2-methylmercapto-4-isopropylamino-6-methylamino-1,3,5-triazine
- 25 per cent wettable powder (G.343660)

diuron - 80 per cent wettable powder

linuron - 50 per cent wettable powder

chloropropham - 40 per cent wt/vol emulsifiable concentrate

prometryne - 50 per cent wettable powder

RESULTS

Field trial with Carrots in 1961

Table I gives the yields of roots harvested from the carrot trial at Mylnefield in 1961, together with weed counts recorded under the five treatments.

TABLE I - HERBICIDE TRIAL WITH CARROTS, 1961:

YIELDS OF ROOTS HARVESTED AND COUNTS OF WEEDS RECORDED

Treatment	Dose/ac	Yield of roots (ton/ac)	Weed seedlings recorded per square foot on 15 June (7 weeks after spraying)
1. propazine	0.5 lb	13.9	10
2. amiben	4 lb	14.1	8
3. OMU +) BiPC)	0.55 lb +0.38 lb	16.5	6
4. mineral oil	80 gal	4.9	-
5. control		11.6	21
Sig. diff. (P = 0.05)		1.8	-

When the mineral oil was applied the weeds were too hard and mature for a complete kill and their competition had stunted the carrots. The yields of roots from the plots of this treatment were consequently much depressed. The other three chemicals all gave complete freedom from early competition, although some hand-weeding was later required. The small differences in weed counts in the table do not adequately reflect the actual weed control obtained, for OMU + BiPC and amiben gave considerably better results than propazine.

Glasshouse Experiment in 1962

The ryegrass weights in Table II suggest trends towards reduced yields with increasing rates of application of the herbicides but the carrot weights do not show such a clear response to herbicide treatment. Although some of the peas suffered from the effects of herbicide damage, the results from different boxes of the same treatment were erratic and no general conclusions could be drawn.

TABLE II - GLASSHOUSE EXPERIMENT 1962:

WEIGHTS OF CARROT AND RYEGRASS FOLIAGE RECORDED 10 WEEKS AFTER SOWING

Treatment		Wt of Ryegrass (g)	Wt of Carrot tops (g)
1. Control		23.4	7.8
2. Control		34.8	13.9
3. OMU 0.25 lb + BiPC 0.18 lb		20.8	13.5
4. OMU 0.5 lb + BiPC 0.35 lb		19.3	9.6
5. OMU 1.0 lb + BiPC 0.70 lb		13.8	5.2
6. simazine	1.0 "	22.1	3.8
7. chloropropham	0.5 "	24.3	15.7
8. "	1.0 "	15.6	11.9
9. "	2.0 "	7.7	11.4
10. propazine	0.5 "	21.7	8.9
11. "	1.0 "	14.1	6.1
12. "	2.0 "	12.3	9.2
13. amiben	2.0 "	24.0	6.6
14. "	4.0 "	10.8	8.8
15. prometryne	0.25 "	41.2	9.9
16. "	0.5 "	29.1	7.6
17. "	1.0 "	27.7	12.2
18. "	2.0 "	19.2	4.7
19. "	4.0 "	10.0	6.2
20. linuron	0.25 "	36.5	15.0
21. "	0.5 "	33.0	11.2
22. "	1.0 "	27.7	10.6
23. "	2.0 "	16.8	11.1
24 "	4.0 "	1.7	6.9

Field trials with Carrots in 1962

At North Berwick the weed control under all treatments, including the mineral oil, was excellent and very little hand weeding was necessary. Abundant growth of Capsella bursa-pastoris, Stellaria media, Matricaria matricarioides, Urtica urens, Senecio vulgaris and Poa annua on the control plots so severely checked the growth of the crop that these plots were abandoned. The plots which received 1 or 2 lb/ac of Hoe. 2747 or linuron, or 2 lb/ac of prometryne, were most weed free; but OMU/BiPC and chloropropham/diuron mixtures were less effective and on the plots of these treatments there were small numbers of Poa annua and Capsella bursa-pastoris. 1 lb/ac of prometryne was the least effective treatment.

The yields of carrots in the North Berwick experiment showed no considerable differences (Table III), although the plots which received 2 lb/ac of linuron gave yields significantly better than those of any other plots. The reason for this is unknown. In the trial at Mylnefield all the plots were more weedy and considerable differences were noted between the treatments. The plots which received 2 lb/ac of prometryne, linuron and Hoe. 2747 were almost weed free for at least three months, after which a few Urtica urens and Chenopodium album survived and grew above the crop. The mineral oil gave an almost complete kill of existing weeds, but a few weeds later grew in these plots also. The remaining treatments were less successful.

The differences in carrot yields in the Mylnefield trial were larger, as shown by the table. Owing to the difficulty of removing a dense weed seedling population by hand at an early stage of development, the hand-weeded control plots only yielded about half as well as most of the other treatments. The differences between the other treatments were smaller, but they do show a trend towards lower yields from those treatments that failed to achieve adequate weed control.

TABLE III - CARROT TRIALS 1962: ROOT YIELDS (N. BERWICK AND MYLNEFIELD) AND "WEEDINESS RATINGS" (MYLNEFIELD)

Treatment	Rate/ ac	N. BERWICK YIELD (tons/ac)	MYLNEFIELD YIELD (tons/ac)	MYLNEFIELD Average weed rating on a Scale 0 (no weeds)-10 (dense cover of weeds)
1. Hand-weeded		Abandoned	8.1	8 (before weeding)
2. mineral oil	80 gal	13.5	17.5	8 (before spraying)
3. chloropropham+ diuron	2.0 lb+ 0.5 lb	15.3	13.5	4
4. prometryne	1.0 lb	13.0	15.3	4
5. "	2.0 lb	11.7	18.5	1
6. linuron	1.0 lb	15.5	17.9	4
7. "	2.0 lb	18.2	18.3	1
8. Hoe. 2747	1.0 lb	14.9	17.4	4
9. "	2.0 lb	12.4	17.6	1
10. OMU + BiPC	0.55 lb+ 0.38 lb	13.7	16.4	4
Sig. diff. (P = 0.05)		1.8	2.6	-

Field trial with Carrots, Peas, Broad beans and French beans in 1962

The control plots of this trial became immediately obvious by their weediness only a few days after spraying, when there was little weed growth on the sprayed plots. The average weediness ratings shown in the table were assessed three weeks after spraying, when all the plots were hand-weeded. The 4.0 lb rates of each of the five chemicals produced almost weed-free seedbeds, and little hand weeding was required. The weeds controlled were mainly Capsella bursa-pastoris, Senecio vulgaris, Polygonum aviculare, Chenopodium album, *Fumaria officinalis*, *Stellaria media*, *Poa annua*, *Lamium amplexicaule* and *Matricaria matricarioides*.

Only the peas suffered visible crop damage (Table IV). The pea yields were severely reduced in the 4.0 lb Hoe. 2747 plots, but the other treatments did not reduce yields. The French beans and broad beans were sown too late to obtain yield data, but the carrots will be lifted and weighed.

TABLE IV - TRIAL IN CARROTS, PEAS AND BEANS: AVERAGE WEED CONTROL RATINGS ON A SCALE OF 0 - 10

Treatment		Weed rating	Visible crop damage
prometryne	1.0 lb	1	
"	2.0 "	1	
"	4.0 "	0	
G 34360	1.0 "	1	
"	2.0 "	1	
"	4.0 "	0	Peas chlorotic
simetryne	1.0 "	2	
"	2.0 "	1	
"	4.0 "	0	
Hoe. 2747	1.0 "	2	
monuron	2.0 "	1	Peas chlorotic
"	4.0 "	0	Peas chlorotic (yield much reduced)
linuron	1.0 "	2	
"	2.0 "	1	
"	4.0 "	0	
Control		6	

DISCUSSION

The accepted commercial weedkiller for use in carrots continues to be mineral oil (either tractor kerosene or a proprietary selective oil), applied after emergence of the crop. In a wet year, weeds seriously compete with the crop before spraying can safely be carried out, and the oil treatment is not always successful. Furthermore, tractor kerosene is a variable commodity and liable to taint the crop, while proprietary mineral oil, though it gives consistent results when correctly applied, is expensive. A reliable soil-acting herbicide that could be applied soon after drilling would possess great advantages, and in the event of its failure it would still be possible to apply a mineral oil herbicide after crop emergence.

The herbicides which have been tried here and elsewhere for this purpose have included amiben, propazine and the OMU/BiPC mixture known as HS 55, but none has been recommended in place of mineral oil in Britain. Some of the newer substituted triazines and substituted ureas reported in this paper may offer an alternative to mineral oil. They are effective weedkillers and appear from these preliminary results to be safe on carrots. Some of them may also offer alternatives to the existing recommendations for peas and beans, but more work is required on the tolerance of them by these crops.

Acknowledgements

For supplying materials used in this work, thanks are due to Fison's Pest Control Ltd.; the Du Pont Co. (U.K.) Ltd.; Farbwerke Hoechst, A.G.; Boots Pure Drug Co. Ltd.; Chemical Spraying Co. Ltd.; and the A.R.C. Weed Research Organisation, Oxford, England.

REFERENCES

ROBERTS, H.A. and WILSON, B.J. (1961) The response of vegetable crops to pre-emergence applications of some substituted triazines. Proc 5th Brit Weed Control Conf, 1960 409-12.

Research Report

PRE-SOWING AND PRE-PLANTING TREATMENT WITH 2,6-DICHLOROBENZONITRILE : A PRELIMINARY REPORT

R. J. Stephens

Scottish Horticultural Research Institute,

Mylnefield, Invergowrie, Dundee.

Summary: A trial is reported in which 2,6-dichlorobenzonitrile (dichlobenil) was applied to bare soil in November 1961, at rates of 2, 4, 6 or 8 lb and either raked or rotavated into the surface. The soil was then left undisturbed until May-June 1962, when it was sown or planted with test crops of carrots, oats, peas, sugar beet, potatoes and cabbage. At the 4 lb, 6 lb, and 8 lb doses all the sown crops were either killed or else reduced in stand and vigour, and even at the 2 lb dose the germination of carrots and sugar beet was very severely depressed. The percentage emergence of potatoes and the growth of the emerged shoots were reduced at all rates of treatment above 2 lb. In general, damage to the crops was greater where the soil had been rotavated after application of the herbicide. Only transplanted cabbage survived without visible injury on the plots which had received 8 lb of material.

INTRODUCTION

The properties of the herbicide 2,6-dichlorobenzonitrile (Koopman and Daams, 1960) were described at the 5th British Weed Control Conference (Barnsley, 1961). The material is volatile and disappears from the soil at a rate depending on soil moisture and temperature (Barnsley and Rosher, 1961). The precise way in which the herbicide affects weed seeds and buds in the soil is unknown, but it is now thought unlikely that it has a genuine "seedicide" action on dormant weed seeds in the soil, as was at one time hoped. However, it seemed possible that this material might be of practical use if applied some months in advance of the sowing or planting of a crop, provided that by sowing or planting time the herbicide residue had fallen to a safe level. An experiment to test this method was therefore begun in November 1961.

METHODS AND MATERIALS

Plots 27 ft x 16 ft in size were marked out on land that had been ploughed 4 weeks previously and recently rotavated, and 2,6-dichlorobenzonitrile was applied to these at 2, 4, 6 or 8 lb/ac, either as a wettable powder or in the form of granules, on 16, 17 and 18 November. The sprays were applied with an Oxford Precision Sprayer and the granules by hand from a small cardboard cylinder perforated at one end. On two replicates of each of these treatments the soil was rotary cultivated again, to a depth of 4 in. immediately after application of the herbicide, and on another two replicates the treated soil surface was lightly raked by hand. There were both rotavated and hand-raked untreated control plots. No further operations were undertaken until spring 1962, when the whole experiment received a uniform application of 5 cwt per acre of a mixed fertilizer.

In May, six sub-plots each 5 ft x 6 ft were marked out in each main plot and raked over by hand before being sown with carrots (var. Chantenay Red Cored, sown 24 May), oats (var. Sun II, sown 8 May), peas (var. Kelvedon Wonder, sown 7 May) or sugar beet (var. Sharpes Klein, sown 9 May) or planted with potatoes (var. Redskin, planted 8 May) or cabbage (var. Golden Acre, planted 14 June). The plots were kept weed-free by hand, and the alleyways between them were rotavated when they became weedy.

Records were made of weed growth before the preparation of the sub-plots for drilling or planting and again at later dates, and the germination and growth of the experimental crops were also recorded. Where the carrots, sugar beet and oats failed to germinate they were redrilled on 25 July.

RESULTS

Weed Control

The chemically treated plots remained remarkably clear of annual weeds throughout the winter and spring, although in some a few small irregularly-shaped weedy strips suggested uneven soil incorporation of the herbicide. In early May, when the assessments shown in Table I were made, the control plots were almost covered with a mixed weed growth consisting mainly of *Chenopodium album* (fat hen), *Fumaria officinalis* (fumitory), *Capsella bursapastoris* (shepherd's purse), *Polygonum convolvulus* (black bindweed), *P. aviculare* (knotgrass), *Stellaria media* (chickweed) and *Veronica hederifolia* (ivy-leaved speedwell). Owing to the uneven distribution of perennial weeds no reliable assessment of the control of these was possible. By the middle of June healthy seedlings of black currant (originating from a previous crop) had become common on many plots. There was little annual weed germination during the summer and early autumn on any of the plots which had received 4 lb/ac or more of the herbicide, whereas the control plots twice required hand weeding after the sown crops had emerged.

Growth of the Experimental Crops

The germination and early development of the six crops are shown in Table II. At the time of writing only the peas have been harvested: the average weight of pods per plot under each treatment are given in Table III, but these results have not yet been analysed.

Carrots and sugar beet were the crops most severely affected by 2,6-DBN, and the results of the second sowings made on 25 July were little different from those of the first, shown in Table II. Raking-in resulted in less phytotoxicity than rotavating-in, but even 2 lb raked-in still had a considerable injurious effect. Higher dosages rotavated-in were completely lethal. Oats were somewhat more resistant, but the residue from the 4 lb dose of treatment either killed the crop or severely reduced it. Peas and potatoes were very much more tolerant, but the higher doses still reduced the stand and growth of these crops. Transplanted cabbage on the other hand, was not adversely affected in either growth or external appearance by the residue of 2,6-dichlorobenzonitrile and ultimately grew larger on the plots treated at the higher dose than on the low-dose and control plots. A possible explanation of this appeared to be that the weeds growing on the latter plots had reduced the soil moisture during a dry period immediately before the cabbages were transplanted. The growth assessments in Table II show poor growth on most plots during a dry period. Following rain, growth on the treated plots was superior to growth on the control plots.

Both weeds and crop were less affected by 2,6-dichlorobenzonitrile residues where the material had been raked-in than where it had been rotavated-in. The difference in effect between the granular and the wettable powder formulations was small and inconsistent.

DISCUSSION

It is evident from these results that under Scottish conditions 2,6-dichlorobenzonitrile can be a highly persistent and potent herbicide. Except for transplanted cabbage, however, none of the crop plants tested escaped injurious effects when sown or planted in soil treated with the chemical 6-7 months previously at rates sufficiently high to control weeds. It is encouraging to note the good growth of transplanted cabbage on treated plots which were weed-free and required no cultivation, but the use of 2,6-dichlorobenzonitrile for this crop cannot be advocated until more is known of the persistence of the chemical and of the amount of any residue taken up by the plants and remaining present at harvest.

Acknowledgements

Thanks are due to "Shell" Research Ltd. for supplying chemicals used in this work and to The British Sugar Corporation for supplying sugar beet seed.

REFERENCES

BARNSLEY, G.E. (1961) As assessment of the new herbicide 2,6-dichloroben--zonitrile. Proc 5th Brit Weed Control Conf 1960, 597-616.

BARNSLEY, G.E. and ROSHER, P.H. (1961) The relationship between the herbicidal effect os 2,6-dichlorobenzonitrile and its persistence in the soil. Weed Research 1 147-58.

KOOPMAN, H. and DAAMS, J. (1960) 2,6-dichlorobenzonitrile: a new herbicide Nature, Lond, 186 89-90.

TABLE I - WEED ASSESSMENTS $5\frac{1}{2}$ MONTHS AFTER APPLICATION OF 2,6-DICHLOROBENZONITRILE

(On scale of 0 - 10, where 0 = no weeds except in small irregular patches, and 10 = almost complete weed cover. Assessments are shown for the two replicates of each treatment.)

2,6-dichlorobenzonitrile (lb/ac)	WETTABLE POWDER FORMULATION				GRANULAR FORMULATION			
	Raked-in		Rotavated-in		Raked-in		Rotavated-in	
2	8	4	2	4	4	6	6	6
4	2	2	0	2	2	2	2	2
6	2	0	0	0	2	2	0	0
8	2	0	0	0	2	0	0	0

All control plots were assessed at 10

TABLE III - PEAS: WEIGHTS OF PODS HARVESTED (LB PER PLOT)

2,6-dichlorobenzonitrile (lb/ac)	WETTABLE POWDER FORMULATION		GRANULAR FORMULATION	
	Raked-in	Rotavated-in	Raked-in	Rotavated-in
2	7.9	8.6	6.5	6.1
4	13.4	8.0	11.6	5.6
6	8.7	4.6	9.8	4.2
8	12.0	2.6	3.2	0.8

TABLE II - EMERGENCE[1] AND DEVELOPMENT[2] OF CROPS ASSESSED 10 JULY 1962

2,6-dichloro-benzonitrile lb/ac	Carrot	Sugar Beet	Oats	Pea	Potatoes	Cabbage
Wettable powder raked in						
2	5 N	25 N	55 N	100 N	100 N	100 M
4	0 -	0 -	10 M	100 N	65 N	100 M
6	0 -	0 -	0 -	80 M	60 N	100 M
8	0 -	0 -	0 -	80 M	30 M	100 M
Granular raked in						
2	5 N	5 M	20 M	100 N	85 N	100 M
4	10 M	0 -	5 M	100 N	60 N	90 M
6	5 M	0 -	5 M	65 M	30 M	90 M
8	0 -	0 -	0 -	45 P	65 N	95 M
Control raked in	55 N	70 N	90 N	100 N	80 N	100 N
Wettable powder rotavated						
2	0 -	0 -	45 N	95 N	90 N	95 N
4	0 -	0 -	0 -	85 M	45 M	100 M
6	0 -	0 -	0 -	60 P	35 M	100 M
8	0 -	0 -	0 -	60 P	35 M	100 N
Granular rotavated						
2	0 -	0 -	85 N	90 N	80 N	100 N
4	0 -	0 -	10 M	80 M	70 M	100 M
6	0 -	0 -	0 -	65 P	55 M	100 M
8	0 -	0 -	0 -	30 P	30 N	100 M
Control rotavated	65 N	95 N	85 N	100 N	75 N	90 N

1 - emergence ('take' of cabbage) as per cent of seed sown or plants or tubers planted.

2 - development of crop rated N - normal
M - moderate
P - poor

Research Report

EXPERIMENTS IN 1961 AND 1962 WITH A MIXTURE OF ENDOTHAL AND PROPHAM FOR PRE-EMERGENCE APPLICATION TO BRASSICA CROPS

B.H. Bagnall and J.J.B. Caldicott

The Murphy Chemical Co. Ltd., Wheathampstead, St. Albans

Summary: Five unreplicated trials on brassica crops in 1961 proved sufficiently encouraging for more extensive investigations to be carried out in 1962. Ten crops were tested in a total of thirteen trials. Latin square layouts were adopted with each plot containing one or more rows of four or five crops at each site. Several of the crops tested were found to require a lower dose of endothal + propham from the point of view of crop safety than was needed for satisfactory weed control. Those crops found to be more resistant are normally drilled at a time of the year when the chances of sufficient rainfall to satisfy the requirements of the chemical application are at a minimum.

INTRODUCTION

Extensive work has been carried out over the last few years by several workers to investigate the use of endothal and propham for pre-emergence weed control in sugar beet. More recently applications on a wide range of mineral soil types with a proprietary formulation of endothal + propham established a relationship between the amounts of coarse sand and clay in a soil and the rate of use of the chemical required for optimum results. (Caldicott 1962; Hunnam and Hey 1962) Investigations also showed that the effectiveness of a given dose for any one soil type was found to be dependent on adequate rainfall between time of application and weed germination; the minimum rainfall required varying with the date of application (Caldicott 1962).

In the course of the trials on sugar beet in 1960 an application of endothal + propham was made to spring cabbage plants. The result was sufficiently encouraging to suggest further investigations into the use of the material on brassica crops in general. In 1961, therefore, at each of five sites where trials of endothal + propham on sugar beet were being conducted, applications were made to five brassica crops. The doses used were those considered optimum for use on sugar beet on the soil types of the sites in question.

The 1961 results were very promising and led to more elaborate investigations on a wider range of crops in 1962. This paper reviews the limited work done in 1961 and covers in detail the more extensive trials conducted in 1962. The weed killing properties of endothal + propham have been adequately reported elsewhere by Bagnall et al (1960) and Caldicott (1962). The main consideration of these investigations is the effect of the material on the crops to which it is applied. The level of weed control is only of value as an indicator of the validity of the experiments.

METHODS AND MATERIALS

The six trials in 1961 were carried out with a band sprayer mounted on a seed spacing drill (Bagnall et al 1960a) operated at 3 mph and using hollow-cone nozzles with an output of 12 fl oz/min at 11 psi over a 7 in. band equivalent to 21 gal/ac of treated ground. The applications were of one dose of endothal + propham onto each seed type at each site in comparison to a similar untreated plot. There was no replication.

In 1962, trials were carried out at 13 sites. Each trial had three doses of endothal + propham and an untreated control. The layout at each site was a 4 x 4 Latin square and each plot contained one or more rows of each of the seed types being tested at each particular site. The number of seed types at each site varied from 2 to 6 but was mostly 4 or 5. In this way observations on several crops were achieved within the same trial layout.

The 1962 series was divided into two groups. Sites 1 to 5 were concerned with market garden brassica crops and sites 6 to 13 with farm brassica crops grown for fodder.

In the market garden trials the seeds were sown by means of a hand operated plant breeders' drill of the type described by Hamblin and Chalmers (1957) and chemical applications were made immediately after drilling. At sites 1 and 2 applications were made by means of a hand operated band sprayer described by Bagnall and Minter (1962). At sites 3, 4 and 5 applications were on an overall basis by means of a knapsack sprayer. The size of the chemical treatment plots was 30 sq yd in the case of site 3, and 90 sq yd at the other four sites.

In the fodder brassica trials at sites 6 - 13 the seeds were sown by means of a tractor drawn seed spacing drill and chemical applications were made by a band spraying technique which was a modification of that used in 1961. Dilutions of the chemical treatments were put into pneumatic cylinders which were pressurised and mounted on the framework of the seed spacing drill. By means of plastic tubing these cylinders were connected to a common pressure reducing unit, through which the liquid from any one cylinder could be fed by the manipulation of the appropriate valves. From the pressure reducing unit the liquid was fed via a splitting box to individual band spray nozzles mounted to the rear of each drill unit. Each nozzle had an output of 8 fl oz/min at 12 psi over a 7 in. band. When operated at 2 mph this gave a rate equivalent to 21 gal/ac of treated ground. The size of the chemical treatment plots was variable according to the length of the field but averaged 150 sq yd.

In all trials a proprietary formulation was used containing endothal (di-sodium) 11.4 per cent wt/vol a e and propham 8.55 per cent wt/vol.* Altogether six doses were employed and the three most appropriate to the soil type in question were used at any one site. The six doses are shown below in terms of lb/ac of actual ground sprayed. All doses in this paper are in terms of endothal as acid equivalent and propham as active ingredient.

a) 1 lb endothal + 0.75 lb propham
b) 1.5lb endothal + 1.125 lb propham
c) 2 lb endothal + 1.5 lb propham
d) 3 lb endothal + 2.25 lb propham
e) 4 lb endothal + 3 lb propham
f) 5 lb endothal + 3.75 lb propham

* as "Murbetex"

Assessments were made in most cases about 4 weeks after drilling. In 1961 counts were made at 16 points in each plot selected at random. In the 1962 randomised trials, counts were made at 5 points in each plot for each seed type and at 5 separate points in each plot for weeds. The weeds were counted in an area of 50 x 2 in. at each point, the count being taken along the length of the row. The crop emergence counts were of 50 in. units of row giving a total of 250 in. per seed type per plot. Vigour was recorded as scores between 1 and 10 by one observer.

The seed types used in the trials were as follows:-

1961:	Turnip	=	Green Globe
	Swede	=	Peerless
	Cabbage	=	First Early Market No. 218
	Rape	=	Dwarf Essex
	Kale	=	Green Marrow Stem
1962:	Broccoli	=	Veitches self protecting
	Brussel Sprouts	=	Cambridge No. 1
	Savoy	=	Early Drumhead
	Cabbage	=	Greyhound, January King and Primo
	Field Cabbage	=	Eclipse Drumhead
	Turnip	=	Imperial Green Globe
	Swede	=	Majestic
	Kale	=	Green Marrow Stem and Imperial Thousand Head
	Rape	=	Dwarf Essex

RESULTS

Experiments in 1961

In 1961 treatments to brassica species were made alongside sugar beet treated at the same rate. The doses chosen were those known to be suitable for sugar beet on the soils in question. Table I gives a summary of the observations made on these trials. The weed control figures suggest that at most of the sites, conditions were suitable for satisfactory herbicidal action by the endothal + propham. The possible exception is the site at Congham where there were 39 per cent surviving weeds on the treated plot. Emergence figures for sugar beet, given alongside those for the brassicas, show that the doses chosen were in fact suitable for that crop.

Experiments in 1962

Experiment details of the 13 trials are given in Table II; this also includes rainfall data. These trials were all laid down as latin squares but in the case of trial 2 one replicate was lost before assessment could be made leaving it as three randomised blocks of four treatments. In Table III the weed-killing performance at each site is shown. At site 4 applications were made to a stale seed bed, many weeds which had already emerged not being controlled. At site 9 there was considerable Agropyron repens (couch grass) present which increased the proportion of surviving weeds. At sites 11, 12 and 13 there was no visible weed control attributable to the lack of rain within the first week after spraying and drilling; these trials were therefore abandoned. Replication was limited, especially in trial 2, which accounts for some of the high figures recorded for Standard Error.

In Tables IV - XIII are recorded the effects of endothal + propham on the ten different types of brassica crops tested both as regards emergence and vigour. Included in all except Table I and II is a column headed Optimum Rate. These are the doses recommended for the treatment of sugar beet on the soil types in question and are the doses which achieved an effective weed kill without undue damage to the sugar beet (Caldicott 1962). In all tables the doses of endothal + propham are in lb/ac as follows: a) 1 + 0.75; b) 1.5 + 1.125; c) 2 + 1.5; d) 3 + 2.25; e) 4 + 3; f) 5 + 3.75. Asterisks indicate treatments showing significant differences from control at * P = 0.05 ** P = 0.01.

DISCUSSION

The crops emergence figures in 1961 suggested that, with the possible exception of swede, the brassicas tested were no more susceptible to damage from endothal + propham than was sugar beet.

In all these trials the main consideration is the effect of the material on the crops to which it is being applied. Thus the weed killing performance gives a measure of validity of the trial and if there is no weed control then the trial is of no value in assessing the safety to the crop. Of the 1962 trials in Table III it will be noticed that weed control is not very good in trial 6 and poor in trial 7. Trial 7 has been rejected as being of little value whereas trial 6 has been retained. The weed control at trial 6 was a visible one but the evaluation of the crop emergence figures at this site must be considered with reservation. The poor weed killing performance in trials 6 and 7 and the total failure at trials 11 - 13 was entirely due to insufficient rainfall after application. This is obvious if reference is made to the rainfall records in Table II and is in accordance with observations on rainfall requirements made by Caldicott (1962).

On the evidence of Tables IV - VIII the crops tested fall into three groups. The first contains those crops which appear not to have been unduly checked by endothal + propham at doses as recommended for sugar beet. In this group fall Marrow Stem Kale, Turnip, Rape and Field Cabbage. The second group includes Thousand Head Kale, Swede, Cabbage and Savoy where, although the recommended doses are too high for safety, it is likely that one, or possibly two doses lower could be used satisfactorily. The third group which includes Broccoli and Brussels Sprouts would seem to be too risky to treat.

With regard to the second group it is necessary to consider the degree of weed control achieved at the lower doses at which it would be safe to treat the crops. In many cases to drop one dose would still give an acceptable control of weeds but when two doses are dropped the weed control achieved is often not a commercial one. Whereas considerable vigour reductions were recorded for the market garden brassicas this was not the case with the fodder brassicas except at site 10. It is difficult to assign a reason for the damage at the latter site except for the possibility that the very much ligher nature of the soil may have been a contributory factor. All sites were visited again three to four weeks after the first assessment. In most cases vigour differences were considerably reduced and in some instances were no longer discernible. However, at site 10 there were still noticeably lower levels of vigour at the higher doses in the cases of field cabbage and rape.

There would appear to be generally less latitude in treating brassica crops with endothal + propham than is the case with sugar beet. The doses required to give satisfactory weed control present the risk of crop check in several varieties. Drilling date and resultant weather conditions would seem to be important. The market garden trials were laid down in March and April and whereas each trial had sufficient rainfall after drilling the two earliest drillings were subject to very cold and poor growing conditions at the end of March; this undoubtedly enhanced the potential damaging effect of the endothal + propham on the brassicas. These conditions were abnormal but cold conditions could always constitute a hazard to early drillings. Of the eight fodder brassica trials, all laid down in May, only three were really successful. This falls in with previous findings on work with endothal + propham (Caldicott 1962) which show that in late April and in May there is often insufficient rainfall after application for the satisfactory working of the herbicide. At this time of year the period between drilling and weed and crop emergence can be as short as 10 - 14 days and more rain is required in a shorter period than is the case in the earlier spring. The three successful trials just happened to benefit from adequate rainfall which fell in their own particular areas.

The results of all these trials indicate that with the exception of some of the market garden varieties quite useful results can be obtained by treating brassicas with endothal + propham for pre-emergence weed control. However, most fodder brassica crops are drilled in late April and May. A firm recommendation for the use of endothal + propham on those brassicas which are most tolerant to the mixture but are grown mostly at this time of the year would seem to be precluded due to the risk of inadequate rainfall.

Acknowledgements

The authors wish to acknowledge the co-operation of the farmers who made land available for these trials to be carried out.

REFERENCES

BAGNALL, B.H., CALDICOTT, J.J.B. and MINTER, D.J. (1960) Field trials with endothal and propham for control of seedling weeds in sugar beet. Proc 5th Brit Weed Control Conf 1960 23-30.

BAGNALL, B.H., CALDICOTT, J.J.B. and MINTER, D.J. (1960a) A technique for the application of pre-emergence herbicides in sugar beet. Proc 5th Brit Weed Control Conf 1960 633-635.

BAGNALL, B.H., and MINTER, D.J. (1962) Experiments in 1962 with salts of endothal in comparison with an endothal/propham mixture for controlling weeds in sugar beet. Proc 6th Brit Weed Control Conf 1962.

CALDICOTT, J.J.B. (1962) Further investigations into the field use of a mixture of endothal and propham for pre-emergence application to sugar beet. Weed Research, 2 100-109.

REFERENCES (cont'd.)

HAMBLIN, H.J. and CHALMERS, G.R. (1957) A drill for plant breeding experiments. Journal of Ag Eng Res 2 12-13.

HUNNAM, D.H. and KEY, G.L. (1962) The control of weeds in sugar beet by an endothal/propham mixture applied at drilling. J. Amer. Sugar Beet Technologists. Report of Proceedings of Conferance at Denver 1962.

TABLE I - EFFECTS OF ENDOTHAL + PROPHAM ON WEEDS AND CROPS IN 1961 TRIALS

SITE		Rate of Endothal + Propham	per cent Survivors all weeds	Emergence as per cent of Untreated						Rainfall in inches			days before rain
				Sugar Beet	Turnip	Swede	Cabbage	Rape	Kale	1st Week	2nd Week	3rd Week	
Welby	20/4	d	10	100					100	0.58	0.71	?	1
Congham	19/7	c	39	100	100	86	84	96	91	nil	0.56	1.15	8
Heydon	20/7	d	12	96	94	100	93	79	100	nil	0.23	0.60	7
Long Marston	25/7	c	13	98	100	93	100	97	100	0.38	1.00	1.34	0
Skirpenbeck	2/8	b	12	100	90	73	96	100	100	0.74	0.78	0.27	0
Mean			17	98	96	86	93	93	98				

TABLE II - DETAILS OF 1962 TRIALS

Site	Types of crop	No. of varieties in trial	Coarse sand per cent	Clay per cent	Application date	Rainfall in inches				Days before rain	Date of assessment
						1st week	2nd week	3rd week	4th week		
Warwick	Market garden	4	54.3	10.0	15/3	nil	0.1	0.59	0.65	12	17/5
Hitchin, Herts	market garden	4	34.8	20.0	21/3	0.17	1.05	0.55	0.17	2	10/5
Eynsford, Kent	market garden	2	12.0	23.0	12/4	0.25	0.37	nil	0.37	3	21/5
Evesham, Worcs	market garden	4	15.2	54.4	25/4	nil	0.31	0.55	0.45	10	24/5
Flitton, Beds	market garden	4	65.0	10.4	30/4	0.24	0.38	0.52	0.76	3	25/5
Wiltsford, Lincs.	fodder	3	33.9	13.0	3/5	0.23	0.21	0.65	0.33	1	28/5
Welby, Lincs.	fodder	5	39.9	21.4	4/5	0.24	0.13	0.53	0.35	2	31/5
Lowick, Northumberland	fodder	5	32.3	10.4	8/5	0.56	1.12	0.57	nil	0	5/6
Cornhill-on-Tweed, Northumberland	fodder	4	20.2	12.4	9/5	0.22	0.97	0.44	0.02	0	6/6
Newton-on-Trent, Lincs	fodder	6	57.0	5.4	15/5	0.94	0.24	nil	0.02	0	14/6
Wetwang, Yorks	fodder	5	4.1	13.4	29/5	nil	0.21	0.36	0.70	14	27/6
Bilbrough, Yorks	fodder	4	20.8	10.6	30/5	nil	0.22	0.008	nil	13	28/6
Sewards End, Essex	fodder	4	14.4	36.0	1/6	nil	0.02	nil	0.01	9	19/6

TABLE III - WEED KILLING PERFORMANCE 1962 TRIALS

SITE	No. of Weeds per 2000 sq in on untreated plots	OPTIMUM DOSE	WEEDS AS per cent SURVIVORS endothal + propham						S.E. per plot as per cent of mean
			a	b	c	d	e	f	
1	1386	c		14*	4**	1**			120
2	444	d			9**	1**	1**		125
3	328	e			25**	9**	1**		23.1
4	219	f				44**	37**	26**	38.8
5	669	b		10**	5**	10**			30.7
6	148	c		34**	43**	37**			27.8
7	351	d		77	81	69			24.8
8	593	c		14**	19**	7**			38.1
9	179	d		37*	25*	22*			97.8
10	495	b	14**	8**	4**				49.2

TABLE IV - EFFECT OF ENDOTHAL + PROPHAM ON BROCCOLI

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated endothal + propham					S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated endothal + propham					S.E. per plot as per cent of mean
		b	c	d	e	f		b	c	d	e	f	
1	c	100	67*	51**			19.9	90	52*	45**			26.7
2	d		27**	15**	5**		73.1		30*	17*	10**		64.8
4	f			74*	71*	61**	19.0			77*	60**	37**	16.3
5	b	57*	55*	52*			28.3	45**	47**	32**			26.6

TABLE V - EFFECT OF ENDOTHAL + PROPHAM ON BRUSSELS SPROUTS

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated endothal + propham					S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated endothal + propham					S.E. per plot as per cent of mean
		b	c	d	e	f		b	c	d	e	f	
1	c	105	64*	58*			12.0	93	60*	45**			24.4
2	d		46	38	14		84.0		33**	20**	13**		25.7
4	f			69	68	71	22.8			77**	55**	37**	15.4
5	b	91	82	60			32.7	57**	40**	35**			17.7

TABLE VI - EFFECT OF ENDOTHAL + PROPHAM ON SAVOYS

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated, endothal + propham: b	c	d	e	f	S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated, endothal + propham: b	c	d	e	f	S.E. per plot as per cent of mean
1	c	84	88	59			34.4	90	42**	32**			12.6
2	d		71	16**	12**		40.5		33**	17**	10**		36.6
3	e		97	76	75*		15.8		97	92*	77**		4.1
4	f			90	70	74	17.0			77*	52**	37**	17.4
5	b	75	69	69			22.7	57**	55**	45**			22.9

TABLE VII - EFFECT OF ENDOTHAL + PROPHAM ON CABBAGE

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated, endothal + propham: b	c	d	e	f	S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated, endothal + propham: b	c	d	e	f	S.E. per plot as per cent of mean
1	c	106	86	60**			60.4	93	60**	37**			15.4
2	d		85	50**	42**		20.3		63*	47**	50**		12.1
3	e		91	74	59*		20.1		80**	70**	65**		7.3
4	f			74	74	74	11.0			82	62**	55*	17.2
5	b	47	50	73			26.1	70*	60*	55**			23.6

Varieties:- Trials 1 and 2 : Greyhound
Trial 3 : January King
Trials 4 and 5 : Primo

TABLE VIII - EFFECT OF ENDOTHAL + PROPHAM ON FIELD CABBAGE

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated				S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated				S.E. per plot as per cent of mean
		endothal + propham					endothal + propham				
		a	b	c	d		a	b	c	d	
6	c		101	97	91	6.4		100	100	100	-
8	c		99	113	89	17.2		100	100	80**	4.3
9	d		105	83	103	34.5		100	87	75*	11.1
10	b	95	166	93		52.5	75	57*	40**		27.2

TABLE IX - EFFECT OF ENDOTHAL + PROPHAM ON RAPE

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated				S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated				S.E. per plot as per cent of mean
		endothal + propham					endothal + propham				
		a	b	c	d		a	b	c	d	
10	b	101	106	66		26.8	80	67**	50**		16.5

TABLE X - EFFECT OF ENDOTHAL + PROPHAM ON SWEDE

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated				S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated				S.E. per plot as per cent of mean
		endothal + propham					endothal + propham				
		a	b	c	d		a	b	c	d	
6	c		98	83**	90*	4.4		100	100	100	-
8	c		93	79	75	18.3		100	100	80**	4.3
9	d		120	107	110	15.2		100	100	100	-
10	b	106	114	76**		1.6	62*	52**	45**		23.5

TABLE XI - EFFECT OF ENDOTHAL + PROPHAM ON TURNIP

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated				S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated				S.E. per plot as per cent of mean
		endothal + propham					endothal + propham				
		a	b	c	d		a	b	c	d	
6	c		108	103	97	83.4		100	100	100	-
8	c		88	90	91	17.2		100	100	100	-
9	d		89	105	95	20.8		100	92	85*	6.09
10	b	91	91	96		23.0	65*	57**	47**		22.6

TABLE XII - EFFECT OF ENDOTHAL + PROPHAM ON MARROW STEM KALE

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated				S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated				S.E. per plot as per cent of mean
		endothal + propham					endothal + propham				
		a	b	c	d		a	b	c	d	
8	c		112	112	109	9.7		100	100	100	-
9	d		106	107	114	11.0		100	100	100	-
10	b	104	97	99		8.75	77	50**	45**		23.7

TABLE XIII - EFFECT OF ENDOTHAL + PROPHAM ON THOUSAND HEAD KALE

TRIAL	OPTIMUM DOSE	EMERGENCE as per cent of Untreated				S.E. per plot as per cent of mean	VIGOUR as per cent of Untreated				S.E. per plot as per cent of mean
		endothal + propham					endothal + propham				
		a	b	c	d		a	b	c	d	
8	c		106	104	94	12.8		100	100	100	-
10	b	95	88	66**		10.5	65*	45**	37**		25.5

Research Report

EXPERIMENTS IN 1962 WITH SALTS OF ENDOTHAL IN COMPARISON WITH AN ENDOTHAL/PROPHAM* MIXTURE, FOR CONTROLLING WEEDS IN SUGAR BEET

B.H. Bagnall and D.J. Minter

The Murphy Chemical Co. Ltd., Wheathampstead, St. Albans.

Summary: Pre-emergence applications of three salts of endothal in comparison with an endothal/propham mixture for weed control in sugar beet, were compared in eight replicated field trials on a variety of soils from highly organic to light mineral types. Doses were varied according to soil type. The materials were band-sprayed, a 7 in. band being applied directly over the row after drilling by means of a suitably adapted pneumatic sprayer mounted on a trolley. For effective use on organic soils, higher doses of the endothal salts than those examined (i.e. 6 lb a e acre) would be necessary; on mineral soils results have been encouraging at 2, 3, and 6 lb a e acre. However, the general weed spectrum covered by the salts is insufficient and several of the more important sugar beet weeds are not controlled.

INTRODUCTION

previous work has shown that endothal is not sufficiently selective as a wide spectrum weedkiller on its own (Parker 1954) and that a mixture of endothal and propham will achieve the necessary effect of an increased selectivity (Murant 1958, Bagnall et al 1960).

This paper describes experiments carried out with three salts of endothal namely the diammonium, dipotassium and mono N,N dimethylcocoamine, to determine whether any of these materials were of use as herbicides. An endothal/propham mixture was used as a standard.

METHODS AND MATERIALS

The chemicals used were as follows:-

Endothal/propham mixture containing 8.6 per cent wt/vol propham and 11.4 per cent wt/vol disodium salt of endothal a e
Dipotassium salt of endothal 36 per cent wt/vol a e
Diammonium salt of endothal 36 per cent wt/vol a e
Mono N,N dimethylcocoamine salt of endothal 24 per cent wt/vol a e

It had been intended that the endothal salts should be compared with an endothal/propham mixture on a wide variety of soil types, using the appropriate dose of the mixture for each soil (Caldicott 1962) and a dose of use thought to be suitable in the case of the three salts.

* Murbetex - Murphy Chemical Co. Ltd.

Some or other of the materials were used in eight trials and were part of a larger trial in each case. The trials were of four-fold replication, the plot size being 120 sq yd, that is each treatment covered approximately one tenth of an acre.

Due, however, to the non-availability of the endothal salts early in the season, the soil types were not as representative as was hoped, half of the trials being on organic soils ranging from Lancashire moss, with an organic matter content of 50.2 per cent through Black Fen and Skirtland Fen to an organic loamy sand (17.4 per cent organic matter). Of the remainder, two trials were on clay loams, one on a loam, whilst the lightest soil type was a loamy sand. In effect, only the loam and loamy sand fall in the range of soil type on which a commercial recommendation for the application of endothal/propham can be made. Higher doses are effective on heavy mineral soils but are not economic. For the clay loams and organic soils two of these higher doses were employed. The various doses of chemicals used were as follows:-

(The endothal is expressed as lb/ac a e, the propham as lb/ac a i)

Disodium endothal + propham	$2 + 1\frac{1}{2}$
	$3 + 2\frac{1}{4}$
	$5 + 3\frac{3}{4}$
	$6 + 4\frac{1}{2}$
Dipotassium endothal Diammonium endothal Dimethylcocoamine endothal	2, 3 and 6

All the spray treatments were applied as soon as possible after the crop had been drilled, with a hand-operated sprayer. This machine was developed in conjunction with Stanhay (Ashford) Ltd., and consisted basically of a trolley constructed of mild steel, fitted with four wheels of the standard type used on the Stanhay precision seeder. Each pair of wheels was joined by a crossmember through which holes had been drilled at 1 in. intervals, enabling the wheels to be set corresponding to any desired row width. The length of the trolley was 20 in. between the two wheel centres and the machine was pushed by means of handles attached to brackets on the crossmember. Also bolted to the central part of the crossmember was a flat steel plate on which a cylindrical pneumatic sprayer was mounted and kept in a rigid position by means of a clip attached to a vertical support behind it. The three gallon sprayer was fitted with a reducing valve and from the outlet, two P.V.C. tubes passed from a T-junction to the spray lances. The latter was mounted, one behind each rear wheel, by means of brackets from the chassis, each lance containing a hollow cone nozzle giving an output of 8 fl oz/min at 12 psi over a 7 in. band, and operated at 2 mph. This gave a rate equivalent to 21 gal/ac of treated ground. The application technique consisted of pressurising the sprayer by means of an air cylinder to approximately 50 psi and reducing this to give the actual operating pressure of 12 psi.

At each site the machine was adjusted to the appropriate row width and the drilled crop was band sprayed by following the wheel marks of the farmer's drill. It was necessary to make the application by pushing the machine at 2 mph. To this end, a bicycle speedometer was so attached that the driving wheel of the speedometer impinged on one of the front wheels. By calculation, a reading on the speedometer equivalent to 2 mph forward speed was ascertained.

When spraying had been completed, the machine was pushed over the untreated plots, without the sprayer operating, in order to create a similar degree of soil compaction over the row.

To determine herbicidal efficiency, counts were made of beet emergence and weed control in one operation. Twenty counts were made on each treatment, five counts per replicate. Each weed count comprised an area of 50 in. x 2 in. i e 100 sq in. directly over the row thus giving a total area of 2,000 sq in. per treatment. For the beet emergence, each count consisted of the total number of beet per 50 in. of row i e 1,000 in. of row.

RESULTS

Tables 1, 2 and 3 give details of the trials, a comparison of herbicidal efficiency and a more detailed account of the degree of susceptibility shown by various weeds to the treatments described.

DISCUSSION

Past work has indicated that an endothal/propham mixture is absorbed and inactivated on soils containing a relatively high organic matter content. Trials 1 - 4 fall into this category. However, in three of these, total weed control was between 63 and 87 per cent using the highest of the rates ($6 + 4\frac{1}{2}$ lb/acre) whilst in the remaining trial, No.2, weed control was poor and erratic on all treatments. Weed control by endothal/propham in all the remaining trials was good.

In all trials, weed control by endothal/propham was better than that by any of the endothal salts, excepting trial 2, and with one exception in trial 1 when the ammonium endothal (6 lb/ac) proved better than endothal/propham ($5 + 3\frac{3}{4}$ lb/ac).

The margin of safety to the beet has been maintained with all treatments at all sites. In trial 3, the number of beet was greater and the vigour noticeably better than that on the control plots. This factor was no doubt due to the excellent control of pale persicaria, which was the dominant weed type.

Herbicidal performance varied very little among the endothal salts themselves although, on balance, the ammonium salt was the most effective, followed by the potassium and amine salts. The latter was used only in five trials.

In trials 3, 5, 7 and 8, weed control by the potassium and ammonium salts was excellent and the amine very good. Four of these have mineral soils whilst trial 3, on Lancashire "moss", has a soil type with an organic matter content of 50.2 per cent, which is very high by any standards, even compared to the black fen soils in Cambridgeshire and the Isle of Ely. Weed control by the ammonium salt (6 lb/ac) was in the region of 86 per cent by the potassium and amine salt at the same rate, about 72 per cent whilst endothal/propham ($6 + 4\frac{1}{2}$ lb/ac achieved a control superior to the ammonium salt. That the endothal/propham mixture, at this rate, gave good control at such a level of organic matter content is somewhat surprising. Likewise the good results obtained by the salts.

Similar results with endothal/propham were obtained during 1961 and 1962 in this area, on the same soil type using the equivalent rate, and also the lower rates of 4 + 3 and 2 + $1\frac{1}{2}$ lb/ac. It may be that a very high coarse sand content counteracts the effect of the organic material and makes the herbicidal materials available for weed control.

At the remaining trials the performance of the salts was fair to mediocre, excepting trial 2. All but one had organic soils whilst trial 6 was on a clay loam. At the latter a large proportion of the total weed population consisted of Stellaria media (Chickweed), Sinapis arvensis (charlock), Chenopodium album (fat hen) and Avena fatua (wild oat), none of which have been satisfactorily controlled at any of the sites at which they were present. It is noticeable also that after drilling, the seed bed was rolled and thus consolidated. The spray applications were made two days later when the soil surface was dry and, after the conditions of compaction, hard. Added to this, further consolidation was afforded by the spraying machine in the very region where assessments were made. Although adequate rainfall followed applications, the effect of capping produced by the above factors may possibly have influenced the herbicidal performance.

The three salts showed a lack of control of Stellaria media whilst the endothal/propham mixture, although giving unsatisfactory control at the organic soil trials, was excellent at those with mineral soils.

Control of Polygonum aviculare (Knotgrass) by all three endothal salts was generally very good. In all cases, this appeared on mineral soils.

Veronica spp (speedwell) was completely eliminated by potassium endothal at the three trials where it occurred (including one organic soil site) and the ammonium salt gave a very good control at two of them. The ammonium and potassium salts dealt favourably with seedling grasses in the two instances where the populations were high and similarly with Polygonum lapathifolium (pale persicaria) control was good even though the trials were on organic soils.

It seems apparent that, generally speaking, an endothal/propham mixture is superior in weed control to any of the aforementioned endothal salts when used on their own at the rates indicated.

For the salts to be effective on organic soils, rates in excess of 6 lb/acre would be necessary, with the exception, perhaps, of those organic soils having a very high coarse sand content, such as at trial 3 where results were quite favourable.

It is perhaps unfortunate that it was impossible to place more emphasis on the mineral soil types at which the results have been shown to be reasonably encouraging at the rates used. Of the weeds encountered in reasonable quantity those such as Veronica spp, Anagallis arvensis ssp. arvensis (scarlet pimpernal), Urtica urens (annual nettle), Trifolium spp. (clover), Polygonum aviculare and Polygonum convolvulus (black bindweed) have been well controlled. However, it would appear that the endothal salts have a limited spectrum of control in that several of the important weeds of sugar beet are unaffected namely Chenopodium album, Sinapis arvensis, Avena fatua and Stellaria media.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the co-operation given by Pennsalt Chemical Corporation, Washing D.C. for providing the endothal salts; Stanhay (Ashford) Ltd., in the production of a trolley for the band sprayer and the help given by the various farmers on whose land the trials were carried out.

REFERENCES

BAGNALL, B.H., CALDICOTT, J.J.B., and MINTER, D.J. (1960) Field trials with endothal/propham for the control of seedling weeds in sugar beet. Proc 5th Brit Weed Control Conf p. 23-30.

CALDICOTT, J.J.B. (1962) Further investigations into the field use of a mixture of endothal and propham for pre-emergence application to sugar beet. Weed Res 2 p. 110-109.

MURANT, A.F. (1958) Experiments in 1958 with propham and endothal for controlling weeds in sugar beet. Proc 4th Brit Weed Control Conf 149-154.

PARKER, C. (1954) Chemical weed control in sugar beet. A report of experimental work in 1954. Proc 2nd Brit Weed Control Conf 447-454.

TABLE I - DETAILS OF TRIALS

Trial	Site	Soil type	Seed bed at time of application	Mechanical soil analysis (per cent)				Organic matter	Rain in 21 days following application in.
				Clay	Coarse sand	Fine sand	Silt		
1	STOWBRIDGE, Norfolk	Organic fine sandy loam	Good	18.0	7.1	43.9	31.0	18.7	1.13
2	SUTTON, Beds	Organic loamy sand	Good, moist	5.3	34.8	32.6	27.3	17.4	0.78
3	SCARISBRICK, Lancs	Organic coarse sand	Good, dry	0.0	82.8	7.7	7.0	50.2	1.28
4	SOHAM FEN, Cambs	Black Fen	Good, dry	14.1	23.4	15.5	32.0	32.3	1.01
5	LINDSELL, Essex	Clay loam	Dry, cloddy	31.0	10.3	34.1	24.6	2.77	1.88
6	RADWINTER, Essex	Clay loam	Dry, firm (rolled)	29.0	15.1	31.9	24.0	5.63	1.57
7	CALDECOTE, Beds	Loamy sand	Good	10.6	43.2	39.8	16.4	3.40	0.78
8	WATTON-AT-STONE Herts	Loam	Dry, rough v. stony	24.0	18.1	33.9	24.0	5.63	1.20

Note: The mechanical soil analyses from trials 1 - 4 will be subject to slight discrepancies due to the high organic content of the soils.

TABLE II - COMPARISON OF HERBICIDES

Site	Date of drilling	Date of application	No. of weeds on untreated plots	Weedkilling performance surviving weeds as per cent of untreated: endothal + propham		potassium endothal		ammonium endothal		amine endothal	S.E. per plot (per cent of mean)	No. Beet on Unt.	Beet emergence as per cent of untreated: endothal + propham		potassium endothal		ammonium endothal		amine endothal
				5+3¼	6+4½	6		6		6			5+3¾	6+4½	6		6		6
1	9/4	10/4	145	46.2*	36.5**	64.1		35.1**		60.0	47.4	741	93.8	102.1	92.4		96.0		100.4
2	11/4	16/4	395		89.7*	87.0*		76.4**		76.9**	9.1	459		97.1	100.0		86.0		105.0
3	24/4	25-26/4	2656		12.2	27.3		14.3		28.0		679		122.0	117.7		104.2		113.8
4	24/4	30/4	556	18.8**	24.8**	39.3**		39.9**			32.2	364	121.1	115.9	113.3		112.6		
5	24/4	27/4	255		9.0**	12.9**		12.5**		18.8**	42.3	340		96.5	98.5		106.8		
6	30/4	2/5	413	21.0**	14.3**	41.6**		55.2**			52.8	401	107.5	103.5	102.0		108.5		
				2+1½	3+2¼	2	3	2	3	2			2+1½	3+2¼	2	3	2	3	2
7	10-11/4	12/4	655	1.2**		3.5**		7.3**		7.2**	74.0	1042	88.6		91.4		92.5		87.4
8	24/4	1/5	317		1.9**		11.0**		7.9**		32.0	541		93.9		92.2		97.6	

Asterisks indicate treatments showing significant differences from control at

* P = 0.05
** P = 0.01

Note Trial 3 not analysed

TABLE III - SUSCEPTIBILITY OF VARIOUS WEEDS

Site	Weed species	No. weeds on untreated /2000 sq in.	Surviving weeds as per cent of untreated											
			Endothal + propham				Potassium endothal			Ammonium endothal			Amine endothal	
			2+1½*	3+2¼*	5+3¾*	6+4½*	2*	3*	6*	2*	3*	6*	2*	6*
2	**Stellaria media**	60				58.33			166.6			105.1		90.0
3		66				62.12			88.4			89.5		100.0
4	(chickweed)	57			28.0	33.3			33.3			33.3		
6		179			8.9	3.3			29.0			53.0		
7		46	2.17				45.65					30.4		36.9
8		30		NIL				53.3			20.0			
2	**Polygonum aviculare**	32				50.0			50 .0			78.1		31.2
5		103				0.9			0.9			0.9		10.7
6		28			NIL	7.1			46.4			25.0		
7	(Knotgrass)	18	NIL				5.5			NIL			NIL	
8		100		NIL				10.0			8.00			
2	**Polygonum convolvulus**	57				128.0			119.3			96.5		
4		182			13.2	26.4			39.0			41.8		
6		10			50.0	20.0			30.0			40.0		
8	(Black bindweed)	85		3.5				2.3			5.9			
1	**Chenopodium album**	56			96.4	73.2			110.7			50.0		92.8
2		127				162.2			86.6			80.3		115.7
5	(Fat Hen)	14				121.4			135.7			142.8		107.1
6		44			56.8	47.7			93.1			122.7		
1	**Veronica spp.**	30			NIL	NIL			NIL			6.7		10.0
6		19			NIL	NIL			NIL			36.8		
8	(Speedwell)	68		1.46				NIL			4.4			
2	Seedling grasses	45				24.4			60.0			88.9		84.4
3		198				20.7			23.2			18.3		28.3
7		100	NIL				1.0			1.0				3.0

540

TABLE III - SUSCEPTIBILITY OF VARIOUS WEEDS (cont'd.)

Site	Weed species	No. weeds on untreated /2000 sq. in.	Surviving weeds as per cent of untreated											
			Endothal + propham				Potassium endothal			Ammonium endothal			Amine endothal	
			$2+1\frac{1}{2}$*	$3+2\frac{1}{4}$*	$5+3\frac{3}{4}$*	$6+4\frac{1}{2}$*	2*	3*	6*	2*	3*	6*	2*	6*
3	Polygonum lapathifolium	981				NIL			21.0			9.2		22.2
4	(Pale persicaria)	43			13.9	41.9			16.3			18.6		
4	Urtica urens	266			17.3	13.9			44.4			39.8		
7	(Annual nettle)	476	NIL				NIL			0.2			1.9	
1	Lamium amplexicaule	23				4.3			NIL			26.0		13.0
2	(Henbit	29				27.5			27.5			17.2		27.5
1	Sinapis arvensis	11			63.6	9.0			127.2			27.2		27.2
6	(Charlock)	38			39.5	34.2			44.7			36.8		
5	Avena fatua	12				8.33			8.3			25.1		50.8
6	(Wild oat)	45			13.3	15.5			71.1			73.3		
6	Anagallis arvensis	24			16.6	12.5			29.1			29.1		
8	(Scarlet pimpernel)	25		4.0				NIL			8.0			
5	Trifolium spp. (Clover)	89				NIL			NIL			2.2		2.2
3	Spergula arvensis (Spurrey)	157				6.36			84.7			59.4		64.9
3	Viola arvensis (Field pansy)	86				36.0			19.7			21.4		18.6
2	Capsella bursapastoris (Shepherds purse)	36				2.77			30.5			13.9		8.3

* lb/ac

Research Report

CONTROL OF ANNUAL WEEDS IN SPRING FIELD BEANS

R.G. Hughes

National Agricultural Advisory Service,
South East Region.

Summary: The application of simazine for weed control in spring field beans is quickly becoming standard practice in this country. General recommendations are for immediate post-sowing applications of this herbicide after final harrowing of the seedbed. An experiment laid down during 1961, in Oxfordshire, investigated the effect of delaying the application of simazine, in a spring field bean crop, until early crop emergence stage should soil conditions restrict field spraying for some time post sowing. Results indicated that two major weed species - *Stellaria media* (chickweed) and *Alopecurus myosuroides* (blackgrass) - would be equally as well controlled, resulting in similar crop yield increase, following both application stages of simazine. *Chenopodium album* (fat-hen) was better controlled by the immediate post-sowing application whilst late-germinating weeds such as *Polygonum convolvulus* (black bindweed) succumbed more readily to delayed applications of simazine.

Atrazine at 0.5 lb a i per acre gave equal weed control and similar crop yield increase to 0.75 lb a i simazine per acre when both were applied at crop emergence stage. Prometryne 0.5 lb a i applied at crop emergence stage gave inferior weed control to atrazine or simazine at similar rate.

INTRODUCTION

At the last B.W.C.C. Conference the results of ten trials, carried out by members of the National Agricultural Advisory Service, to evaluate simazine for weed control in field beans (*Vicia faba*) were reported (Bullen and Hughes 1960). During 1961 a further trial laid down in the South East Region compared other triazine herbicides with simazine for use in spring sown field beans. Immediate post-sowing applications of simazine were also compared with applications at the time of crop and weed emergence.

METHOD AND MATERIALS

The trial was sited on a well drained Great Oolite clay loam having the following mechanical analysis:-

Coarse sand 25 per cent; fine sand 18 per cent; clay 23 per cent; silt 14 per cent; organic matter 8.5 per cent; free calcium carbonate 10 per cent with some stones.

The bean crop (var. Minor) followed two cereal crops in a ley-arable rotation. Sowing was carried out in a moist firm seed bed - with soil aggregates in the range $\frac{1}{8}$ in. - 2 in.) - on 12 March, 1961. Seeding was at the rate of 250 lb per acre in 7 in. width rows with sowing depths 1-2 in. The seed bed was harrowed immediately post-sowing but prior to herbicide application. All spray treatments were applied in a volume of 20 gal/ac. The post-sowing treatments of simazine applied on 13 March - one day post-sowing - were - 0.5 lb, 0.75 lb and 1 lb active simazine a i /ac. Rolling of the seed bed followed two days later. Sunny dry conditions prevailed at the time of spraying with dry air temperature 13°C and relative humidity 76 per cent. Emergence stage treatments were applied when 5-10 per cent of the crop had emerged on 16 April - 35 days post-sowing. These were:-

Simazine 0.5 lb and 0.75 lb/ac)	using 50 per cent
Atrazine and prometryne each 0.5 lb/ac)	wettable powders.

At this time the emerged beans were either in folded leaf or open bifoliate leaf stage. The majority of grains had germinated with growing points at or near soil surface. Alopecurus myosuroides (blackgrass) was in early braird stage. Stellaria media (chickweed) was mainly in cotyledon stage. Polygonum species were emerging and shed barley (Hordeum sativum)was in single leaf braird stage. Soil conditions, although wet, did not hinder spraying and wheel depressions, on rolled surface, did not exceed 0.75 in. An additional treatment involving wheelmarking with the sprayer - but no spray application - was included at this stage. At the time of spraying dry air temperature was 15°C - humidity 83 per cent.

The treatments, including a control, were arranged in randomised blocks with 4 replications giving a total of 36 plots. Spraying was carried out using a Land Rover mounted sprayer - each plot, as sprayed, being 5 yd wide by 64 yd length = 1/15 acre.

Weather conditions during the trial period are summarised below:-

	Period	Rainfall (in.)	General Conditions
(i)	Sowing to first stage spray (24 hours)	nil	Dry and cool
(ii)	Interval from first to second spray stage. 13 March - 6 April	0.9	Dry warm for 14 days then cool. Most rain in last four days.
(iii)	From second stage spray to date of bean and weed plant assessment. 6 April - 3 May	2.9	Generally cool with showers - these heavy at end of April.
(iv)	Hence to crop harvest - May to September	5.4	Alternating dry, warm with showery periods.

Weed control was assessed by a visual score method and a plant population could of weeds on 3 May. Bean plant populations were also determined for each treatment on the same day, followed by yield data at harvest.

TABLE I - WEED CONTROL - TREATMENT EFFECT ON PLANT POPULATION AND SCORES FOR GENERAL CLEANLINESS

Treatment	Doses lb/ac	Weed Plant Population - 3 May, 1961: Alopecurus myosuroides – Square Root transformation	Plants per square foot	Stellaria media – Square Root transformation	Plants per square foot	Chenopodium album – Square Root transformation	Plants per square foot	Polygonum convolvulus – Square Root transformation	Plants per square foot	Mean Visual Scores for general cleanliness (10 = max. weed density 0 = no weeds): 3 May - at time of weed plant count – Transformed data	Visual score on scale 0-10	11 September - at harvest – Transformed data	Visual score on scale 0-10
Control - no spray		2.5	6.2	4.4	19.4	1.7	2.9	0.6	0.4	71.0	9	77.0	9
Post planting applications: simazine	0.5	1.1	1.2	0.8	0.6	1.2	1.4	1.0	1.0	26.4	2	45.2	5
Post planting applications: simazine	0.75	1.2	1.4	0.7	0.5	1.2	1.4	0.7	0.5	22.1	1	35.9	3
Post planting applications: simazine	1.0	0.9	0.8	0.5	0.2	0.9	0.8	0.9	0.8	17.8	1	32.7	3
Applications at crop and weed emergence: prometryne	0.5	2.1	4.4	2.0	4.0	1.1	1.2	0.8	0.6	35.5	3	61.9	8
Applications at crop and weed emergence: atrazine	0.5	0.7	0.5	0.4	0.2	1.0	1.0	0.9	0.8	22.7	1	31.6	3
Applications at crop and weed emergence: simazine	0.5	1.7	2.9	1.1	1.2	1.4	2.0	1.0	1.0	31.5	3	40.0	4
simazine	0.75	0.9	0.8	0.6	0.4	1.2	1.4	0.6	0.4	19.8	1	32.3	3
S.E. Treatment means		±0.20		±0.34		±0.15		±0.15		± 3.81		± 2.90	

TABLE II - EFFECT OF TREATMENTS ON BEAN PLANT POPULATION AND YIELD

Treatment Dose lb per acre of active chemical		Bean Plant Populations - 3 May, 1961			Yield of clean grain @ 15.5 per cent moisture		Harvest 11 September
		Plants/ sq ft	Plants in thous/ac	Plant population - percent of control	Cwt/ac	Yield as percent of control yield	Moisture content of produce ex-combine harvester
Control - no spray		) 3.2	) 139	) 100	14.9	100	) 18.9 per cent
Control - wheelmarked at crop emergence stage		)	)	)	14.0	94	)
Post planting applications	0.5 simazine	3.4	148	107	20.8	140	17.7
	0.75 simazine	3.7	161	116	21.3	143	17.2
	1.0 simazine	3.8	166	119	20.2	136	17.1
Applications at crop and weed emergence	0.5 prometryne	3.0	131	94	19.2	129	17.5
	0.5 atrazine	4.0	174	125	21.8	147	17.3
	0.5 simazine	3.3	150	108	22.1	149	17.5
	0.75 simazine	4.0	174	125	20.4	137	17.5
S.E. of treatment means		0.28			± 0.98 cwt.		

RESULTS AND DISCUSSION

I. Weed Control

Table I summarises the effect of treatments on four dominant weed species encountered at this site. A comparative score for general weed control, recorded in May and again at harvest, is also shown. All doses are in terms of active ingredient per acre.

Alopercurus myosuroides. The best control (91 per cent plant reduction) was achieved by 0.5 lb atrazine applied at bean emergence stage. This was closely followed (87 per cent control) by 0.75 lb simazine applied at the same time or 1 lb simazine applied immediately post-sowing. A 0.5 lb rate of simazine gave inferior results to 0.5 lb atrazine where spraying was delayed until crop emergence stage. Rates of 0.5 lb and 0.75 lb simazine, applied immediate post-sowing, resulted in similar control of A. myosuroides (80 per cent plant reduction). Prometryne 0.5 lb applied at crop and weed emergence stage gave rather poor control (30 per cent) of this weed.

Stellaria media. All treatment rates of atrazine and simazine gave excellent kill (95 per cent plant reduction) of chickweed, there being little difference between application stages for 0.5 or 0.75 lb simazine. Prometryne 0.5 lb applied at bean emergence stage gave 79 per cent plant reduction.

Chenopodium album. Generally the best control followed post-sowing applications of simazine rather than later applications. The highest dose of simazine, 1 lb gave 70 per cent plant reduction with the lowest rate, 0.5 lb giving 50 per cent control, when applied immediate post-sowing. Both atrazine and prometryne, at 0.5 lb were superior to simazine in controlling C. album when spraying was delayed until the crop emergence stage.

Polygonum convolvulus. Plant populations of this weed increased in all treatment plots following the application of triazine herbicides but least in plots treated with 0.75 lb simazine at bean emergence stage. P. convolvulus tends to germinate late in early sown spring beans and in common with other members of the Polygonum genus shows a distinct resistance to the herbicidal properties of the triazine derivatives used in this trial. This resistance is, no doubt, strengthened by the removal of competition from other more susceptible weed species when these herbicides are used for the control of a mixed stand of annual weeds in beans.

Other weeds. Whilst plant counts for ten other weed species were recorded many of these were too sparse to give any reliable indication of susceptibility to the spray treatments. There were however indications that (i) Polygonum aviculare (knotgrass) showed equal resistance to that exhibited by P.convolvulus; (ii) Veronica spp. (speedwell) succumbed readily to all treatments with the exception of prometryne; (iii) shed barley was resistant to doses of simazine below 1 lb and was hardly affected by 0.5 lb doses of prometryne or atrazine.

Visual scores recorded for general cleanliness in early May indicated that an early post-sowing application of 0.5 lb simazine gave a slightly better control of weeds in general than the same rate of simazine delayed until crop emergence stage. There was no advantage, at this site, in increasing the dose of simazine above 0.75 lb/ac at immediate post-planting stage. Where herbicide application was delayed until the crop emergence stage a 0.5 lb dose of atrazine resulted in as good a general weed control as a higher dose (0.75 lb) of simazine applied at the same stage. Prometryne was generally disappointing. At harvest there was a full bottom cover of weeds in the bean stubble where this herbicide was applied.

II. Treatment effect on the bean crop

Bean plant counts in 40 quadrats, each one square foot, per treatment recorded during early May indicated a significant increase in plant population, compared to that found in control unsprayed areas, where 0.5 lb atrazine or 0.75 lb simazine was applied at crop emergence stage. Details of bean populations together with crop yield data, obtained by harvesting areas of 1/24 acre from the centre of each plot, are given in Table II. There was a noticeable increase in the moisture content of the produce taken from control unsprayed areas compared to that of the produce combine-harvested from spray treated areas. Yields of clean grain from all sprayed plots significantly outyielded the control yield with the highest yields being obtained from areas sprayed with 0.5 lb simazine or 0.5 lb atrazine at crop emergence stage. Prometryne at 0.5 lb/ac applied at crop emergence stage, gave a lower yield of beans than any other spray treatment.

All spray treatments gave satisfactory control of A. myosuroides and S. media - the dominant weeds at this site - resulting in a significant increase in crop yield. Thus where these two rather susceptible species constitute the major weed problem on land sown to spring field beans it would appear that to delay applications of simazine or atrazine until near crop emergence stage, due to adverse weather conditions, is not likely to reduce weed control efficiency or result in reduced crop yields. Where however C. album is likely to dominate in a March sown bean crop, then early post-planting application of simazine would be preferable. The reverse would appear to hold where late germinating weeds, such as P. convolvulus, are likely to be a serious problem since applications of simazine or atrazine are best delayed until near crop emergence stage to give optimum control.

At this site in 1961 there was little advantage in increasing the application rate of simazine, at crop sowing period, above 0.75 lb/ac (1.5 lb of commercial 50 per cent wt/wt wettable powder). This confirms the results from earlier N.A.A.S. trials. When treatment application was delayed until crop emergence stage then 0.5 lb atrazine gave equal results, particularly in controlling S. media and A. myosuroides as 0.75 lb/ac simazine. Since the cost of commercial preparations giving equal active chemical ingredient are similar for atrazine and simazine (current price list) it would appear therefore to be an advantage to substitute atrazine for simazine where field conditions immediately post sowing necessitate a delay in herbicide application in a spring bean crop. Prometryne 0.5 lb applied at crop emergence stage, was inferior to both atrazine and simazine, at equal rates, at this centre.

REFERENCE

BULLEN, E.R. and HUGHES, R.G. (1960) NAAS/ARC trials on simazine in field beans Proc 5th British Weed Control Conf 79-89.

Research Report

FURTHER STUDIES ON THE USE OF PRE-EMERGENCE HERBICIDES IN FODDER MAIZE CROPS

R.G. Hughes

National Agricultural Advisory Service, South East Region

Summary: Following earlier studies on the efficiency of simazine in controlling weeds in fodder maize crops, trials were laid down during 1961 to evaluate other soil acting herbicides, as alternatives, under equal field conditions. Atrazine proved much more effective as a pre-emergence treatment in 1961. Prometryne gave rather disappointing results whilst a CDAA/trichlorobenzylchloride mixture, although giving a useful control of grass weeds, was relatively ineffective in controlling many of the common annual weeds found in maize grown for ensiling in the south east region.

INTRODUCTION

Early control of weeds in maize is important. Simazine, applied pre-emergence cannot always be relied upon to provide a good control of weeds in the early crop growth stage in a dry season due mainly to its rather low solubility. This report covers studies laid down, during 1961, in an attempt to find more reliable soil-acting herbicides for use in the maize crop. Sowing of the crop generally takes place during early May - a period of the year that is often dominated by dry warm weather resulting in parched seedbeds. A technique involving logarithmic applications of the herbicides undergoing test was adopted as in previous studies relating to weed control in maize reported at the last conference (Hughes 1960).

METHOD AND MATERIALS

The main centre was on Oolite Sands (coarse sand 54 per cent; fine sand 28 per cent; silt 5 per cent; clay 5 per cent with low organic matter 4 per cent). Here the dominant weeds were Chenopodium album and Chrysanthemum segetum. At other centres, mainly clay with flints over chalk, Polygonum convolvulus, Raphanus raphanistrum, Stellaria media and Agropyron repens were the most troublesome weeds.

The treatments at all centres including logarithmic applications of simazine, atrazine and prometryne - starting at 3 lb a i/ac. and reducing to 0.4 lb a i/ac - and also a mixture of CDAA + trichlorobenzylchloride - ratio 1 : $2\frac{1}{2}$* starting at 13.5 lb total chemical per acre and reducing to 1.8 lb total chemical per acre. The application rate for all treatments was kept constant at 28 gal/ac. All treatments were applied immediately post-planting, but prior to a final ring-rolling of seedbeds. The variety Orla 266 was sown at all centres. The crops involved were grown in 28 in. rows with sowing depths in the range $1\frac{1}{2}$-$2\frac{1}{2}$ in. Seedbeds at the time of sowing were generally moist at 2 in. depth but with the surface drying out rapidly.

* as "Randox T"

The layout was based on randomised logarithmic blocks each straddling six rows of maize with three-fold replication. Each block consisted of a 5 yd run-in followed by 64 ft logarithmic reducing application and ending with a 2 yd control unsprayed area. The half dose distance was 20 ft.

Weed control was assessed by noting the frequency of each individual weed species in each yard length of a logarithmic block on two occasions - mid June and again in early July. During the last week in September 'harvest areas' representing two dosage ranges in each logarithmic block were harvested for crop yield data and, in addition, the crop in each control unsprayed section was weighed to provide yield of stover and cobs separately.

RESULTS AND DISCUSSION

Dry weather prevailed in the localities involved for a minimum of three weeks post spraying and seedbeds were generally subjected to drought conditions. Heavy thundery showers occurred during June 1961 - six weeks post sowing - and thereafter alternating periods of showery and warm dry weather were recorded until harvest.

Under these conditions atrazine showed overall weed control superiority at any specific dosage level. In general rates above 1.5 lb atrazine per acre gave a clean bed around the maize plants whilst in the simazine and prometryne blocks only where the dosage rate exceeded 2 lb/ac. could the seedbed be described as clean.

Chrysanthemum segetum succumbed much more readily to atrazine than other treatments. The CDAA/trichlorobenzylchloride mixture had almost negligible effect on this weed.

Polygonum convolvulus showed considerable resistance to all treatments but atrazine reduced the vigour of this weed at doses above 1.5 lb/ac.

Chenopodium album was satisfactorily controlled by atrazine (above 1 lb); simazine (above 1.5 lb); prometryne (above 1.75 lb) and CDAA/trichlorobenzylchloride (above 9 lb total ingredient/ac).

Agropyron repens showed very much reduced vigour, even at lower dosage levels applied, following application of the CDAA/trichlorobenzylchloride mixture but other treatments had little effect below 2.5 lb/ac.

Stellaria media succumbed to all treatments with the exception of the lower doses of prometryne.

At the main centre (Oxon), areas corresponding to known dosage ranges for each chemical were harvested from each replicate logarithmic block to provide yield data. The dry matter content of the green crop, as harvested, was in the range 18.5 - 19.8 per cent. Mean yields, in tons dry matter per acre, for each treatment were as shown in Table I.

The farmer's crop, adjoining the trial area, was sprayed with $\frac{3}{4}$ lb simazine per acre immediate post-sowing. Poor initial weed control led the grower to carry out inter-row cultivation in late June when maize plants had 6-7 leaves. Yields from a number of plots selected at random in the crop indicated that inter-row cultivations, at this stage, were justified to supplement the effect of the herbicide.

TABLE I - DRY MATTER MAIZE AS ENSILED - TONS PER ACRE MEAN YIELD

Herbicide	Dosage Range 1-1.5 lb a i per acre			Dosage Range 2-3 lb a i per acre		
	Stover	Cobs	Total	Stover	Cobs	Total
simazine	1.80	1.23	3.03	1.80	2.13	3.93
atrazine	2.36	1.52	3.88	3.13	2.21	5.34
prometryne	0.82	0.54	1.36	1.12	0.85	1.95
CDAA/tri-chlorobenzylchloride	0.98	0.85	1.83	1.80	1.58	3.38
	Dosage range 5.5 to 7.0 lb total a i/acre			Dosage range 9.0 to 13.5 lb total a i/acre		
Control no spray no cultivation	Stover 1.15	Cobs 0.74		Total dry matter 1.89		
Farmer's crop $\frac{3}{4}$ lb/acre Simazine + cultivation	Stover 1.85	Cobs 2.21		Total dry matter 4.06		

The yields of total dry matter (Table I) in the treatment areas confirmed the superiority of atrazine, as a pre-emergence herbicide in this crop, under conditions prevailing in late spring 1961. Rates of simazine normally recommended for use in maize (1-1.5 lb/ac) proved fairly satisfactory under such conditions but lower rates would have necessitated a resort to cultivations, at a later stage, in order to obtain a reasonable control of weeds at most sites. Prometryne gave disappointing results and the CDAA/trichlorobenzylchloride mixture, apart from its effect on Agropyron repens, would not have met the requirements of maize growers in terms of a satisfactory weed control - a result that has been confirmed elsewhere (Williams and Lee 1960). Under the variable climatic and soil conditions that prevail in the east and south east of England in late spring it may well be that mixtures of simazine and atrazine would prove more reliable as a pre-emergence herbicide treatment in maize crops - a conclusion that appears to be shared by some investigators for conditions in other countries (Chesneau and Laborde 1961).