THE EFFECT OF MCPB ON THE ESTABLISHMENT OF CLOVER LEYS

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Summary

The results of two types of field experiments are described:-

1. Experiments showing the immediate relative effect of MCPB and MCPA on seedling red and white clovers.

2. Experiments showing the relation between effect on seedlings and subsequent yields.

These experiments show that MCPB has a much greater selective advantage (8-10:1) over MCPA in white clovers as compared with red (4-5:1) and that the lower seedling toxicity of MCPB may appear in the form of higher crop yields up to two seasons later. Some evidence is also given for highly persistent effect on Cirsium arvense.

Introduction

Over the past three years we have carried out a considerable number of experiments both in the greenhouse and in the field to assess the toxicity to seedling clovers of MCPB and other phenoxybutyric acids in various formulations. As it is not feasible to describe all the work here, only the data falling into two limited categories, is included. These categories are:-

(a) Field experiments on seedling clovers carried out in 1955-56, in which MCPB and MCPA are directly compared over a wide dose range (i.e. not less than five dose levels). All earlier experiments are omitted as they contain either no MCPA or a very limited dose range.

Data coming under this category are given in Tables 1, 2 and 3. All of the experiments in Table 1 were concerned also with weed control and all were heavily infested.

(b) Field experiments on the long term effect of seedling treatment on clover sward development, in which there was adequate comparison between MCPB and MCPA. (Tables 4 and 5, Fig. 2).

Experimental methods and results

1. Materials

MCPB was used throughout in the form of a commercial preparation of the sodium salt. MCPA was used chiefly as the commercial preparation of the potassium salt, although the sodium salt was used in a few cases.

2. Application methods

All materials were applied through our motorised plot sprayer in 15 gal/ac of water. Plots were all 4 ft 6 in. wide, but the length varied according to the nature of the experiment. In the undersown cereals experiments (Table 1), they were 25 ft long. In the direct sown clovers the treatments were applied

across strips of varieties, 3 ft wide. All were arranged in randomised blocks with four replicates for the undersown and three replicates for the direct sown experiments.

3. Method of assessment

One of the most difficult features of clover assessment is the high variation in plant stand, even in apparently well drilled crops. Although plant counts have been made in some of the experiments, most of the results are expressed in the form of leaf counts. We have found that these are rather less variable and moreover, give a direct measure of rate of establishment if taken at intervals. Estimation was by quadrat counts which varied in size and number according to the size of plot and density and eveness of clover cover.

Yields of herbage (Table 4) were measured by cutting the whole plot area, less discards, and weighing immediately. In experiment 31/7 the herbage was mainly clover but in 31/6 the proportion of grasses was higher and sub-samples were taken for clover content measurement.

Table 1

Effect of MCPB and MCPA on undersown clover eight weeks after spraying

Expt. No.	Type of Clover	Growth Stage at Spraying	Compound	Clover leaves/sq.yd as percentage of control. Dose rates in lb/ac.						
				0.75	1	1.5	2	3	4	6
71/3	Early Red and Alsike	Cotyledon	MCPB	-	130	83	75	92	-	-
			MCPA	-	72	41	32	18	-	-
71/10	Early Red and Alsike	Cotyledon to first leaf	MCPB	-	71	109	79	68	-	-
			MCPA	65	56	38	19	-	-	-
71/11	Early Red and Alsike	First trifoliate leaf	MCPB	-	108	82	78	80	-	-
			MCPA	36	56	46	30	-	-	-
71/12	S.184	First trifoliate leaf	MCPB	-	111	105	80	57	-	-
			MCPA	22	6	4	10	-	-	-
71/13	Yellow Trefoil	Cotyledon	MCPB	-	111	83	74	40	-	-
			MCPA	29	14	24	18	-	-	-
71/14	Yellow Trefoil	Cotyledon	MCPB	-	63	69	77	39	-	-
			MCPA	65	77	36	20	-	-	-
71/25	Early Red	Two trifoliate leaves	MCPB	-	77	75	81	49	-	-
			MCPA	81	68	59	39	-	-	-
88/1	Early Red	First trifoliate leaf	MCPB	-	103	-	106	91	101	82
			MCPA	-	127	112	104	89	-	-
88/3	Early Red	First trifoliate leaf	MCPB	-	76	-	60	73	57	44
			MCPA	-	62	83	50	70	-	-
88/11	Early Red	Varying from 1-3 trifoliate leaves	MCPB	-	82	79	61	56	40	-
			MCPA	-	57	61	42	29	-	-

Table 2

Effect of MCPB and MCPA on undersown clover seven months after spraying
(Measured on two of the experiments in Table 1)

Expt. No.	Type of Clover	Compound	Dose rates in lb/ac Clover plants/sq.yd. as % control				
			0.75	1	1.5	2	3
71/10	Early Red	MCPB	-	126	121	89	118
		MCPA	111	87	66	71	-
	Alsike	MCPB	-	113	86	108	95
		MCPA	43	22	14	6	-
71/11	Early Red	MCPB	-	114	82	115	85
		MCPA	55	76	62	86	-
	Alsike	MCPB	-	155	75	47	45
		MCPA	13	35	20	15	-

Table 3

Effect of MCPB and MCPA on early growth stages of direct sown white clover, six weeks after spraying

Expt. 92/2

Variety	Growth Stage	Compound	Clover leaves/sq.ft as % of control Dose rates in lb/ac						
			0.5	0.75	1	1.5	2	3	4
S.100	Cotyledon	MCPB	-	-	127	46	43	22	80
		MCPA	47	4	9	8	2	-	-
	First leaf	MCPB	-	-	133	97	102	42	29
		MCPA	77	15	12	6	2	-	-
	First trifoliate leaf	MCPB	-	-	85	116	102	167	52
		MCPA	47	60	43	39	30	-	-
Kent Wild White	Cotyledon	MCPB	-	-	79	119	105	81	172
		MCPA	60	32	17	2	3	-	-
	First leaf	MCPB	-	-	168	129	240	89	102
		MCPA	88	37	14	18	1	-	-
	First trifoliate leaf	MCPB	-	-	197	216	169	157	131
		MCPA	123	125	29	58	98	-	-
Kersey White	Cotyledon	MCPB	-	-	65	183	68	35	77
		MCPA	41	13	24	5	6	-	-
	First leaf	MCPB	-	-	49	63	33	92	74
		MCPA	27	7	0	4	1	-	-
	First trifoliate leaf	MCPB	-	-	104	103	60	86	61
		MCPA	58	77	27	22	30	-	-
Ladino	Cotyledon	MCPB	-	-	102	30	67	33	35
		MCPA	26	9	14	0	4	-	-
	First leaf	MCPB	-	-	84	55	42	35	56
		MCPA	67	25	3	0	0	-	-
	First trifoliate leaf	MCPB	-	-	59	93	111	76	71
		MCPA	72	37	45	17	21	-	-

Reduction of weed density of Veronica persica of 1450 leaves/sq.yd. MCPB, LD_{50}, 1.9lb/ac, LD_{95}, 3.3lb/ac. MCPA, LD_{50}, 0.8lb/ac, LD_{95}, 3.0lb/ac.

Table 4

Relation between effect on seedlings and subsequent yield of clover

Expt. No.	Date of Spray	Type of Clover	Interval between treatment & Assessment	Quantity Measured	Treatment (dose in lb/ac)									
					MCPB					MCPA				
					0.5	1	1.5	2	3	0.5	1	1.5	2	3
31/6	16.8.54 3-4 leaf	Kent Wild White	Three months	Leaves/sq.ft as % control	140	190	187	194	141	77	79	90	73	30
			Two years		91	112	90	93	112	90	98	80	65	52
			Two years	Weight of herbage as % control	83	101	108	96	98	110	95	93	79	72
			Two years	Weight of clover as % control	105	83	99	79	94	109	85	37	37	33
			Two years	% of clover in herbage	77	47	47	48	47	53	47	26	23	25
		S.100	Two years	Weight of herbage as % control	92	92	106	98	91	76	90	93	75	82
			Two years	Weight of clover as % control	97	92	97	82	85	80	81	36	33	28
			Two years	% of clover in herbage	63	58	57	45	52	57	47	23	27	18
31/6	16.8.54 3-4 leaf	Early Red (Essex cert.)	Three months	Leaves/sq.ft as % control	73	98	91	105	68	48	44	72	71	99
			One year		94	110	111	103	122	122	116	75	90	98

Cont.

Table 4 Cont.

Expt. No.	Date of Spray	Type of Clover	Interval between Treatment & Assessment	Quantity Measured	Treatment (dose in lb/ac)											
					MCPB						MCPA					
					0.5	1	1.25	1.5	1.75	2	0.5	1	1.25	1.5	1.75	2
31/7	23.9.54 2-3 leaf	Kent Wild White	Two months	Leaves/sq.ft as % control	71	70	68	67	69	59	79	57	36	39	14	20
			Two years		102	107	100	110	106	85	94	95	78	115	73	90
			Two years	Weight of herbage as % control	93	93	96	91	96	96	93	94	87	104	94	82
		S.100	Two months	Leaves/sq.ft as % control	104	113	114	52	56	94	104	45	34	36	14	47
			Two years		109	121	109	118	108	106	100	106	105	95	82	93
			Two years	Weight of herbage as % control	105	93	97	110	101	105	104	109	110	109	90	103
		Late Red	Two months	Leaves/sq.ft as % control	85	118	116	102	97	90	100	98	100	73	49	65
			One year		158	140	129	129	123	167	159	107	123	112	136	101
			Two years	Weight of clover as % control	101	102	109	110	114	121	110	115	105	102	102	103

Table 5

Long term control of creeping thistle in the white clover ley plots in Table 4

Expt. No.	Spray Date	Counted after:-	Compound	% reduction in thistle population							
				Application rate in lb/ac							
				0.5	0.75	1	1.25	1.5	1.75	2	3
31/6	20.8.54	Ten months	MCPB	50	88	-	-	95	-	95	91
			MCPA	51	72	-	-	90	-	88	90
		Two years	MCPB	45	85	-	-	92	-	79	82
			MCPA	44	46	-	-	59	-	69	57
31/7	23.9.54	One year	MCPB	51	-	67	93	41	60	95	-
			MCPA	66	-	58	88	73	88	78	-
		Two years	MCPB	16	-	48	62	72	82	96	-
			MCPA	58	-	70	52	54	74	98	-

Discussion

Immediate Effect on Seedling Clover

1. Red Clover

All the experiments in Table 1 were also concerned with weed control and therefore show the relative reaction to MCPA and MCPB under different conditions of weed competition. In two of the experiments, both infested with Raphanus raphanistrum, the red clover density was similar for both MCPB and MCPA at all levels. If the results for the other five are grouped, however, the MCPB and MCPA values fall into two distinct dosage-response bands, except for some intermingling at the lower doses. Thus at 1 lb/ac some of the MCPB values fall into the MCPA band, but the remainder are considerably higher and in line with those for higher doses of MCPB. This initial variation is almost certainly due to inadequate control of some weeds at what is known to be a sub-effective dose. After allowing for this effect, these results show an equitoxic dose ratio for MCPB/MCPA of approximately 3:1. This figure is in general agreement with pot experiments, where the ratio has generally been about three for the two-leaf stage and above, rising to five or six for earlier stages. MCPB offers an advantage over MCPA in red clover seedlings for treatment of weeds with lower ratios. These include Cirsium arvense, Ranunculus arvensis and Polygonum aviculare at all stages of the clover, and Atriplex patula, Chenopodium album and Papaver rhoeas at clover stages prior to one-trifoliate leaf.

2. White Clover

The bulk of evidence for white clover comes from direct sown crops and comparative results are summarised in Tables 3 and 4. The experiment in Table 3 was intended to be weed free but in fact became quite badly infested with Veronica persica, which, owing to the great sensitivity of the small

leaved white clovers to competition by this weed, somewhat complicates the picture. However the MCPB/MCPA toxicity ratio as measured by leaf density is clearly very much higher than for red clover. Over this series of experiments it varies between eight and ten. With all varieties, both compounds are more toxic at the younger growth stages, but there is no significant indication of a difference in ratio. The plant counts taken in this experiment are more variable, but show a ratio of about six to seven. These values are closely paralleled in pot experiments. The differences in varietal response are probably an indication of relative sensitivity to competition by V. persica, rather than relative varietal susceptibility to the treatments. The relative check of V. persica given in this experiment represents considerable selective advantage for MCPB at the time of estimation. There is no doubt that the check is not permanent but it has been sufficient to show pronounced benefit in clover density density. The extent to which this initial benefit may be maintained is shown by the results for experiment 31/6 (Table 4, and discussion below) in which the initial weed infestation was almost identical.

The effect of seedling treatments on establishment

1. White clover

The most significant feature of the two long term experiments in Table 4 is that differences between the effect of MCPB and MCPA on the seedlings may persist for up to two years afterwards. This is probably due to an upset of the grass-clover ratio which can only very slowly be restored. Both these experiments received normal fertiliser treatment in the seasons after spraying and were mown at intervals.

The differences in reduction as a percentage of control values in the last year, do not appear to be significant, as they are somewhat masked by the general increase in growth in all plots over the period. The persistence of the effect is more clearly shown by an examination of the actual leaf density changes through the three seasons of the experiments (Fig. 1, 2 & 3). These densities were measured in October-November when the clover density might be expected to be stable.

They show that a gap is maintained between the MCPA and MCPB dosage-yield curves which bears a constant relationship to the immediate effect on the seedling clovers within each experiment. As both experiments were sprayed at a fairly late stage (about three trifoliate leaves) the initial check was not as high, particularly with MCPA, as in the experiment shown in Table 3.

In both varieties in experiment 31/7 (Fig. 2 & 3), the relative growth rate can be shown to be the same for all treatments for both years. The gap between MCPB and MCPA at successive counts is therefore directly proportional to the immediate reduction in leaf density and is possibly a function of the difference in seedling mortality alone. In experiment 31/6 an optimum level of leaf density was obviously reached in the first year in both control and MCPB plots, (Fig. 1). Rates of MCPA application above 1 lb/ac caused a severe reduction in relative growth rate during the first season, but in the second season this has returned almost to the normal rate shown in the control and MCPB treatments in both experiments. This effect could be due to a severe disturbance of the clover-grass balance on spraying and the yield data (Table 4) show that it is certainly so two seasons later. Both these experiments were rather late sown, giving little time for either grass or clover to respond fully. Clearly the contribution of changes in this balance to the type of sward eventually produced, needs further investigation.

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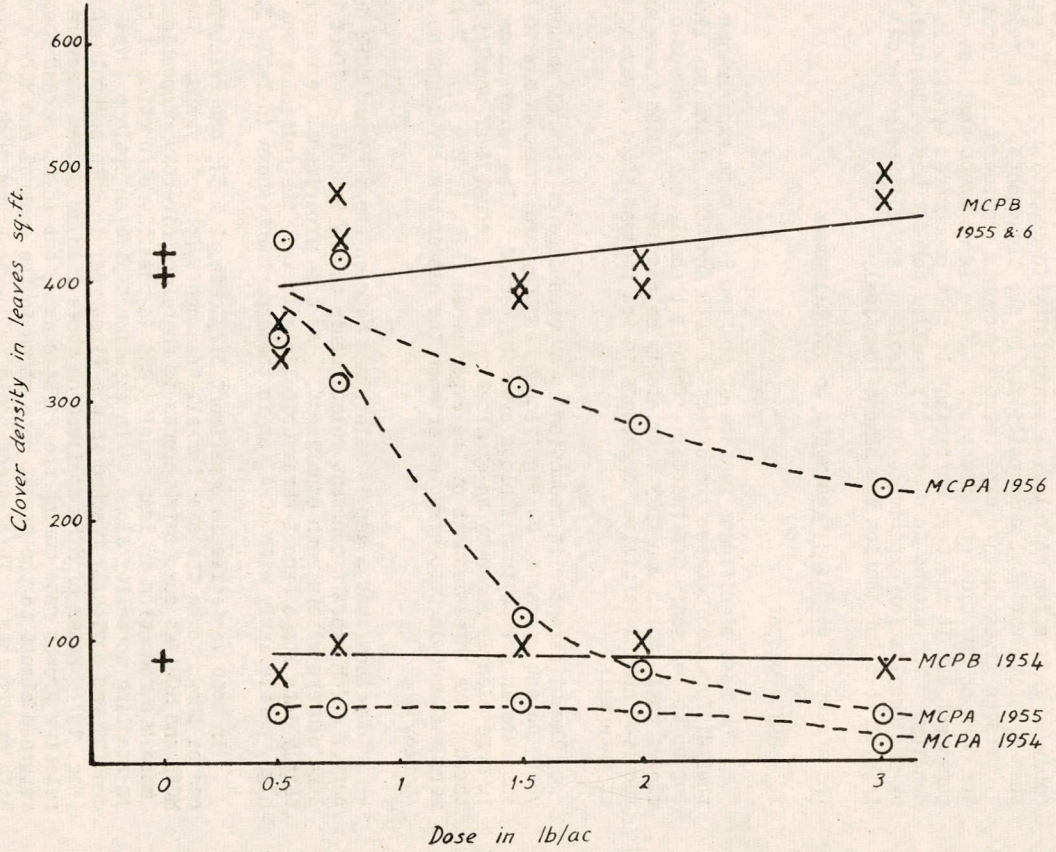
442

Fig. 1 Expt. 31/6. Wild White Clover



(47011)

Fig. 2. Expt. 31/7 S.100 Clover

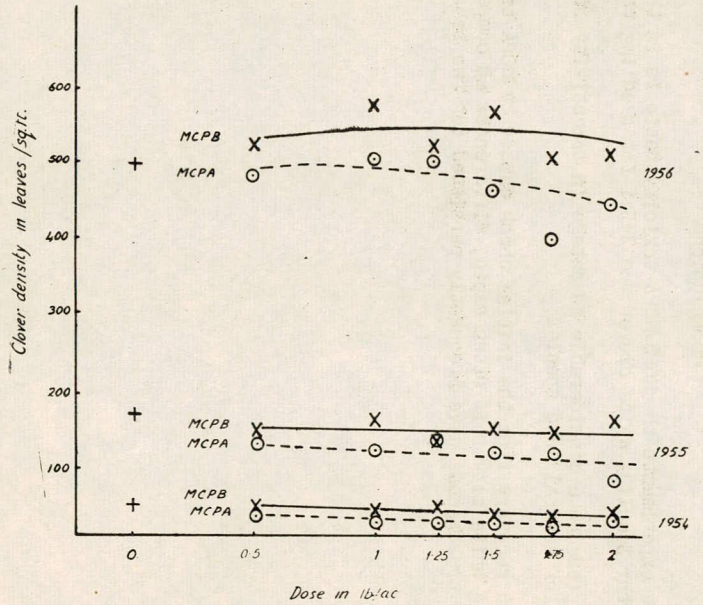
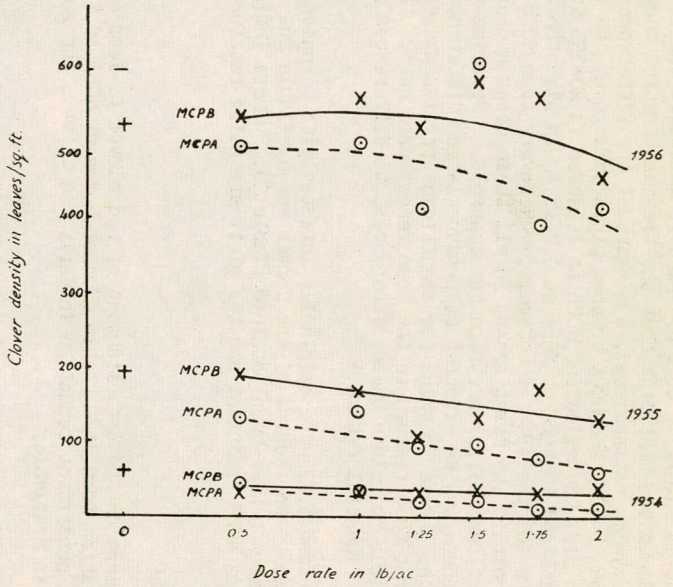


Fig. 3. Expt. 31/7 Wild White Clover



If the curves in Fig. 1 to 3 are used to calculate the relative rates of clover leaf production (assuming that the treatment ratios shown in the Figures are constant between estimations), a measure of the difference between the total leaf production on MCPB and MCPA treated plots throughout the two years can be obtained. In 31/7 the value for MCPB at 1.5lb/ac is 20-25% more than for MCPA at the same rate and 10-15% for MCPA at 0.75lb. In 31/6 the corresponding differences are 60% and 15% respectively. Recovery from MCPB treatment has been complete within the first season in all these cases and none of the doses show any significant difference from the controls. Spraying at earlier growth stages might therefore be expected to produce larger differences between MCPB and MCPA, as the threshold value for significant persistent reduction in yield by MCPB, has not been reached in the dose ranges used here. It is unfortunately impossible to relate these differences, to differences in productivity of the ley or financial return.

Both 31/6 and 31/7 were originally infested with Veronica persica and Cirsium arvense. No records of the former are available but successive counts of thistle regrowth have been obtained (Table 5). These indicate a more lasting effect from MCPB treatment and the plots are being retained for further study.

2. Red Clover

The evidence on the establishment of red clover is less complete. There is some suggestion from 31/6 (Table 4) that doses of MCPA of 1.5lb. and above may produce a persistent reduction in early red clover, but so far no confirming evidence is available.

Conclusions

1. In these experiments the MCPB/MCPA toxicity ratio is in the order of 8-10:1 for seedling white clover and 3-5:1 for seedling red clover.

2. This represents a considerable advantage in selectivity of MCPB for the control of several weed species.

3. Although recovery from the initial check caused by MCPA treatments in seedling white clover is often rapid, differences as compared with control or MCPB treatments, have frequently persisted for two seasons after sowing.

THE ROLE OF MCPB AND 2,4-DB FOR THE CONTROL OF WEEDS IN UNDERSOWN CEREALS, YOUNG LEYS AND ESTABLISHED PASTURE

Part 1: 1955 results (2,4-DB not included): W. Ochiltree

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Summary

1. Effect of MCPB on clover.

MCPB (sodium) had little or no adverse effect on red and white clovers at 20 oz active acid equivalent per acre once the clovers were past the two trifoliate leaf stage.

2. Effect of MCPB on weeds.

The performance of MCPB (sodium) on weeds generally was inferior to that of MCPA (potassium), particularly on flowering charlock.

Seedling charlock, creeping and erect buttercup, spear thistle and, to a lesser extent, creeping thistle, were fairly satisfactorily controlled by MCPB (sodium) at 20 oz/ac a.e.

Introduction

During 1955 MCPB (sodium) was evaluated as a weedkiller in clover leys and its performance compared with MCPA (potassium). The results of this work are given in Part 1 of this paper.

During 1956 the scope of this work was extended to include a comparison between 2,4-DB and MCPB. This work is detailed in Part 2 of this paper.

Experimental

Twenty-three trials based on a random block layout were completed. Thirteen of these were in the Southern Counties, six in the East Riding of Yorkshire and four in Northumberland.

Rates of application

MCPA (potassium) was used at rates from 3 oz to 24 oz/ac a.e. and MCPB (sodium) at rates ranging from 5 oz to 40 oz/ac a.e.

Note: Henceforth in this report rates of application will be referred to in ounces (oz). This is an abbreviation for "ounces active acid equivalent per acre". MCPA (potassium) will be referred to as MCPA, and MCPB (sodium) as MCPB.

Method of application

The chemicals were applied by Land Rover mounted low-volume sprayer. The volume of application was 11 gal/ac of water in each trial. Each treatment was replicated four times, and plots were 2 yd wide and 20 yd long.

Method of assessment of weed control

The control of all weeds was measured initially by an assessment of epinasty. This was made on a grading basis from 0 - 10; 0 representing no epinasty and 10 indicating severe epinasty - death imminent. On annual weeds in undersown cereals later assessments estimated the vigour of the weeds remaining. Plant counts, both before and after treatment, were made on creeping thistle and spear thistle.

Method of assessment of treatment effect on clover

The early effect of chemicals on clover was measured by a grading of epinasty. Later assessments were made of the stand of clover to indicate relative speed and extent of recovery. On established leys stand refers to the density of clover and was estimated by taking at random 10 assessments of one sq. yd/quadrat per plot. Individual gradings were from 0 - 10. 0 represented no clover present and 10 represented the amount of clover present on unsprayed areas adjacent to the trial. In the undersown clover trials stand refers to percentage ground cover of clover.

Statistics

All gradings and counts have been converted to "percentage weed control" and "percentage clover stand". These are shown as such in the tables at the end of this paper. An indication of the method of assessment used is given in each case. A representative number of these results were statistically analysed. Where results are quoted which have not been statistically analysed, they should be regarded as trends only. Owing to space restriction some of the less important results are excluded from these tables.

Results

Effect of MCPB on clover

(i) Red Clover (Table 1)

In trials on six established leys MCPB at 20 oz caused negligible damage to red clover, as compared with untreated plots. In three trials on undersown cereals there was some slight depression of the young red clover plants. In a single undersown clover trial 20 oz MCPB reduced the stand of clover by 45%. In another undersown clover trial (Table 1, Serial No. 13) the stand of clover on all plots was very poor due to the extreme drought conditions. There was consistently more damage at the 40 oz rate than at the 20 oz rate of MCPB.

(ii) White Clover (Table 2)

In trials on four established leys and two undersown leys MCPB at 20 oz caused negligible damage, but some damage occurred at 40 oz.

Owing to drought conditions prevailing in the 1955 season it was not possible to make an assessment of undersown clover after harvest in seven of the eleven trials laid down.

Effect of MCPB on weeds

1. Charlock - Sinapis arvensis (Table 3)

(i) Seedling Charlock

MCPB at 20 oz gave an acceptable control of seedling charlock. MCPA, however, even at 3 oz and 6 oz gave a markedly superior control. The performance of MCPB was better at 40 oz being equivalent to the 3 oz rate of MCPA.

(ii) Flowering Charlock

Three further trials were completed on flowering charlock in undersown cereals. In these trials MCPB at 20 oz was not effective, whilst MCPA at 3 oz, 6 oz and 12 oz effectively suppressed the weed. Where MCPB was used at 10 oz (and, to a lesser extent, at the 20 oz rate) charlock was observed to be forming seed.

2. Creeping Thistle - Cirsium arvense (Table 4)

In five trials MCPB at 20 oz caused some suppression of the aerial growth of creeping thistle. The control of the weed was substantially improved by increasing the rate to 40 oz and at this rate the control was generally equivalent to that obtained by MCPA at 24 oz.

3. Spear Thistle - Cirsium lanceolatum (Table 4)

Two trials were completed on spear thistle in the rosette stage in young clover leys. In one trial where growing conditions were very good MCPB at 20 oz gave complete control in 31 days. On the other site where growing conditions were very poor MCPB at 20 oz gave a 52% control after 41 days and 85% after 110 days. MCPA at 24 oz gave equivalent control to MCPB at 20 oz in the first trial and in the second trial was superior to MCPB up to 41 days after spraying, but not significantly better after 110 days.

4. Buttercup species - Ranunculus sp. (Table 4)

(i) Creeping buttercup - Ranunculus repens

In one trial MCPB at 20 oz killed creeping buttercup. In a second trial MCPB at 20 oz gave a poor control of the weed although at 40 oz the kill was 60%, whereas MCPA at 24 oz gave a 50% reduction.

(ii) Erect buttercup - Ranunculus acris

In one trial in a clover ley excellent results were obtained using MCPB and MCPA at 20 oz and 24 oz respectively.

(iii) Bulbous buttercup - Ranunculus bulbosus

MCPB at 20 oz had little effect on this weed and MCPA at 24 oz was not significantly better. Only one trial was laid down and that on a clover ley.

5. Ragwort - Senecio jacobaea (Table 4)

In a single clover ley trial MCPB at 20 oz and 40 oz proved useless against ragwort whilst MCPA at 24 oz gave a 95% control after 31 days.

6. Polygonum spp. (Table 5)

(i) Bindweed - Polygonum convolvulus

MCPB at 20 oz gave a poor kill of this weed. Control was greatly improved at 40 oz, although MCPA at 24 oz was still superior to the higher rate of MCPB.

(ii) Redshank - Polygonum persicaria

On a direct reseed neither MCPB nor MCPA at their recommended rates gave a satisfactory control of redshank.

(iii) Knotgrass - Polygonum aviculare

MCPB at 20 oz gave a poor control of knotgrass, whereas MCPA at 24 oz was satisfactory in two of the three trials completed.

7. Campion - Silene alba

In two trials, one in an undersown crop and one on a clover ley, MCPB at 20 oz gave a moderate control of campion with some improvement at the 40 oz rate. MCPA at 24 oz was superior to MCPB at both rates and gave good results.

8. Other Annual Weeds (Table 5)

(i) Fumitory - Fumaria parviflora

Fumitory was present in two trials on undersown cereals. In one of these MCPB at 20 oz reduced fumitory by 72%, but only by 43% in the other. MCPA at 12 oz was slightly superior to MCPB at 20 oz in each trial.

(ii) Fathen - Chenopodium album

Best results were obtained when in the seedling stage. When fathen was very advanced results were disappointing. MCPA at 24 oz was superior to MCPB at 40 oz in four trials and gave similar results in the fifth.

(iii) Spurrey - Spergula arvensis and shepherd's purse - Capsella bursa-pastoris

One trial was laid down on each of these weeds. MCPB at 20 oz gave very poor weed control in both cases, in contrast to MCPA at 24 oz which was very effective.

Discussion

During the dry spring of 1955 weeds in undersown cereals were often well established before the clover was at a safe stage to spray. For this reason the control of some weeds with MCPB was disappointing.

In red clover MCPA at 12 oz caused temporary depression from which the clover recovered. In the trials 12 oz MCPA was effective as a weedkiller. It may therefore be argued that in undersown cereals containing purely red clover there is no big case for the use of MCPB.

It is known that MCPA can cause some depression to seedling white clover and so there is a sound case for using MCPB on undersown cereals where white clover is present and the main weeds are susceptible, such as seedling charlock or creeping thistle.

It has been shown that MCPB is safe on clovers and at the same time gives an acceptable control of creeping and erect buttercup, spear thistle and, to a lesser extent, creeping thistle, at least during the year of application. In view of this MCPB should find a definite outlet on young clover leys containing these weeds.

On permanent pasture where wild white clover forms only a small part of the sward, MCPA may be used effectively and safely. In some permanent pastures, wild white clover is a major component of the sward. Under heavy grazing conditions any check to this clover is likely to result in a temporary reduction in the productive capacity of the pasture. MCPB would, therefore, be of great value on such a sward where susceptible perennial weeds occur.

Conclusions

Cereals

In undersown cereals there would appear to be a sound technical case for the use of MCPB

(a) where white clover is present in the seeds mixture and where charlock in the seedling stage is the main weed;

(b) where creeping thistle is the main weed problem in such a crop.

Young leys

Where creeping and erect buttercup, spear thistle and possible creeping thistle are the main weeds, then on the 1955 performance MCPB should find a definite place on grounds of safety to clovers.

Established pastures

In permanent pasture where clover is a vital component of the sward, then the use of MCPB would be justified on creeping and erect buttercup, spear thistle and possibly creeping thistle.

(47011)

Table 1

Percentage stand of red clover after treatment

Site Serial No.	3	5	6		7		10		12		13	15	16	23	
Method of Assessment *	S	S	E	S	E	S	E	S	S	S	S	S	S	S	S
No. of days after spraying	45	128	9	64	8	63	12	72	31	85	110	41	110	9	44
Type of ley (Und = undersown)	Ley	Und	Ley		Ley		Ley		Ley		Und	Und	Und	Und	
CHEMICAL USED (a.e. in 11 gal/ac water)															
MCPA (potassium) @ 12 oz	82	61	5	100	30	100	85	92	79	97	32	35	49	77	88
MCPA (potassium) @ 24 oz	83		5	100	28	100	49	77	79	93	26	40		67	92
MCPB (sodium) @ 20 oz	96	55	83	93	88	100	100	100	80	98	28	80	79	83	94
MCPB (sodium) @ 40 oz	95	49	68	100	65	100	95	100	60	84	34	90	68	83	86
Control (untreated)	100	100	100	98	100	100	100	100	100	95	42	100		97	98
Significant diff. 5% level		6							10				19		10

450

Table 2

Percentage stand of white clover after treatment

Site Serial No.	10	12		13	16	19		23	
Method of Assessment *	S	E	S	S	S	S	S	S	S
No. of days after spraying	31	11	85	41	110	15	107	9	44
Type of Ley (Und = undersown)	Ley	Ley		Und	Und	Ley		Ley	
CHEMICAL USED (a.e. in 11 gal/ac water									
MCPA (potassium) @ 12 oz	50	55	94	30	37	47	77	62	50
MCPA (potassium) @ 24 oz	47	44	80	40		50	65	33	36
MCPB (sodium) @ 20 oz	100	88	99	80	83	92	72	80	86
MCPB (sodium) @ 40 oz	95	55	100	92	66	75	85	63	72
Control (untreated)	100	100	98	100		100	74	100	88
Significant diff. 5% level		11			7	10	NS		23

* S = Grading of ground stand of clover
E = Complement derived from grading of epinasty (e.g. where Epinasty = 30% Stand = 70%)

Table 3

Percentage control of charlock in undersown cereals

Stage of growth	Seedling Stage							Flowering Stage					
Site serial No.	16			20		21		5		8		9	
Method of assessment *	E	V	C	E	V	E	V	E	E	E	E	E	E
No. of days after spraying	20	41	41	15	35	15	35	3	16	3	16	3	16
CHEMICAL USED (a.e. in 11 gal/ac water)													
MCPA (potassium) @ 3 oz	80	95	83	97	100	97	100	37	60	52	67	52	72
MCPA (potassium) @ 6 oz	92	100	100	100	98	95	100	47	70	55	85	50	82
MCPA (potassium) @ 12 oz	100	100	99	100	96	100	100	52	87	52	70	57	90
MCPB (sodium) @ 20 oz	30	70	63	55	64	52	100	22	41	30	47	17	37
MCPB (sodium) @ 40 oz	62	88	75	82	95	75	100	35	70	32	55	20	20
Control (untreated)	-	-	-	-	-	-	-	0	0	0	0	0	0
Significant diff. 5% level	12	18	38							15	25		
Coefficient of variation	16%	61%	90%							31%	38%		

* C = Physical count of plants

E = Grading of plant epinasty (e.g. Epinasty = 70%, Weed Control = 70%)

V = Grading of plant vigour (e.g. Vigour = 70%, Weed Control = 30%)

(47011)

Table 4

Percentage control of buttercup, ragwort, creeping thistle and spear thistle

	Creeping Buttercup		Erect Buttercup	Bulbous Buttercup	Ragwort		Creeping Thistle							Spear Thistle (Rosette Stage)			
Site Serial No.	3	14	6	12	10		1		2	15	18	19	22	10		17	
Method of Assessment *	V	E	V	V	E	V	E	C	C	V	E	C	E	E	V	E	C
Days after spraying	45	21	26	31	12	31	8	95	42	41	20	107	15	12	31	20	110
Type of Ley (Und = undersown)	Ley	Und	Ley	Ley	Ley		Ley		Ley	Und	Und	Ley	Ley	Ley		Ley	
CHEMICAL USED (a.e. in 11 gal/ac water)																	
MCPA (potassium) @ 12 oz	99	40	90	45	10	87	22	Trial cut too early after spraying, heavy regrowth no sig. diff.	82	76	72	77	70	76	100	50	98
MCPA (potassium) @ 24 oz	96	50	100	50	45	95	42		89	88	77	70	77	94	100	57	100
MCPB (sodium) @ 20 oz	92	28	85	36	15	10	22		75	54	55	72	67	94	100	22	85
MCPB (sodium) @ 40 oz	96	60	95	51	12	22	25		96	72	80	87	67	94	100	40	93
Control (untreated)	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0
Sig. diff. 5% level	11		20	20					45			47	15	13		25	18
Coefficient of variation	42%		16%	19%					109%			89%	16%	12%		47%	65%

* E = Grading of plant epinasty (e.g. Epinasty = 70%, Weed Control = 70%)

V = Complement of vigour and ground cover (e.g. Vigour = 70%, Weed Control = 30%)

C = Count

Table 5

Percentage control of fumitory, fat hen, campion, spurrey, shepherd's purse, bindweed, redshank and knotgrass

	Fumitory		Fat hen					Campion		Spurrey	Shepherds Purse	Bindweed		Redshank	Knotgrass			
Site Serial No:	13	20	4	11	13	15	18	4	6	11	11	4	18	11	13	15	18	
Method of Assessment*	E	E	E	V	E	E	E	E	V	V	V	E	E	E	E	E	E	V
No. days after spraying	21	15	17	27	21	21	20	17	26	27	27	17	39	28	21	41	20	39
Type of Ley (Und = Undersown)	Und	Und	Und	Direct Reseed	Und	Und	Und	Und	Ley	Direct Reseed	Direct Reseed	Und	Und	Direct Reseed	Und	Und	Und	
CHEMICAL USED (a.e. in 11 gal/ac water)																		
MCPA (potassium) @ 12 oz	48	80	77	100	30	42	55	77	67	86	99	67	40	20	0	70	45	10
MCPA (potassium) @ 24 oz	80		95	100	68	50	65	87	67	82	97	87	80	28	13	79	75	63
MCPB (sodium) @ 20 oz	43	72	67	99	8	30	35	57	52	23	28	27	28	23	0	48	37	10
MCPB (sodium) @ 40 oz	57	80	85	99	23	38	67	75	65	22	42	57	64	33	3	67	67	46
Control (untreated)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sig. diff. 5% level		20	18			23	18		20	29	23	23	25	16		28		24
Coefficient of variation		29%	19%			41%	26%		23%	32%	38%	29%	34%	15%		44%		28%

* E = Grading of plant epinasty (e.g. Epinasty = 70%, Weed control = 70%)

V = Complement of vigour of remaining plants (e.g. Vigour = 70%, Weed control = 30%)

THE ROLE OF MCPB AND 2,4-DB IN THE CONTROL OF WEEDS IN UNDERSOWN CEREALS, YOUNG LEYS AND ESTABLISHED PASTURES

Part II : 1956 results : P. F. Le Brocq
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Summary

General

In general an increase in dose of MCPB and 2,4-DB from 24 - 36 oz/ac did not give a commensurate increase in weed control, or proportional depression of pure stands of clover (S.100, wild white, alsike, broad red, late-flowering red).

Weeds

1. At equal weights of active acid equivalent per acre, the control of weeds by MCPA was superior to MCPB and 2,4-DB except for redshank (Polygonum persicaria), where the control by 2,4-DB was superior to MCPA.

2. 2,4-DB was more effective than MCPB in controlling redshank in the two leaf stage and 4 - 8 in. high (good control by 2,4-DB), black bindweed (Polygonum convolvulus) in the 2 - 3 leaf stage (fair control by 2,4-DB), and fat hen (Chenopodium album) 6 - 12 in. high (fairly good control by 2,4-DB).

3. MCPB was more effective than 2,4-DB in controlling fat hen in the 2 - 3 leaf stage (very good control by MCPB) and musk thistle (Carduus nutans) 4 - 6 in. high (excellent control by MCPB).

4. MCPB and 2,4-DB were about equal in their control of seedling creeping buttercup (Ranunculus repens) (excellent control), creeping thistle (Cirsium arvense) 4 - 14 in. high (good control), and yellow charlock (Sinapis arvensis) (excellent control) in the early flower bud stage. Both chemicals gave a poor control of yellow charlock when applied at a more advanced stage of flowering.

Clovers

1. There was approximately 30% depression of stand by MCPB and 2,4-DB at 24, 30 and 36 oz/ac of S.100, wild white, alsike, broad red and late-flowering red clovers, in the three to four leaf (established seedling) stage, thirty days after treatment.

2. MCPA severely depressed the stand of S.100, wild white clover and alsike. Broad red and late flowering red clovers were less severely depressed by MCPA.

Lucerne

1. 2,4-DB at 24 and 30 oz/ac was applied safely to lucerne.

2. MCPB was phytotoxic and MCPA was very phytotoxic to lucerne.

Wheat and barley

No ear malformities were observed in almost ripe wheat and barley.

Introduction

MCPB, 4-(2-methyl-4-chlorophenoxy) butyric acid has shown promise as a selective weedkiller on undersown cereals, leys and pastures. There are indications that MCPB may be applied safely to wheat, oats and barley in the early growth stages and is safer to apply to white and red clovers at an earlier stage than MCPA. However, the number of weed species controlled and the degree of control by MCPB are limited when compared with MCPA.

2,4-DB, 4-(2,4-dichlorophenoxy) butyric acid has also shown promise in the same role as MCPB but less is known of its range of action in the field.

Part I of this paper has dealt with the 1955 work on MCPB (sodium) in comparison with MCPA (potassium).

Part II deals with (a) a continuation of the 1955 work, and (b) an extension to include 2,4-DB (potassium) in comparison with MCPB (sodium) and MCPA (potassium) on the following crops and their weeds:

1. Undersown spring wheat and barley with annual weeds such as moderately susceptible (MS) yellow charlock and fat hen, moderately resistant (MR) redshank and black bindweed. Also one perennial in undersown spring wheat, viz. young seedling creeping buttercup.

2. A direct-reseeded ley in its first year with annuals such as redshank and fat hen in an advanced stage.

3. An established ley with creeping thistle.

4. A one year clover ley with musk thistle.

5. Pure stands of clover and lucerne.

Experimental methods

General data

Eleven replicated, randomised block trials were laid down in the spring of 1956, ten in southern and one in northern England.

Plot size was standardised at 3 yd x 20 yd but the area treated was 2 yd x 20 yd, thereby leaving a yard wide discard between plots.

All treatments were applied, in water, by a Land Rover mounted sprayer, fitted with a 6 ft spray boom, calibrated to deliver 19 gal/ac. They were: MCPB (sodium) and 2,4-DB (potassium) at 24, 30 and 36 oz/ac*; MCPA (potassium) at 12, 18 and 24 oz/ac, in some trials only two rates of MCPA (potassium) were used; control untreated.

Hereafter in this report these chemicals will be referred to as MCPB, 2,4 2,4-DB and MCPA.

(* All rates expressed in oz active acid equivalent per acre).

Assessments

(a) Undersown spring wheat and barley

1. Weeds: By counts in ten one-ft quadrats per plot.

2. Ear Malformities: Wheat and barley in ear were examined for malformities.

3. Clovers (Assessed after harvesting). Visual estimation of the cover of clover in one-yard quadrats expressed as a percentage, a minimum of five quadrats per plot.

(b) Leys and pastures

1. Weeds

(i) Creeping thistle and musk thistle. Total counts of shoots on the treated area of each plot.

(ii) Redshank and fat hen (direct reseeded ley). Visual gradings of plant height combined with bulk, an average of not less than two observers working independently.

2. Clovers

Visual estimation of the cover of clover in one-yard quadrats expressed as a percentage.

(b) Pure stands of clovers and lucerne

Visual gradings of plant height combined with bulk, an average of not less than two observers working independently.

Undersown spring wheat and barley

Four four-replicate and one three-replicate trials were laid down on undersown cereals. Treatments were applied when the majority of the clovers present had reached the one trifoliate stage (the safe-to-treat stage for MCPB and 2,4-DB); tillering of wheat and barley was then well advanced.

Leys and pastures

Three four-replicate trials were laid down, one on redshank and fat hen, one on creeping thistle and one in northern England on musk thistle.

Pure stands of clover

One five-replicate trial was laid down at Fernhurst on S.100, wild white, alsike, broad red and late flowering red clovers in the 3 - 4 leaf, established seedling stage.

Lucerne

Two four-replicate trials were laid down, one at Wilsford where MCPA was applied at 12 and 18 oz/ac, and the other at Fernhurst where the rates of MCPA were 12, 18 and 24 oz/ac.

Experimental results

Weed control

In general an increase in dose of MCPB and 2,4-DB from 24 - 36 oz/ac did not give a corresponding increase in weed control.

Redshank (Tables 1 and 2)

2,4-DB at 24, 30 and 36 oz/ac gave a good control of redshank, in the two leaf stage in one trial (approximately 80%) and at the advanced seedling stage, 4 - 8 in. high in the other (approximately 70%). The control by MCPB and MCPA at all rates was inferior to 2,4-DB.

Black bindweed (Table 1)

2,4-DB at 24, 30 and 36 oz gave a fairly good control (approximately 60%) of this weed in the 2 - 3 leaf stage. The control by MCPB at all rates, and MCPA at the low (12 oz) rate, was poor. MCPA at 24 oz was slightly superior to 2,4-DB at all rates.

Fat hen (Tables 1 and 4)

MCPB and MCPA gave a very good control of fat hen in the 2 - 3 leaf stage at all rates. MCPB at 24 oz was slightly superior (86%) to MCPA at 12 oz (82%), 2,4-DB was slightly inferior to MCPB at 24 oz and noticeably so at 30 and 36 oz.

The control of fat hen 6 - 12 in. high, was fairly good (60 - 70%) by all rates of 2,4-DB, but poor by MCPB. MCPA at 12 and 24 oz was superior to 2,4-DB at all rates, giving approximately 80% control.

Yellow charlock (Table 2)

In one trial on this weed in the early flower bud stage an excellent control was obtained by all chemicals at all rates. MCPA at both rates gave 100% control. MCPB and 2,4-DB were about equal in their control of yellow charlock, but were slightly slower acting than MCPA.

In the two other trials on this weed in the advanced flowering stage, the control by MCPB and 2,4-DB was very poor. MCPA gave a moderate control at the 12 oz rate (approximately 60%) and a good control at the 18 and 24 oz rates (approximately 85%).

Creeping buttercup (Table 3)

An excellent control (90%) of seedling creeping buttercup was obtained by MCPB, 2,4-DB and MCPA at all rates. MCPB gave a control similar to 2,4-DB.

Creeping thistle (Table 5)

A very good control (approximately 80%) of creeping thistle 4-14 in., but mostly 8 in. high, was obtained by MCPB, 2,4-DB and MCPA at all rates. MCPB at the 36 oz rate was slightly superior to 2,4-DB and MCPA at all rates. MCPB and 2,4-DB acted at about the same speed as MCPA.

Musk thistle (Table 5)

An excellent control (90 - 95%) of musk thistle 4 - 6 in. high was obtained by MCPB and MCPA. 2,4-DB was inferior but still gave a fair to good control. MCPB and 2,4-DB acted at about the same speed as MCPA.

Clovers in undersown spring wheat and barley and in the direct-reseeded ley

At the time of writing this report it was too early to obtain reliable data on clover establishment.

Pure stand clover trial - Fernhurst (Table 6)

First grading - seven days after treatment

Results seven days after treatment showed that all treatments depressed all five clovers, i.e. S.100, wild white, alsike, broad red and late-flowering red. The depression from the 2,4-DB treatments was slight on all clovers, but that from the MCPB treatments was more pronounced.

An increase in dose of MCPB and 2,4-DB from 24 to 36 oz did not give a corresponding increase in phytotoxicity to any of the clovers.

MCPA produced a definite depression on all clovers at the 12 and 18 oz levels and a severe depression at 24 oz.

There appeared to be little difference in the effect of a given treatment on the five clovers, except that the high rate of 24 oz of MCPA was slightly more phytotoxic to S.100 and wild white clover than to alsike or the red clovers.

Second Grading - Thirty days after Treatment

Visual gradings indicated increased differences between treatments and controls (i.e. a greater apparent depression) for all five clovers, except for MCPA at 18 and 24 oz on broad red and late flowering red clovers which remained fairly constant. This increase in apparent depression was most marked with MCPA treatments on S.100, wild white and alsike clovers.

The level of depression (approximately 30%) caused by the phenoxybutyric treatments on all clovers was fairly severe and unexpected on these established seedlings.

As in the first gradings, an increase in dose of MCPB and 2,4-DB from 24 to 36 oz did not give a corresponding increase in phytotoxicity.

MCPB and 2,4-DB had much the same effect on S.100 and wild white clover. 2,4-DB, however, was slightly more phytotoxic than MCPB on broad red and late flowering red clover, but less phytotoxic on alsike.

Lucerne trials - Fernhurst and Wilsford

2,4-DB at 24, 30 and 36 oz in both trials gave a slight initial depression of lucerne and very slight epinasty at the 36 oz rate, which was still evident four weeks after treatment. However, in the Fernhurst trial there was full recovery ten weeks after treatment at the 24 and 30 oz rates, but not at the 36 oz rate. In the Wilsford trial the lucerne was cut for silage immediately following the first assessment (4 weeks after treatment). When the second

assessment was made, 15 weeks after treatment, the height combined with bulk of the lucerne on all the 2,4-DB plots was greater than that on the control plots.

Up to five weeks after treatment, MCPB at 24, 30 and 36 oz/ac caused a severe depression of lucerne in the Fernhurst trial and a fairly severe depression at the 36 oz rate in the Wilsford trial. MCPB at 24 and 30 oz/ac produced only a moderate depression of lucerne in the latter trial.

In the Wilsford trial, however, fifteen weeks after treatment, there was a complete recovery of lucerne at the 24 oz rate of MCPB and a nearly full recovery at the 30 oz rate; the lucerne did not make a satisfactory recovery at the 36 oz rate.

MCPA was very phytotoxic at 12, 18 and 24 oz/ac and the recovery was only slight.

Wheat and barley

No ear malformities were observed on nearly ripe wheat and barley.

Discussion and conclusions

Undersown spring wheat and barley

Owing to the long dry spring of 1956, yellow charlock in undersown cereals was well advanced by the time the clovers had reached the one trifoliate leaf stage. This was especially the case on two of the three trials where yellow charlock was treated at the advanced flowering stage and it was, perhaps, not surprising that a poor control was obtained by all rates of MCPB and 2,4-DB and only a moderate control (approximately 60%) by MCPA at 12 oz/ac. Furthermore, the control (approximately 85%) obtained by MCPA at 18 and 24 oz/ac was well below the normal standard expected.

It would appear advantageous, therefore, to apply MCPB and 2,4-DB to yellow charlock in undersown cereals before the clovers have reached the one trifoliate leaf stage, but further information is needed on the effect of these chemicals, 2,4-DB especially, on clovers treated at such an early stage. It is hoped that contributors to this Weed Control Conference will be presenting data on this point.

Pure stands of clovers

The definite depression, still very evidene thirty days after treatment, of S.100, wild white, alsike, broad red and late flowering red clovers, in the 3-4 leaf stage, by MCPB and 2,4-DB at even 24 oz/ac, was unexpected and unexplained; the MCPB results being contrary to those for 1955 given by W. Ochiltree in Part I of this paper.

Similarly, the marked depression present thirty days after treatment of broad red and late flowering red clovers by MCPA at the 12 oz rate cannot be accounted for.

Lucerne

In the Wilsford Trial, the increase in height combined with bulk, of lucerne on the 2,4-DB plots over the control plots, was probably due to control of orache (*Atriplex patula*), being the main weed present.

2,4-DB at 24 and 30 oz/ac may be applied safely to lucerne, but 2,4-DB at 36 oz/ac is not recommended, since the lucerne may not fully recover from its initial depression for up to ten weeks after treatment (Fernhurst trial).

MCPB and MCPA may not be applied safely to lucerne.

Table 1

Counts, expressed as percentage control of redshank, black bindweed and fat hen in undersown barley

Weed	Stage Treated	Date Treated	Assessment days after treatment	Treatments in oz/ac a.e.							
				MCPB			2,4-DB			MCPA	
				24	30	36	24	30	36	12	24
Redshank	2 leaves	11 May 1956	(1) 53	28	23	31	61	70	73	10	48
			(2) 76	15	27	28	82	87	77	14	58
Black bindweed	2-3 leaves	11 May 1956	(1) 53	27	33	56	47	46	56	39	84
			(2) 76	22	36	27	54	70	62	26	72
Fat hen	2-3 leaves	11 May 1956	(1) 53	65	85	76	69	72	72	70	86
			(2) 76	86	90	93	84	74	77	82	95

Table 2

Counts, expressed as percentage control of yellow charlock in undersown barley

Weed	Stage Treated	Date Treated	Assessment days after treatment	Treatment in oz/ac a.e.								
				MCPB			2,4-DB			MCPA		
				24	30	36	24	30	36	12	18	24
Yellow Charlock	Early flower bud	12 May 1956	(1) 32	89	87	92	83	89	87	99	-	99.8
			(2) 68	99.5	99	99.3	98	99.4	99.3	100	-	100
Yellow Charlock	Advanced flower bud	17 May 1956	(1) 33	-3	-12	-11	6	9	5	39	72	-
			(2) 56	-10	-19	11	-1	1	11	64	89	-
Yellow Charlock	Advanced flower bud	1 June 1956	(1) 28	25	28	9	12	25	33	65	-	84
			(2) 63	25	20	4	20	24	10	67	-	83

Table 3

Counts, expressed as percentage control of creeping buttercup seedlings in undersown wheat

Weed	Stage Treated	Date Treated	Assessment days after treatment	Treatments in oz/ac a.e.							
				MCPB			2,4-DB			MCPA	
				24	30	36	24	30	36	12	24
Creeping Buttercup (seedling)	Some in cotyledon most in 1-2 leaf stage	18 May 1956	(1) 55	98	94	97	93	89	96	87	96
			(2) 81	97	92	98	90	91	94	91	98

Table 4

Visual gradings of redshank and fat hen expressed as a percentage of control in the first year of a direct-reseeded ley

Weed	Stage Treated	Date Treated	Assessment days after treatment	Treatments in oz/ac a.e.							
				MCPB			2,4-DB			MCPA	
				24	30	36	24	30	36	12	24
Redshank	4-8 in. high with lateral branching	19 June 1956	(1) 16	40	42	48	73	73	78	48	54
Fat hen	6-12 in. high	19 June 1956	(1) 16	28	29	28	60	65	69	80	83

Table 5

Counts, expressed as percentage control of creeping thistle in a pasture and musk thistle in a one year clover ley

Weed	Stage Treated	Date Treated	Assessment days after treatment	Treatments in oz/ac a.e.								
				MCPB			2,4-DB			MCPA		
				24	30	36	24	30	36	12	18	24
Creeping Thistle	4-14 in. high, most at 8 in.	31 May 1956	(1) 60	87	89	94	90	92	93	91	-	87
			(2) 82	78	79	89	78	82	82	85	-	82
Musk Thistle	4-6 in.	28 May 1956	(1) 28	75	80	82	66	70	74	81	89	-
			(2) 80	92	95	96	72	80	87	91	95	-

Table 6

Visual gradings of five seedling clovers expressed as a percentage of control

Clover Type	Stage Treated	Date Treated	Assessment days after treatment	Treatments in oz/ac a.e.								
				MCPB			2,4-DB			MCPA		
				24	30	36	24	30	36	12	18	24
S.100	3-4 leaves (seedling)	10 July 1956	7	89	88	86	95	91	90	69	58	39
			30	76	73	77	77	75	74	39	29	25
Wild white	"	"	7	87	87	80	91	90	89	68	59	41
			30	73	69	62	67	73	65	31	35	18
Alsike	"	"	7	84	84	82	92	89	88	64	51	43
			30	59	62	51	65	67	66	36	29	23
Broad Red	"	"	7	83	81	82	92	90	89	73	60	50
			30	70	65	66	65	61	62	69	59	54
Late Flowering Red	"	"	7	86	82	81	95	88	88	76	59	46
			30	67	67	69	64	60	61	70	59	52

Table 7

Visual gradings of seedling lucerne expressed as a percentage of control

Crop	Stage Treated	Date Treated	Assessment days after treatment	Treatments in oz/ac a.e.								
				MCPB			2,4-DB			MCPA		
				24	30	36	24	30	36	12	18	24
Lucerne (Fernhurst trial)	Six leaf 3-4 in. high	18 June 1956	(1) 10	46	31	33	92	89	68	18	14	19
			(2) 30	35	22	37	102	94	65	17	6	19
			(3) 71	82	71	81	102	100	93	35	24	21
Lucerne (Wilsford trial)	Six leaf 3-4 in. high	14 June 1956	(1) 34	82	82	57	85	97	92	33	14	-
			(2) 103	102	94	86	108	122	113	75	66	-