-row cultivation of the crops. In spite of the considerable success that measures have achieved weeds continue to limit yields of brassica forage crops, and for this reason a more efficient and cheaper means of weed control has been sought.

In the summers of 1956-57 and 1957-58 field trials were put down in South Otago to test the tolerance of turnip, swede, and kale crops and their associated weeds to pre-emergence applications of TCA at 10 lb and 20 lb per acre, propham $\frac{1}{2}$ lb, 1 lb, and 2 lb acid equivalents per acre, and chlorpropham carbamate at $\frac{1}{2}$ lb, 1 lb, and 2 lb acid equivalent per acre. In these trials (1) pre-emergence applications of TCA at 10 lb and 20 lb per acre controlled neither yarr nor fathen even when applied under favourable weather conditions to moist soils. Pre-emergence applications of propham at $\frac{1}{2}$ lb, 1 lb, and 2 lb acid equivalents per acre controlled yarr, redshank, and seedling docks, but did not give effective control of fathen. At the heavier rates of application propham caused marked reductions in the density of the turnip and swede crops. Pre-emergence applications of chlorpropham at $\frac{1}{2}$ lb, 1 lb, and 2 lb acid equivalents per acre gave good control of yarr, redshank, and seedling docks without giving effective control of fathen. When used at equivalent rates, pre-emergence applications of chlor-

propham caused less damage to the brassica crop, and under a range of various weather conditions gave more consistent results than were obtained from pre-emergence applications of propham.

In the summer of 1958-59 post-emergence applications of MCA at 20 lb per acre were used in addition to pre-emergence applications of chlorpropham. In these field trials post-emergence applications of MCA at 20 lb per acre did not control either yarr or fathen, though pre-emergence applications of chlorpropham at 1 lb and 2 lb acid equivalents per acre gave complete control of yarr.

The results obtained prompted further investigation. Last summer in a series of field trials the tolerances of some brassica crops and their associated weeds to applications of chlorpropham, MCA, CDEC, EPTC, and sodium nitrate were tested. One trial in which these materials were used is described.

The trial was put down in a crop of Resistant rape which had been sown at the end of November on a ridged seedbed on a moderately fertile silt loam which had been cropped previously with swedes and wheat. A randomised block design with six replications was used, and each plot which was 15 ft square enclosed eight ridges of rape.

Pre-emergence applications of chlorpropham at $\frac{1}{2}$ lb, 1 lb, and 2 lb acid equivalents per acre, CDEC at 2 lb acid equivalent per acre, EPTC at 2 lb acid equivalent per acre, and a mixture of CDEC at 2 lb plus chlorpropham at $\frac{1}{2}$ lb acid equivalent per acre were made four days after the rape seed had been sown. These materials were applied in water 20 gallons per acre to the surface of the seedbed.

An early post-emergence application of MCA at 15 lb per acre was applied in 35 gallons of water 19 days after the rape seed had been sown or about 12 days after the crop seedlings had emerged.

A post-emergence application of sodium nitrate at 240 lb per acre dissolved in 200 gallons of water per acre was made 24 days after the rape seed had been sown.

A later post-emergence application of MCA at 15 lb per acre was applied in 35 gallons of water 40 days after the rape seed had been sown.

A cultivation treatment which involved one inter-row cultivation of the ridges was carried out 40 days after the rape seed had been sown.

No rain fell, temperatures remained at moderate levels, and moderately strong westerly winds were experienced for at least three days after the application of each treatment.

At the time the pre-emergence applications of weedicides were made, neither crop nor weed seedlings had become established. When the early post-emergence application of MCA and the post-emergence application of sodium nitrate were made rape and weed seedlings were established. The rape seedlings had developed two to three true leaves which were up to 2 in. long. The yarr seedlings had not branched and were up to 1 in. tall. The autumn hawkbit had produced cotyledons only. The later post-emergence application of MCA and the cultivation treatment were made when the rape had produced six to eight true leaves, each 4 to 6 in. long; and the yarr had branched and was 4 in. tall.

On the control areas yarr and autumn hawkbit became established between and in the rows of rape. The yarr formed a dense cover which checked the growth of the crop and autumn hawkbit. Where inter-row cultivation had been carried out yarr and autumn hawkbit plants were prevented from growing in the area between the rows of rape which grew vigorously and outyielded that on the control areas. The pre-emergence application of chlorpropham at 2 lb acid equivalent per acre prevented completely the establishment of yarr, though autumn hawkbit plants became established. This treatment caused a marked reduction in the density of the rape crop, which in spite of the complete absence of yarr yielded as poorly as the rape crop on the control areas.

The pre-emergence applications of chlorpropham at $\frac{1}{2}$ lb and 1 lb acid equivalents per acre and the mixture of CDEC at 2 lb plus chlorpropham at $\frac{1}{2}$ lb acid equivalent per acre prevented completely the establishment of yarr, but significant increases in the numbers of autumn hawkbit plants

occurred. These treatments caused no reduction in the density of the rape crop, which outyielded that on the control area, but did not yield as well as that where inter-row cultivation had been carried out.

The pre-emergence applications of CDEC at 2 lb acid equivalent per acre and EPTC at 2 lb acid equivalent per acre did not prevent the establishment of either yarr or autumn hawkbit. The rape crop was not damaged by either of these treatments and yielded as poorly as that on the control areas.

The early post-emergence application of MCA at 15 lb per acre caused initially some scorched tips and margins on the leaves of rape and yarr plants. The rape plants recovered and resumed normal growth within a few days. Some of the smallest yarr seedlings did not recover, but most which remained stunted for a period of seven to 10 days resumed vigorous growth. This treatment caused no apparent reduction in the numbers of yarr, autumn hawkbit, and rape plants. The rape crop outyielded that growing on the control areas, but did not yield as well as that where inter-row cultivation had been carried out.

The later post-emergence application of MCA at 15 lb per acre caused initially the rape and yarr plants to become pale yellow. Over a period of four or five days all plants regained normal colour and resumed normal growth. Apart from this colour change this treatment had no effect on either the yarr or autumn hawkbit or rape crop, which yielded as poorly as that on the control areas.

The post-emergence application of sodium nitrate at 240 lb per acre caused a short check to the growth of yarr, which recovered and later grew more vigorously. The density of the rape crop was reduced by this treatment. However, the rape crop grew more vigorously and in spite of the presence of yarr and the smaller number of crop plants yielded as well as that where inter-row cultivation had been carried out.

In this trial pre-emergence applications of chlorpropham and the inter-row cultivation treatment gave complete control of yarr. The early post-emergence application of MCA at 15 lb per acre and the post-emergence application of sodium nitrate at 240 lb per acre caused temporary checks to the growth of yarr and also caused reductions in the number of yarr plants, which reached significance at the lower level, but did not reach significance at the higher level.

TABLE 1—NUMBERS OF YARR PLANTS PER SQUARE FOOT

Control	.....	.....	.....	.....	.....	.....	72	a	A
EPTC 2 lb	.....	.....	.....	.....	.....	.....	62	ab	A
MCA 15 lb later	.....	.....	.....	.....	.....	.....	57	ab	A
CDEA 2 lb	.....	.....	.....	.....	.....	.....	55	ab	A
MCA 15 lb early	.....	.....	.....	.....	.....	.....	38	b	A
Sodium nitrate 240 lb	.....	.....	.....	.....	.....	.....	33	b	A
Chlorpropham $\frac{1}{2}$ lb	.....	.....	.....	.....	.....	.....	2	*	
CDEC 2 lb and chlorpropham $\frac{1}{2}$ lb	.....	.....	.....	.....	.....	.....	1	*	
Chlorpropham 1 lb	.....	.....	.....	.....	.....	.....	0	*	
Chlorpropham 2 lb	.....	.....	.....	.....	.....	.....	0	*	
Inter-row cultivation	.....	.....	.....	.....	.....	.....	0	*	

C.V. 47.0 per cent

*Omitted from statistical analysis

The effect of the application of weedicides on the growth of autumn hawkbit has been obscured by the effect of the growth of yarr, which limited the growth and density of autumn hawkbit plants. It is apparent, however, that the pre-emergence applications of CDEC at 2 lb acid equivalent per acre, chlorpropham at $\frac{1}{2}$ lb and 1 lb acid equivalents per acre did not control autumn hawkbit. The pre-emergence application of chlorpropham at 2 lb acid equivalent per acre limited the numbers of autumn hawkbit plants.

TABLE 2—NUMBERS OF AUTUMN HAWKBIT PLANTS
PER SQUARE FOOT

Chlorpropham $\frac{1}{2}$ lb	....	....	....	26	a	A
Chlorpropham 1 lb	....	....	....	18	b	B
CDEC 2 lb + chlorpropham $\frac{1}{2}$ lb	....	....	....	16	bc	B
Chlorpropham 2 lb	....	....	....	14	bcd	BC
MCA 15 lb later	....	....	....	12	cde	BC
CDEC 2 lb	....	....	....	12	cde	BC
EPTC 2 lb	....	....	....	12	cde	BC
MCA 15 lb early	....	....	....	11	de	BC
Control	....	....	....	11	de	BC
Sodium nitrate 240 lb	....	....	....	8	e	C
Inter-row cultivation	....	....	....	0	*	

C.V. 28.5 per cent

*Omitted from statistical analysis

The pre-emergence application of chlorpropham at 2 lb acid equivalent per acre and the post-emergence application of sodium nitrate at 240 lb caused significant reductions in the density of the rape crop, which was not affected by the other treatments.

TABLE 3—NUMBERS OF RAPE PLANTS PER 10 FT ROW

Inter-row cultivation	....	....	....	50	a	A
Control	....	....	....	45	ab	A
CDEC 2 lb + chlorpropham $\frac{1}{2}$ lb	....	....	....	45	ab	A
CDEC 2 lb	....	....	....	44	ab	A
MCA 15 lb later	....	....	....	42	ab	A
Chlorpropham $\frac{1}{2}$ lb	....	....	....	41	ab	A
Chlorpropham 1 lb	....	....	....	38	b	AB
MCA 15 lb early	....	....	....	37	b	AB
EPTC 2 lb	....	....	....	37	b	AB
Sodium nitrate 240 lb	....	....	....	26	c	B
Chlorpropham 2 lb	....	....	....	25	c	B

C.V. 21.7 per cent

Six treatments, that is, the inter-row cultivation, the pre-emergence applications of chlorpropham at $\frac{1}{2}$ lb and 1 lb acid equivalents per acre, and the mixture of CDEC at 2 lb and chlorpropham at $\frac{1}{2}$ lb acid equivalents per acre, the early post-emergence application of MCA at 15 lb, and the post-emergence application of sodium nitrate at 240 lb per acre caused significant increases in the yields of the rape crop, though in the case of the two latter treatments complete control of yarr was not achieved. The results obtained from the early post-emergence application of MCA at 15 lb per acre indicates that complete weed control may not be necessary provided the growth of the dominant weed or weeds is checked sufficiently to

TABLE 4—YIELDS OF RAPE: DRY MATTER
LB PER ACRE

Inter-row cultivation	....	....	....	2,860	a	A
Sodium nitrate 240 lb	....	....	....	2,230	b	AB
CDEC 2 lb + chlorpropham $\frac{1}{2}$ lb	....	....	....	1,960	bc	BC
Chlorpropham 1 lb	....	....	....	1,860	bc	BC
MCA 15 lb early	....	....	....	1,850	bc	BC
Chlorpropham $\frac{1}{2}$ lb	....	....	....	1,830	bc	BC
Chlorpropham 2 lb	....	....	....	1,470	cd	BCD
CDEC 2 lb	....	....	....	1,230	de	CD
Control	....	....	....	1,070	de	D
EPTC 2 lb	....	....	....	840	e	D
MCA 15 lb later	....	....	....	830	e	D

C.V. 27.0 per cent

allow the crop to grow above the weed or weeds and become the dominant growth. The marked response to the application of sodium nitrate at 240 lb per acre occurred as a result of the crop response to the nitrogen applied, and focuses attention on the need to supply adequate quantities of those fertilisers required for vigorous crop growth. Crops which lack vigour are unable to compete with growing weeds, even when these have been checked temporarily.

Weed control is carried out in field crops in order to improve the yield of the crop and in order to prevent reinfestation of the soil with weed seeds. In this trial three treatments are associated with significant increases in the yield of the rape crop and complete control of the dominant weed yarr.

The results of this trial and other trials indicate that wherever yarr, red-shank, wire weed, and seedling docks occur in South Otago brassica forage crops weed control may be best achieved by either inter-row cultivation of the crop or pre-emergence application of chlorpropham at 1 lb acid equivalent per acre.

It is estimated that inter-row cultivation or scuffling costs some 7s. to 9s. per acre per operation and that a pre-emergence application of chlorpropham at 1 lb acid equivalent per acre costs about 33s. per acre. Where intensive along the row cultivation, which involves weeding and thinning the crop in addition to scuffling, is practised, costs amount to some 140s. to 160s. per acre. It seems likely, therefore, that wherever moderate infestations of weeds occur in South Otago brassica forage crops weed control will be achieved by scuffling, but where heavy infestations of susceptible weeds occur pre-emergence application of chlorpropham at 1 lb acid equivalent per acre would provide an effective and cheaper means of control than is obtained by the intensive along the row cultivation which is practised at present on some properties.

ACKNOWLEDGMENTS

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REFERENCE

Stephen, R. C., Spurrey Control in Brassica Crops, N.Z. Journal of Agriculture, 99: 115, 1959.

DISCUSSION

Q.—In the North Island there has been good success with MCA on brassicas. Were the poor results in the South Island due to applying MCA at a later stage?

A.—I treated brassicas at a later stage with poor results in previous year so tried earlier growth stage in this experiment.

Comment: In soft turnips MCA applied at 2 in. destroyed turnips and at 4 in. there was no effect on turnips.

Q.—What was the equipment used?

A.—Knapsack sprayer. MCA was applied in 35 gallons of water.

Q.—Were cone or fan nozzles employed?

A.—MCA was applied with coarse jets.

Q.—Could you indicate the level of cultivation required to equal control of chemicals?

A.—The basis was scuffling; that is, for normal cultivation.

Q.—What are the costs of treatments?

A.—Chlorpropham at 1 lb cost 33s. per acre and scuffling 7s. to 9s. per acre.

Q.—Are slower growing conditions responsible for lack of effect of MCA?

A.—MCA adheres to leaves of swedes and rape, causing chlorotic spots on leaves.