STUDIES WITH PHENOXYBUTYRIC HERBICIDES IN PEAS, 1955-56

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Summary

1. Two small-scale trials in 1955 compared sodium and ester formulations of MCPA and MCPB, the sodium salts of 2,4-DB and 2,4,5-TB, and dinoseb triethanolamine, each at two dosage rates, against weeds in eight pea varieties. Two further experiments in 1956 tested a range of dosages of the sodium salts of MCPA and MCPB and a 1:7 mixture of these compounds, in marrowfat peas, with dinoseb (triethanolamine) and hoeing for comparison.

2. MCPA (ester) was very phytotoxic to all varieties. MCPB (sodium and ester) had less effect on both weeds and crop than MCPA (sodium), but on a yield basis the two compounds were equivalent. 2,4-DB (sodium) possessed greater herbicidal activity than MCPB, but had some effect on the crop. 2,4,5-TB (sodium) had a negligible effect on weeds and peas. Dinoseb and hoeing gave the greatest weed kill, caused least crop damage, and produced the highest yield response.

3. Of the varieties compared, Gregory's Surprise and Thomas Laxton were the most sensitive to all the compounds tested. Varieties scorched by dinoseb recovered but the effects produced by MCPA and the phenoxybutyric compounds were more persistent.

Introduction

The possible application of certain substituted phenoxybutyric acids as selective herbicides for use in peas was reported at, and immediately following, the 1954 Conference (1,2). Since this new development might prove of significant importance in dealing with the weed suppression problem in this crop, it was decided to carry out exploratory trials in 1955 to test several of the more promising derivatives on a number of popular varieties, of differing growth habit, used for canning, quick freezing and harvesting dry. Dinoseb and MCPA were included for comparison; the former is now widely used for chemical weed control in peas but the latter - related to the phenoxybutyrics - is now generally accepted as being of limited value in this crop.

Experiments were continued on a field scale in 1956 but it was decided to test only one phenoxybutyric compound - namely MCPB - available commercially and being recommended by suppliers for use in certain varieties of peas.

Experimental methods and results

Exploratory Trials : 1955

Small-scale trials were laid down at two sites near Peterborough, namely Postland (light fenland peat) and Nassington (medium-heavy loam). Strips of eight varieties, each comprising four rows, 16 in. apart, were sown on 29th April and 4th May respectively. The chemicals were applied by knapsack sprayer across the varieties at high volume (100 gal/ac) in mid-June at two dosage rates,

there being 16 treatments including two untreated control strips. Each trial therefore comprised 128 plots, individual plots being approximately 5.5 ft square. Details of the varieties sown, their stage of growth at the time of spraying, the treatments applied, weeds present and weather conditions are set out below.

Varieties tested	Utilisation	Size at time of spraying: POSTLAND Height (in)	POSTLAND Expanded leaves	NASSINGTON Height (in)	NASSINGTON Expanded leaves
Zelka	for harvesting dry	7.0	5-6	5.0	4-5
Servo		4.5	5-6	3.5	5
Gregory's Surprise	for quick-freezing and/or canning	12.5	5-6	8.0	4-5
Meteor		6.5	5	5.0	4-5
Thomas Laxton		12.0	5	9.5	4-5
Kelvedon Wonder		7.0	5-6	5.5	4-5
Lincoln		3.5	4-5	3.5	4-5
Charles I		6.5	5	4.0	4

Chemical Treatments		lb/ac a.e. Low dose	lb/ac a.e. High dose
2-methyl-4-chlorophenoxyacetic acid (MCPA)	(sodium salt	0.5	1.0
	(butyl ester	0.5	1.0
4-(2-methyl-4-chlorophenoxy) butyric acid (MCPB)	(sodium salt	0.5	1.0
	(butoxyethyl ester	0.5	1.0
4-(2,4-dichlorophenoxy)butyric acid (2,4-DB),	sodium salt	0.5	1.0
4-(2,4,5-trichlorophenoxy)butyric acid (2,4,5-TB),	sodium salt	0.5	1.0
4,6-dinitro ortho secondary butylphenol (dinoseb),	triethanolamine salt	1.0	2.0
Control (untreated)		-	-

Weeds present at time of spraying (Numbers based on counts made within three 1 ft sq. quadrats per variety, chosen at random i.e. a total of 24 sq. ft).

POSTLAND

Main Species	Density ('000/acre)	Size
Small nettle (Urtica urens)	254	0.5-3 in. high
Shepherd's purse (Capsella bursa-pastoris)	93	Rosettes up to 3 in.diameter
Swine-cress (Coronopus ruellii)	34	" 3-4 in. diameter
Chickweed (Stellaria sp.)	27	Variable, mostly small
Knotgrass (Polygonum aviculare)	27	3-4 in. high, 3-4 leaves
Speedwell (Veronica spp.)	14	1.5 in. high,2-3 pairs leaves
Black bindweed (Polygonum convolvulus)	11	Up to 2 in. high, 1 pair leaves
Groundsel (Senecio vulgaris)	11	1-1.5 in. high, 2-3 pairs leaves

Other Species

Fat hen (Chenopodium album), plantain (Plantago sp.), common orache (Atriplex patula), willow weed (Polygonum persicaria)

NASSINGTON

Main Species

Chickweed	790	0.5-4 in. high
Speedwell	127	0.25-1.5 in. high, 2 pairs leaves
Fat hen	85	Up to 3.5 in. high, 3 pairs leaves
Knotgrass	62	Up to 3.5 in. high, 3 pairs leaves
Groundsel	44	Up to 2.5 in. high, 2 pairs leaves
Black bindweed	42	Up to 2 in. high, 2 pairs leaves
Thistle (Cirsium sp.)	18	0.5-6 in. high
Charlock (Sinapis arvensis)	11	Up to 6 in. dia. 3 pairs leaves

Other Species

Buttercup (Ranunculus sp.) sowthistle (Sonchus sp.), common orache, shepherd's purse, willow weed.

Weather Conditions

POSTLAND - Heavy rain day before spraying. Cool, dry, and becoming warmer on day of treatment (56-62°F).

NASSINGTON - Sunny and warm with moderate breeze on day of spraying (c. 65°F).

Table 1

Summary of observations on weeds in general : 1955 trials

Compound / Date	MCPA Sodium 0.5lb	MCPA Sodium 1lb	MCPA Ester 0.5lb	MCPA Ester 1lb	MCPB Sodium 0.5lb	MCPB Sodium 1lb	MCPB Ester 0.5lb	MCPB Ester 1lb	2,4-DB Sodium 0.5lb	2,4-DB Sodium 1lb	2,4,5-TB Sodium 0.5lb	2,4,5-TB Sodium 1lb	Dinoseb Amine 1lb	Dinoseb Amine 2lb
Centre: Postland, Peterborough (Sprays applied on 13th June)														
15th June	D	DD	DDD/ SS(1)	DDDD/ SSS(1)	C	C			D	D	U	U	SS(2)	KK(2)
17th June	CC	CC(3)	CCC	CCCC	C	C(4)	C	C	C	CCC	U	C	SS	KK
3rd August	R	R	K(5)	K(6)	K	K	K(7)	K	K	K	U	R	KK	KK
Centre: Nassington, Peterborough (Sprays applied on 15th June)														
17th June	DD or d		DDD		D		DD		U(8)		U	U	U(9)	
20th June													KK	KK
1st July	R(10)		K(11)		C(12)		C		U(13)		U		KK	
12th July (charlock)	KK	KK	KK	KK	KK	KK	KK	KK	KK	KK	K	K	KK	KK
22nd August	R	R	K	(14)	R	R	R	R		R	U	U	KK	KK

1. Swine-cress = CCC
2. Knotgrass = CCC
3. Small nettle = CCC
4. Knotgrass = CC
5. Groundsel, chickweed, cleavers and shepherd's purse = R
6. Small nettle = R
7. Groundsel and shepherd's purse = R
8. Chickweed = C
9. Thistle, groundsel and charlock = SSS; fathen = CC
10. Thistle = CC
11. Thistle = DD/SS; chickweed = S
12. Chickweed = U; thistle = SS; charlock = SSSS
13. Thistle = DD/SS
14. Chickweed = R

Key to letters used

C - Slight check
CC - Moderate check
CCC - Considerable check
CCCC - Severe check

D - Slight distortion
DD - Moderate "
DDD - Considerable distortion
DDDD - Severe "

S - Slight scorch
SS - Moderate "
SSS - Considerable "
SSSS - Severe "

K - Partial kill
KK - Complete kill or almost so
R - Recovered
U - Unaffected
d - Drooping

Table 2

Summary of observations on pea varieties in general: 1955 trials

Compound / Date	MCPA Sodium 0.5lb	MCPA Sodium 1lb	MCPA Ester 0.5lb	MCPA Ester 1lb	MCPB Sodium 0.5lb	MCPB Sodium 1lb	MCPB Ester 0.5lb	MCPB Ester 1lb	2,4-DB Sodium 0.5lb	2,4-DB Sodium 1lb	2,4,5-TB Sodium 0.5lb	2,4,5-TB Sodium 1lb	Dinoseb Amine 1lb	Dinoseb Amine 2lb
Centre: Postland, Peterborough (Sprays applied on 13th June)														
15th June	D	DD	DDD/ SS	DDDD/ SSS	U (1)	U	d	d	D	D	U	U	S(2)	
17th June	DD (4)	DDD (5)	DDD/ SS(5)	DDDD/ SSSS(6)	D	DD	DD	D/S	D	S	D	D	R(7)	S(8)
3rd August				Stunted & sparse										
Centre: Nassington, Peterborough (Sprays applied on 15th June)														
17th June	DD	DDD	DDD	DDDD/ SSSS	D		DD		U	D	U	d	U	S(8)
1st July			DDD/ SSS						U(9)		U (10)		U(11)	
2nd August		Distorted. leaves dead	Stunted	Mostly killed esp. Greg. Surprise					Elongated leaflets				U	R
9th August			100% secondary growth	Secondary growth from surviving plants										

1. Gregory's Surprise and Thomas Laxton = DD
2. " " = SS; " " = SSS
3. " " = SSS; " " = SSSS
4. " " = DDD
5. " " and Thomas Laxton = DDDD
6. Gregory's Surprise and Thomas Laxton = DDDD+
7. " " = S
8. " " and Thomas Laxton = SS
9. Lincoln and Kelvedon Wonder = C
10. Thomas Laxton = C
11. Gregory's Surprise = SS

For Key to letters used, see foot of Table 1

Table 3

Effect of chemical treatments on yield, averaging all varieties (1955 trials)

(Cwt/ac threshed peas)

Compound	Nassington		Postland	Mean of (a) and (b)
	low dose	high dose (a)	high dose (b)	(± 2.63)
MCPA, sodium	21.4	23.3	17.5	20.4
, ester	9.4			
MCPB, sodium	20.7	21.0	17.4	19.2
, ester	18.9	20.1	20.1	20.1
2,4-DB, sodium	20.3	14.8	12.9	13.9
2,4,5 - TB, sodium	20.9	11.6	17.4	14.5
Dinoseb, amine	28.3	32.0	21.0	26.5
Control (untreated)	16.3	16.3	16.4	16.3
Mean	19.5	19.9	17.5	18.7

SE per high dosage treatment strip as per cent of general mean: 19.9(6 d.f.)

Table 4

Yield performance of varieties averaging all treatments (1955 trials)

(Cwt/ac threshed peas)

Variety	Nassington		Postland	Mean of (a) and (b)
	Means over:			(± 3.82)
	low dosage treat-ments	high dosage treat-ments* (a)	high dosage treat-ments* (b)	
Zelka	26.5	26.9	29.7	28.3
Servo	29.0	27.3	33.6	30.5
Gregs. Surprise	10.2	10.1	12.8	11.5
Meteor	21.8	19.2	23.8	21.5
Thomas Laxton	13.7	13.5	10.6	12.1
Kelvedon Wonder	14.4	17.2	9.1	13.2
Lincoln	18.9	19.3	9.2	14.3
Charles I	21.9	25.4	11.3	18.3
Mean	19.5	19.9	17.5	18.7

SE per variety strip as per cent of general mean: 28.9 (7 d.f.)

* Excepting MCPA, ester.

General assessments of the effect of chemical treatments on weeds and pea varieties were made on several occasions following spraying. Results are summarised in Tables 1 and 2. Yields of dry peas were obtained at both sites (Tables 3 and 4) except in the case of the low dosage plots at Postland which suffered serious bird damage and were therefore discarded.

Field Experiments : 1956

In conjunction with May & Baker Ltd. experiments on Zelka (marrowfat) peas were arranged at two centres to test a range of dosages of the sodium salts of MCPA and MCPB (both separately and mixed), by comparison with dinoseb and inter-row hand-hoeing to simulate tractor tool-bar work. The sites were near Peterborough at Elton (clay) and Glass Moor (fenland peat). Chemical treatments, set out below, were completely randomised and replicated four times; each replicate also contained four hoed and four untreated plots. Each experiment this comprised 108 plots and individual plot size was 90 sq. ft at Glass Moor and 108 sq. ft at Elton.

Chemical Treatments Tested

Compound	lb/ac a.e.								
	0.5	0.75	1.0	1.5	2.0	2.25	3.0	3.5	4.0
MCPA, sodium (a)	x	x	x	x	x				
MCPB, sodium (b)			x	x	x		x		x
MCPA/MCPB mix ((a):(b)::1:7)		x	x	x	x		x		
Dinoseb, triethanolamine			x	x		x		x	

The dinoseb was applied at a volume of 50 gal/ac with the co-operation of A. H. Marks & Co., Ltd., using an Oxford Precision Sprayer(3). The other preparations were applied by means of a modified version of the field plot sprayer described by Carpenter et al. (4)

Spraying was carried out on 17th-18th May under dry soil conditions, the peas being 5 - 6 in. high with 5 - 7 expanded leaves. The weather at the time of application was dull and cool (ca. 58°F.) and was followed by several days during which the maximum air temperature did not exceed 60°F. Hoeing was done once at each centre at the end of May.

Weed counts were made immediately before the spray treatments were applied within a small permanently defined area (2 or 3 sq. ft) on each plot. The same areas were counted again two weeks (dinoseb treated plots only) and four weeks (all other plots) after the spraying date, the counts on the hoed plots revealing the effect on the weed population of this treatment two weeks after it was carried out. A further assessment was made of the effect of all treatments six weeks after spraying (four weeks after hoeing) but the counts were not made in the same areas, nor on all replications; the area counted on each plot was 9 sq. ft and was chosen at random. Results are presented in Tables 5 and 6, the weed species prior to treatment being as follows:-

Table 5

General results of weed counts : Elton, 1956

Principal species:		Scarlet pimpernel		Black bindweed		Wild carrot		Fat hen & Orache	
Treatment	Dosage lb/ac a.e.	Populations at intervals (after treatment dates) shown, in relation to first (pre-treatment) counts, expressed as % kills.							
		4 weeks	6 weeks	4 weeks	6 weeks	4 weeks	6 weeks	4 weeks	6 weeks
MCPA, sodium	0.5	30	79	22	77	34	88	50	67
(applied 18th	0.75	32	92	30	77	26	70	-20	17
May)	1.0	17	89	18	63	15	80	67	93
	1.5	31	69	27	83	53	88	35	84
	2.0	57	96	38	78	91	96	43	78
	Mean	32	89	27	77	38	83	34	69
MCPB, sodium	1.0	7	78	8	74	7	50	30	76
(applied 18th	1.5	27	84	15	92	-27	52	29	56
May)	2.0	25	88	4	83	13	57	0	67
	3.0	41	94	44	89	16	26	45	80
	4.0	39	92	25	86	9	60	9	76
	Mean	30	88	21	88	7	50	26	73
MCPA/MCPB 1:7 mix	0.75	15	79	-4	89	-18	4	37	78
(applied 18th	1.0	-1	64	4	52	6	18	21	84
May)	1.5	33	82	13	72	15	73	35	76
	2.0	24	90	10	63	0	38	50	57
	3.0	50	89	36	85	50	21	39	98
	Mean	27	83	15	72	8	39	35	80
		2 weeks		2 weeks		2 weeks		2 weeks	
Dinoseb, amine	1.0	81	89	36	86	-10	-26	30	88
(applied 17th May)	1.5	83	91	76	98	8	52	54	82
	2.25	83	89	83	93	29	87	-20	18
	3.5	98	96	100	96	24	68	65	87
	Mean	88	92	78	94	17	57	42	82
			4 weeks		4 weeks		4 weeks		4 weeks
Hoeing (on 28th May)		82	92	88	93	89	90	85	88
		4 weeks	6 weeks	4 weeks	6 weeks	4 weeks	6 weeks	4 weeks	6 weeks
Control (untreated)		3	71	9	68	-3	46	8	35

Table 6

General results of weed counts : Glass Moor, 1956

Principal species		Speedwell	Cleavers		Fat hen & Orache
Treatment	Dosage lb/ac a.e.	Populations at intervals (after treatment dates) shown in relation to first (pre-treatment) counts, expressed as % kills			
		4 weeks	4 weeks	6 weeks	4 weeks
MCPA, sodium (applied 18th May)	0.5	-29	-20	-136	50
	0.75	-32	0	-44	80
	1.0	-22	36	12	50
	1.5	-21	20	-27	83
	2.0	-35	6	45	55
	Mean	-28	10	-8	62
MCPB, sodium (applied 18th May)	1.0	-100	25	-83	-100
	1.5	-57	39	41	80
	2.0	-21	21	-37	78
	3.0	41	20	-35	69
	4.0	-50	40	30	86
	Mean	-32	29	-10	73
MCPA/MCPB 1:7 mix (applied 18th May)	0.75	33	25	48	0
	1.0	-12	50	8	73
	1.5	-29	6	-3	15
	2.0	11	30	36	43
	3.0	0	29	-7	45
	Mean	5	31	12	38
		2 weeks	2 weeks		2 weeks
Dinoseb, amine (applied 17th May)	1.0	96	7	63	33
	1.5	43	67	100	50
	2.25	91	88	100	82
	3.5	100	100	100	100
	Mean	81	64	89	59
				4 weeks	
Hoeing (on 31st May)		45	79	62	89
		4 weeks	4 weeks	6 weeks	4 weeks
Control (untreated)		-36	33	5	47

Table 7

Yields of threshed peas: Elton, 1956
Mean yield of experiment : 17.5 cwt/ac

Treatment	lb/ac a.e. 0.5	0.75	1.0	1.5	2.0 (±1.11)	2.25	3.0	3.5	4.0	Mean	
MCPA, sodium	18.8	16.5	17.1	16.4	17.6					17.3	
MCPB, sodium			15.7	16.0	15.1		15.3		12.9	15.0	(±0.50)
MCPA/MCPB 1:7 mix		17.1	15.7	16.9	18.5		16.6			16.9	
Dinoseb, triethanolamine			19.1	18.4		20.0		18.4		19.0	
Hoeing										20.2	(±0.56)
Control (untreated)										17.2	

SE per plot as per cent of general mean : 12.8 (84 d.f.)

Table 8

Yields of threshed peas : Glass Moor, 1956
Mean yield of experiment : 14.7 cwt/ac

Treatment	lb/ac a.e. 0.5	0.75	1.0	1.5	2.0	2.25	3.0	3.5	4.0	Mean
MCPA, sodium	14.2(3)	15.7(4)	13.1(3)	13.0(2)	12.7(4)					13.7(±0.60)
MCPB, sodium			16.1(3)	12.8(2)	10.9(2)		12.0(3)		16.0(3)	13.6(±0.66)
MCPA/MCPB 1:7 mix		14.2(1)	12.4(3)	11.6(4)	16.9(2)		11.8(4)			13.4(±0.71)
Dinoseb, triethanolamine			16.6(4)	16.1(1)		18.0(3)		19.5(2)		17.6(±0.84)
Hoeing										17.4(±0.60)
Control (untreated)										13.4(±0.68)

SE per plot as per cent of general mean : 15.9 (37 d.f.)

Standard errors: (1)±2.34; (2)±1.65; (3)±1.35: (4)±1.17

ELTON	Density ('000/acre)	Size
Main Species		
Scarlet pimpernel (Anagallis arvensis)	640	Up to 1 in. diameter
Black bindweed	228	0.75-4in. diameter, up to 4 leaves
Wild carrot (Daucus carota)	64	Up to 2 in. diameter
Fat hen)	60	1-6 in. diameter, up to
Common orache)		3 branches

Other Species

Buttercup, perennial sowthistle (Sonchus arvensis), knotgrass, toadflax (Linaria sp.), speedwell, chickweed, charlock, cleavers (Galium aparine)

GLASS MOOR

Main Species

Speedwell	107	Cotyledon stage to 1-2 in. high.
Cleavers	69	Cotyledon stage to 4-6 in. high.
Fat hen)	49	Cotyledon stage to 1-2 in.
Common orache)		high.

Other Species

Hempnettle (Galeopsis tetrahit), charlock, black bindweed, chickweed, knotgrass, shepherd's purse, wild oat (Avena fatua), groundsel, sowthistle, small nettle, white dead-nettle (Lamium album), cranesbill (Geranium sp.), willow weed, spurge (Euphorbia sp.), thistle.

A few days after spraying it was observed that the two highest rates of MCPA and the highest rate of the MCPA/MCPB mix had resulted in some contortion to the peas; the other treatments seemed to have had virtually no effect in this respect, although the highest rate of dinoseb had caused some scorch.

By mid-June the crops, in general, were well in flower but observations showed that the higher rates of MCPA, MCPB and the MCPA/MCPB mix had retarded flowering and growth (Glass Moor) as follows:-

Compound	Dosage lb/ac a.e.	ELTON Flowering (13th June)	GLASS MOOR Flowering (15th June)	GLASS MOOR Growth (15th June)
MCPA	1.0	rr	r	rr
	1.5	rr	rr	rr
	2.0	rrr	rr	rr
MCPB	3.0	r	U	U
	4.0	rr	U	U

Compound	Dosage lb/ac a.e.	ELTON Flowering (13th June)	GLASS MOOR Flowering (15th June)	GLASS MOOR Growth (15th June)
MCPA/MCPB mix	1.5	r	U	U
	2.0	rr	r	rr
	3.0	rrr	rr	rr

Key: r - slightly retarded; rr - moderately retarded;
rrr - considerably retarded (no flowers open);
U - apparently unaffected.

Both experiments were ultimately harvested for yield comparisons and results are set out in Tables 7 and 8. Yields obtained from some plots at Glass Moor had to be discarded owing to spray drift from the adjacent field crop which was treated with dinoseb.

Discussion

Effects on weeds

Reference to Tables 1 and 2 reveals that in the 1955 trials both rates of MCPB and 2,4-DB tested had only a moderate effect on the weed population at each site except in the case of charlock which was eradicated. 2,4,5-TB seemed to have virtually no effect at all beyond a partial kill of charlock. MCPA (sodium) was slightly better than MCPB and 2,4-DB but only succeeded in checking the majority of weeds which subsequently recovered. The butyl ester formulation of MCPA had a more drastic effect on the weeds (and peas) - especially at the high rate - but despite severe contortion and checking in general, some weeds succeeded in recovering as was to be expected. Dinoseb was the outstanding treatment, both rates giving an almost complete kill of weeds.

Direct comparisons are not valid between the two post-treatment weed counts (expressed as percentage kills) made on the 1956 experiments since they are not based on the same places within each plot. On the average of the rates tested, MCPA, MCPB and the MCPA/MCPB mix had given a 10-50% kill off the principal weeds at both sites (Tables 5 and 6) when counts were made four weeks after spraying. Exceptions were speedwell which appeared resistant to all three compounds, and wild carrot which was little affected by MCPB and the mixture of MCPA/MCPB. Degree of control normally improved with increasing dosage in all cases, but it was clear that for equivalent kill, the dosage of MCPB and MCPA/MCPB (1:7) required to be higher than for MCPA. 2 lb MCPA, for example, was comparable in effect to about 4 lb MCPB and 3 lb of the MCPA/MCPB mix. Bearing in mind that the air temperature at the time of spraying was below 60°F., dinoseb gave good results on the basis of counts made two weeks after application. It produced, on average, about an 80% kill of speedwell, scarlet pimpernel and black bindweed, a 60% kill of cleavers, and a 40 - 60% reduction in numbers of fat hen and common orache. Wild carrot was only partially controlled. Weed kill improved with increasing dosage. Hoeing was also extremely effective, resulting in an 80 - 90% destruction of all principal weeds except speedwell.

The last series of weed counts, carried out two weeks subsequently and presented as percentage kills in relation to the pre-treatment counts, suggested that the degree of weed eradication achieved at Elton by that time by

all chemicals and hoeing was generally of the order of 60 - 90%. At Glass Moor the population of cleavers increased on the plots treated with MCPA, MCPB and MCPA/MCPB mix and also, to a lesser extent, on the hoed plots. The dinoseb-treated plots, on the other hand showed a further improvement in degree of eradication. Numbers of the other principal weeds at Glass Moor - speedwell, fat hen and orache - could not be assessed on the final count owing to the dominance of cleavers.

Effects on peas

In the 1955 trials, all compounds tested had some effect on all varieties (Table 2) but in many cases it was of little or no consequence. Zelka and Servo were the most resistant, and Gregory's Surprise and (particularly) Thomas Laxton the most susceptible varieties. Triethanolamine dinoseb caused slight scorching - somewhat more pronounced at the higher rate (2 lb) - but all varieties later recovered. Scorching was less in evidence at Nassington.

MCPA resulted in serious distortion, more severe and accompanied by considerable scorching in the case of the butyl ester formulation. MCPB caused slight distortion initially, the sodium salt having the lesser effect. 2,4-DB was slightly more harmful than MCPB; at Nassington, Kelvedon Wonder and Lincoln were checked by 2,4-DB and all varieties subsequently developed elongated leaflets. 2,4,5-TB had virtually no effect.

Sodium MCPA at a rate of 1 lb and above and the 1:7 mixture of MCPA/MCPB at 2 lb and above retarded growth of the peas (Zelka) at Glass Moor to some extent in 1956. MCPB and dinoseb at all rates had no effect in this respect. Rates of MCPA and the MCPA/MCPB mix above 1 - 1.5 lb and 1.5 - 2 lb respectively delayed flowering at both centres and MCPB had a similar effect at 3-4 lb at Elton.

General

The combined effect of the control of weed competition and any injury to varieties is reflected in the yields. In the 1955 trials, due to lack of replication it was only possible to statistically examine differences between chemical treatments and differences between varieties. Owing to the type of layout used it was not possible to determine whether the low yield of a particular variety was associated with a particular treatment.

The effect of treatments over all varieties (Table 3), however, clearly indicated that dinoseb gave the highest yields. MCPA (ester) seriously depressed yield at the low dosage rate at Nassington due to damage to the crop. The high dosage almost completely destroyed the crop and plot yields were so low that they were discarded. MCPA (sodium) and the two MCPB formulations produced small increases in yield, while the high rates of 2,4-DB and 2,4,5-TB, somewhat depressed yields. Dinoseb and hoeing outyielded all the other treatments in the 1956 experiments (Tables 7 and 8). MCPA, MCPB and the MCPA/MCPB mix did not increase yield, probably because their herbicidal properties were offset by the effects of the higher dosages on the crop.

Examination of individual plot yields of the 1955 trials indicated that damage to varieties by dinoseb was only temporary whereas MCPA and the phenoxybutyric compounds had a permanent effect on certain varieties, reflected in yield depressions by comparison with the yields given by dinoseb and untreated control plots. The position may be summarised thus:-

Fairly resistant varieties (Yields little affected)

Zelka, Servo, Charles I

Susceptible varieties (Yields depressed)

Gregory's Surprise, Thomas Laxton

Intermediate varieties

Meteor, Kelvedon Wonder, Lincoln

The overall effect of all treatments on the yield of individual varieties (Table 4) supports these findings, although it is not possible in the construction of this Table to divorce differences in varietal susceptibility from inherent differences in yielding capacity.

Conclusions

In terms of herbicidal efficiency and yield increase normally associated with the reduction or elimination of the weed population, there is little to be said in favour of the phenoxybutyrics tested, although most of the principal weeds were species which had previously shown resistance or only moderate susceptibility to this group of compounds. 2,4,5-TB had virtually no effect on the weed species encountered, excepting charlock, while 2,4-DB though possessing greater herbicidal activity, had some effect on the crop. MCPB was less effective than 2,4-DB in regard to weed control but caused insignificant damage to the crop. Comparing yields, however, both the ester (1955) and sodium (1955-56) formulations of MCPB were not superior to MCPA (sodium) which, even at half the rate of MCPB, had a greater herbicidal effect than the latter. The 1:7 mix of MCPA and MCPB did not appear to have any advantage over the two compounds applied separately. The ester formulation of MCPA (1955) proved very toxic to both weeds and peas, especially at the 1 lb rate and, used alone, must be ruled out as a weedkiller for this crop.

Dinoseb and hoeing, as in other experiments (5,6,7), proved to be outstanding and similar in effect as regards weed eradication, least crop damage, and yield response. They still remain the most efficient means for controlling weeds in peas. MCPB formulations might be useful alternatives in certain instances where sodium MCPA can be employed: for example where the crop is being grown in narrow rows and the predominant weed species are very susceptible to MCPB and MCPA (sodium). Under such conditions it would doubtless prove more economic to use such compounds rather than dinoseb.

The experiments described also confirmed that differences in varietal susceptibility exist. Gregory's Surprise and particularly Thomas Laxton seemed the most sensitive to all the compounds tested in 1955 whereas other varieties, notably those grown for harvesting dry, appeared fairly resistant. Varietal differences due to spraying with dinoseb were only temporary but with MCPA and the phenoxybutyric compounds, the effects persisted and were reflected, to some extent, in the treatment yields obtained.

Acknowledgements

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THE EFFECT OF MCPB ON THE YIELD AND MATURITY OF VINING AND PICKING PEAS

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Summary

Field experiments were carried out on the effect of MCPB (sodium) salt at rates of 1.5-6 lb/ac on twelve varieties of vining and picking peas during 1955 and 1956. Yields were measured either as shelled peas or peas in pod, according to the chief use of the variety concerned.

Eight of the twelve varieties showed high tolerance, there being no significant decrease in yield at treatment rates as high as 3 lb/ac or even at 6 lb/ac in some cases. This represents a good safety margin for practical use in these varieties.

Two varieities, Meteor and Shasta, exhibited a borderline tolerance and further evidence is needed to establish whether the safety margin is adequate. Kelvedon Wonder was susceptible at dose rates slightly in excess of 2 lb/ac and the safety margin is not sufficient. Gregory's Surprise was susceptible at all the dose rates tried.

The maturity of the peas at harvest was measured by the Alcohol Insoluble Solids (A.I.S.) content. There was no significant effect of treatment on A.I.S. content in any variety, although there was a slight tendency towards an increase with dose level at the higher A.I.S. levels (16% and over).

Introduction

The possible use of the phenoxybutyric acids in the pea crop has been recognised from the beginning of their development.(1) The preliminary experiments with the more important members of this series carried out in 1954 indicated that MCPB was the most promising member.(2) More extensive field experiments were therefore laid down in 1955 and 1956 with various formulations of MCPB. The 1955 series of experiments confirmed the general usefulness and safety of the compound in crops with and without weeds, but indicated the importance of varietal response, particularly on vining and picking peas. The 1956 series of experiments were therefore aimed primarily at obtaining more information on this type of pea. The work on the effect of formulation has proved to be complex and the standard sodium salt solution has so far been the most generally satisfactory. The present report is therefore confined to results with this material.

Experimental method and results

(a) Layout

The 1955 experiments were in the form of simple randomised blocks, each experiment on a portion of a different commercial crop. A few of the 1956 experiments were of the same type but the majority of the information was gained from two large split plot experiments, each containing the same twelve varieties specially sown. As, however, only part of the experiments is being summarised here, the data from these more complex experiments has been split up for individual varieties and analysed accordingly. All experiments contained four replicates.

(b) Method of application

Treatments were applied through a motorised small plot sprayer (3) at a volume rate of 15 gal/ac of water in both years.

(c) Yield estimations

1955. The plots in this series were 4 ft 6 in. x 20 ft. An area 3 ft x 15 ft was used for sampling in each plot. The samples consisted of 12 ft x 1 ft depth of row, and the yields estimated either as shelled peas or peas in pod, according to the normal use of the variety concerned.

1956. In this series a wider boom was used giving plots of 6 ft x 20 ft for the single variety experiments, of which the sampling area was 3 ft x 5 ft. Yield samples consisted of 2 ft x 4 ft lengths of row from each plot.

In the combined variety experiments (87/1 and 87/2 in the Tables) the individual treatment-variety plots were 12 ft x 8 ft of which the sampling area was 6 ft by about 6 ft 6 in. arranged to cover the same number of rows throughout the plots. In experiment 87/1 the whole of the sampling area was taken for yields. In 87/2 however, drought and bird damage combined had given a very patchy stand and yields were based on 25 plant samples from each plot.

All peas were shelled on the day of picking or the following day. All pulling, podding and shelling operations were carried out by blocks to offset the effect of loss of moisture.

(d) Maturity estimations

As the 1956 experiments were concerned chiefly with canning and quick freezing varieties it seemed important to gather these at the correct stage of maturity and to measure the effect of treatment on the time at which this stage of maturity was reached. The Alcohol Insoluble Solids (A.I.S.) content was chosen as representing a practical method of assessing this. The A.I.S. content should reach about 12-13% for quick freezing varieties and 14-15% for canning varieties, although values up to 18% are often accepted for the latter.

The aim was to harvest each variety when the controls reached the appropriate stage and measure the A.I.S. content for each treatment yield.

This value is usually considered to change at the rate of about 1% per day so that the difference between the treatment and control values should give a measure of the effect on time of reaching correct maturity. Pre-harvest samples were taken in order to predict and plan for the probable harvest date.

Very uneven temperature conditions were experienced, however, which caused a very erratic rate of change (Table 3). This, coupled with some lack of experience in judging the fitness of this crop, resulted in some of the varieties being gathered rather too soon in the early stages of the experiment and the general speeding up of ripening later, resulted in some plots being left too long. In most of the experiments the peas were in fact at about the practical canning stage, rather than the quick freezing stage, although the difference is only normally two to three days.

Pre-harvest sampling consisted of the total yield from 24 plants per treatment spread over all four replicates. Harvest samples were taken from the peas shelled for yield estimations. About 25 g were taken from the bulked replicates for each treatment as it was impossible to carry out separate A.I.S. testing for each replicate. All samples were taken from blocks shelled on the day of harvesting only and either tested at once or immediately deep frozen for test within a day or two.

Table 1

Effect of MCPB on yield of vining and picking peas

Variety	Experiment No.	Date of Spray	No. of Leaves	Yield Assessed by weight of	Yield as percentage control after MCPB treatment in lb/ac						Weed Population per sq. yd
					1	1.5	2	3	4	6	
Alaska	87/1	24.5.56.	7	Peas	-	109	114	104	94	67**	None
Canner's Perfection (Early Strain)	87/1	24.5.56.	7	Peas	-	135**	101	111	104	102	None
	87/2	6.6.56.	5-6	Peas	-	98	90	90	78	82	None
Clipper	71/5	3.5.55.	8	Pods	122	102	107	93	-	-	38
Dark Skinned Perfection	71/29	26.5.55.	4-5	Peas	102	102	79	96	-	-	19
	71/31	26.5.55.	4-5	Peas	111	111	104	94	-	-	17
	87/1	24.5.56.	8	Peas	-	95	101	98	89	100	None
	87/2	6.6.56.	6	Peas	-	104	102	103	115	105	None
Gregory's Surprise	87/1	24.5.56.	6	Pods	-	77**	102	78*	61**	62**	None
	87/2	6.6.56.	7	Peas	-	73*	79	64**	69*	48**	None
Kelvedon Wonder	87/1	24.5.56.	7	Peas	-	97	91	89	84*	79**	None
	87/2	6.6.56.	8	Peas	-	90	82	74*	66**	68**	None
Lincoln	87/1	24.5.56.	6-7	Peas	-	109	103	99	114	103	None
	87/2	6.6.56.	7	Peas	-	103	116	110	95	93	None

* Significant difference from control at P = 0.05.

** Signfficant difference from control at P = 0.01.

Table 1 (Contd.)

Variety	Experiment No.	Date of Spray	No. of Leaves	Yield Assessed by weight of	Yield as percentage control after MCPB treatment in lb/ac						Weed Population per sq. yd
					1	1.5	2	3	4	6	
Meteor	87/1	24.5.56.	6-7	Peas	-	95	91	90	96	86	None
	87/2	6.6.56.	8	Peas	-	89	94	87	86	62*	None
Onward	71/33	2.6.55.	6	Pods	91	96	100	87	-	-	33
	71/39†	15.6.55.	3-4	Pods	125	107	128	95	-	-	31
	71/41†	22.6.55.	5-6	Pods	116	106	121	115	63	-	30
	87/1	24.5.56.	6	Pods	-	92	86	100	99	73**	None
	87/2	6.6.56.	5	Peas	-	113	88	105	111	90	None
Perfected Freezer	71/37	2.6.55.	2	Peas	103	91	102	85	-	-	19
	87/1	24.5.56.	6-7	Peas	-	95	116	104	91	91	None
	87/2	6.6.56.	5-7	Peas	-	88	110	123	86	100	None
Shasta	87/1	24.5.56.	6	Peas	-	95	95	82**	95	82**	None
	87/2	6.6.56.	5-6	Peas	-	94	72	87	85	91	None
Thomas Laxton	71/30	26.5.55.	5	Peas	130	109	136	92	-	-	12
	87/1	24.5.56.	6-7	Peas	-	101	105	106	89	107	None
	87/2	6.6.56.	8	Peas	-	113	107	102	104	80	None

* Significant difference from control at P = 0.05.

** Significant difference from control at P = 0.01.

† Same crops at different growth stages.

Table 2

Change in A.I.S. content with time and treatment in two varieties

Variety	Sampling Date	Appln. rate of MCPB in lb/ac			Control
		1.5	2	3	
Meteor	26.6.56.	10.6	10.6	9.1	9.9
	29.6.56.	11.4	11.0	11.5	11.7
	2.7.56.	15.1	15.7	15.5	16.0
Kelvedon Wonder	27.6.56.	8.3	7.6	7.9	8.6
	29.6.56.	8.7	8.0	8.0	8.5
	3.7.56.	10.4	10.3	10.0	10.4

Table 3

Effect of MCPB treatments on A.I.S. content at vining

Variety	Expt. No.	Appln. rate of MCPB in lb/ac					Control
		1.5	2	3	4	6	
Alaska	1	17.6	20.8	22.1	21.7	23.9	18.8
Canner's Perfection (Early Strain)	1	8.2	8.1	8.0	8.1	8.3	8.4
	2	13.0	15.1	14.8	14.6	13.1	14.8
Dark Skinned Perfection	1	15.0	14.7	13.8	13.9	14.4	13.9
	2	15.5	13.9	14.0	14.0	13.5	15.5
Gregory's Surprise	1	15.0	16.7	15.1	14.0	14.3	16.7
Kelvedon Wonder	1	10.4	10.2	10.0	9.5	11.6	10.4
	2	16.5	16.5	17.0	18.7	18.9	16.0
	3	13.2	14.3	13.2	14.4	-	12.9
Lincoln	1	18.6	19.8	18.3	18.7	16.6	17.9
	2	15.5	15.1	13.3	14.1	14.1	14.7
Meteor	1	15.1	15.7	15.5	16.0	16.8	16.0
	2	18.3	20.4	21.9	23.4	24.4	20.8
Onward	1	19.2	20.0	18.2	18.1	20.1	18.1
	2	13.3	15.6	14.4	13.5	14.1	15.9
Shasta	1	8.4	8.1	8.0	8.1	8.3	8.4
	2	13.0	15.1	14.8	14.6	13.1	14.8
Thomas Laxton	1	9.1	10.0	9.2	9.2	9.3	8.8
	2	16.8	15.5	17.6	17.6	15.6	15.4
Mean of all experiments		14.3	15.0	14.6	14.9	15.0	14.6

Discussions and Conclusions

Yields

Although there was a fair variation in the yields within the experiments, it is clear from an examination of the higher dose levels that certain varieties were very resistant. These were Alaska, Dark Skinned Perfection, Lincoln, Onward, Perfected Freezer and Thomas Laxton. Canner's Perfection and Clipper are also highly resistant but the results so far are not so conclusive. All these varieties appeared to be able to withstand treatments of at least 3 lb/ac without any significant loss of yield. The variety Meteor seemed to be slightly more susceptible than these as it showed a small but non-significant decrease in yields at all rates up to 4 lb/ac in both experiments. Shasta appears to have a similar degree of susceptibility to Meteor.

The variety Kelvedon Wonder was rather more susceptible still, since in both experiments recorded here it showed a definite decrease at 3 lb/ac and above. In two very late crops of Kelvedon Wonder, for which the results were not complete at the time of writing, the reductions in yield appear to be even greater. This variety is a borderline case and the safety margin at the normally recommended dose of 2 lb/ac is too small for safe use of MCPB.

Gregory's Surprise is definitely susceptible at all rates of application and MCPB cannot be recommended for use in this variety under any circumstances.

Maturity

The term maturity has been considered more from the canners' and quick freezers' point of view, that is to say the stage at which the peas in the pod have reached the correct degree of maturity for processing. In general terms, no rates of MCPB had any significant effect on maturity in this sense as measured by the A.I.S. content. There is however a very slight tendency in many of these experiments for the MCPB treatments to produce a higher A.I.S. content at the higher levels of maturity. There is also a slight tendency for this advancement of maturity to increase with dose rate.

Maturity can be considered in another sense, however, that is the date or the stage at which there is an economic weight of peas fit for picking. In those varieties where no significant change in A.I.S. content is accompanied by no significant drop in yield it can be assumed that maturity in this sense is also not affected. Where there is a significant drop in yield, however, this can be due either to some permanent damage to the plant which would result in a decrease of yield even of dry peas, or simply a delay in filling out of the pods. This might not necessarily be shown up fully by the A.I.S. content since the younger and almost empty pods do not make a very large contribution to the estimation of this value.

As yet uncorrelated data from these experiments on the proportion of immature pods and pea/vine ratio, may throw further light on this aspect of the problem.

We should like to thank our colleagues Miss B. Campbell, for her work on A.I.S. content and Miss H. Cottrell for her help in the organisation of the 1956 yield assessments.

We are also indebted to Mr. W. B. Adam of the Chipping Campden Research Station for his advice on the measurement of maturity.

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WEED CONTROL IN PEAS WITH DINOSEB AND PHENOXYBUTYRIC ACID DERIVATIVES

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Summary

The results reported in this paper deal with a series of trials designed to investigate the susceptibility of various varieties of peas to MCPB, 2,4-DB and dinoseb and to compare the efficiency of all three chemicals as weedkillers.

In part A, a series of 9 field trials, yield depression following spraying with MCPB was noted on Gregory's Surprise but the vigour of several other varieties was reduced. Dinoseb in general gave a better control of weeds than MCPB.

In part B, designed to test the reaction of 13 varieties of peas to MCPB and dinoseb, the yield of Thomas Laxton only was depressed following spraying with MCPB though epinasty was observed on several varieties, especially when sprayed at the later stage. Dinoseb had no effect on crop yield but the ammonium salt scorched the peas more severely than the amine.

Introduction

Professor Wain's work on MCPB indicated that peas might not be susceptible to damage from this chemical and other reports indicated that some pea varieties varied in their susceptibility to MCPB.

PART A

Experimental layout

9 trials on 8 varieties of peas were laid down. Each trial consisted of 4 randomised blocks, each plot being 12 yd x 4 yd. The treatments used were MCPB and 2,4-DB at 20, 28 and 36 oz a.e. applied in 20 gal/ac of water and dinoseb amine and ammonium salts at 1, 2 and 3 lb in 40 gal/ac of water.

Assessment methods

Visual gradings of crop and weed vigour were the main methods of assessment. Counts were made where the crop appeared severely reduced and where weed cover was even enough to warrant them.

Three trials were harvested. In one (2), where the peas were grown in wide drills, 12 ft run of row was harvested per plot to give yield data. In the second (7) on peas grown for marketing, the whole plot was picked. In the

third trial (6) where the peas were to be harvested dry, all the pods from two yard squares per plot were picked.

The results were statistically analysed where it was considered worthwhile. Crop vigour, counts and yield have been expressed as a percentage of the untreated control; weed gradings and counts have been expressed as a percentage check.

Experimental results

(a) Effect on crop

Meteor (1) was severely checked by 20, 28 and 36 oz 2,4-DB. The stand of Gregory's Surprise (2) was reduced by 28 and 36 oz and growth checked by all rates of 2,4-DB.

MCPB was used in all nine trials. The vigour of Meteor (1), Gregory's surprise (2), Harrison's Glory (4), Rondo (6) and Onward (9) (in one trial only) was depressed by all rates.

Dinoseb(amine), also used in all the trials, depressed the growth of Meteor (2) at all rates and the growth of Harrison's Glory (4) was checked by 2 lb/ac but not by 3 lb/ac. Onward (9) was checked by 3 lb/ac.

In the three trials (3, 4 and 8) in which dinoseb ammonium salt was used the growth of Harrison's Glory (4) was checked by 3 lb/ac.

(b) Effect on weeds

MCPB at all rates gave a better weed control than 3 lb dinoseb amine in one trial (3) and comparable control in another (9). In one trial (1), 2,4-DB gave a comparable weed control to MCPB.

There was little difference in weed control between 20, 28 and 36 oz MCPB and rarely was the weed control over 50%. The stand of charlock (Sinapis arvensis) was reduced by at least 90% in two trials (1 and 4) by MCPB at all rates, 2,4-DB gave an equivalent control in one trial (1). Mayweed (Anthemis spp.) was resistant to all rates of MCPB (1 and 2). Fat hen (Chenopodium album) (2, 3 and 6) was checked by all rates of MCPB. Creeping thistle (Cirsium arvense) (6) was efficiently suppressed by 28 and 36 oz MCPB. Knotgrass (Polygonum aviculare) (5) was better controlled by MCPB especially at 36 oz a.e. than by all rates of dinoseb amine.

Dinoseb amine at 1, 2 and 3 lb gave a better weed control than the ammonium salt in two trials (3 and 4). It was especially noticeable that dinoseb ammonium salt at all rates gave a poor control of charlock in one trial (4).

(c) Effect on yield

Gross yield was assessed by weighing the total sample harvested from each plot. Sub-samples of 100 pods were weighed, shelled and the peas weighed. These figures gave a measure of the delay in ripening. In two trials (2 and 6) the number of pods harvested per plot were counted to give a measure of any check to flower production.

All rates of MCPB and 2,4-DB and 3 lb dinoseb amine depressed the gross yield and delayed the ripening of Gregory's Surprise (2). 1 and 2 lb dinoseb (amine) had no effect on yield.

Neither MCPB nor dinoseb(amine) had any significant effect on the yield of Rondo (6), although the treated plots apparently yielded considerably more than the untreated.

Onward (7). The entire plot was harvested and the treated plots showed a slight but not significant increase in yield over the controls.

PART B

Experimental layout

A single replicated small plot experiment was laid down on thirteen varieties of peas sown on 24th April; the plots measured 53 ft x 4 ft and consisted of four rows of each variety. There was a complete randomisation of treatments and pea varieties in each of four replicates.

The treatments used were MCPB at 20, 28 and 36 oz a.e. in 40 gal/ac of water, dinoseb amine salt and dinoseb ammonium salt at 1, 2 and 3 lb active ingredient in 40 gal and 80 gal/ac of water respectively.

MCPB was applied at two stages of growth (a) when all varieties had reached the three to four leaf stage and (b) when, according to the variety, the peas had grown to a height of 6 to 10 in.

Both dinoseb formulations were applied at the 3 to 4 leaf stage.

Assessment methods

Visual gradings for scorch, epinasty and crop vigour were made on each variety in each plot. Nine varieties were harvested, all the pods were picked from 1 sq. yd per variety per plot and each variety was treated as a separate entity. All the pods from each plot were weighed. To determine any delay in ripening one hundred pods from each square yard sample were shelled and the peas weighed.

Experimental results

(a) Effect on Crop Growth

MCPB Early Application:

At 36 oz/ac a.e. moderate initial epinasty developed on the varieties Thomas Laxton, Gregory's Surprise and Emigrant, but with lower rates damage was only slight.

MCPB Late Application:

At all rates of application there was definite epinasty on all varieties, but Rondo, Servo and Big Ben were the least susceptible. After three weeks, however, all varieties had outgrown the damage, and no depression in crop growth was apparent.

Dinoseb (amine):

This was comparatively safe on all varieties, but at 3 lb/ac a.e. slight scorch developed on Thomas Laxton, Alaska, Onward, Kelvedon Wonder, Large Dutch Blues and Meteor; this was completely outgrown after two weeks.

Dinoseb (ammonium):

Thomas Laxton, Gregory's Surprise, Onward, Alaska and Large Dutch Blues were severely scorched at 2 and 3 lb/ac a.e. but had recovered seven weeks after spraying.

(b) Effect on yield

MCPB caused no apparent depression of gross yield i.e. yield of unshelled peas from the 1 sq. yd quadrat sample, nor were any differences found between early and late applications. MCPB, when applied at the 3 to 4 leaf stage delayed ripening of Thomas Laxton; this was shown by the reduced weight of peas from 100 shelled pods.

Although dinoseb (ammonium) caused severe damage to several varieties in the early stages of growth, it did not reduce the gross yield. Dinoseb (amine), although less phytotoxic to pea foliage than the ammonium salt, did not increase the gross yield.

No analysis of variance was calculated, as the yield data were so similar from plot to plot. Chi-squared tests were carried out to find the general trend in yield throughout the trial; also one 't' test on Thomas Laxton (See Table 6).

Conclusions

1. Gregory's Surprise and Thomas Laxton are susceptible to MCPB at rates of 28 oz/ac a.e. and above. Flower production is not affected but maturity is considerably delayed. This delay in maturity seems to be the main effect of MCPB on peas.

2. Damage by 2,4-DB is more severe than by MCPB. The stand of Gregory's Surprise was reduced by rates of 28 oz/ac a.e. and above.

3. Dinoseb (amine) had a depressant effect on the crop vigour only after application at the flower bud stage. Yield of Gregory's Surprise is reduced by 3 lb/ac a.e.

4. The ammonium salt of dinoseb damages the crop more severely than the amine, but this is not reflected in yields.

5. The weedkilling potentialities of MCPB and 2,4-DB appear to be similar.

6. Fat hen and creeping thistle are as well checked by MCPB as by dinoseb (amine). Other weeds especially charlock are better controlled by dinoseb than by MCPB.

Table 1 — Crop grading as percentage of control

Variety	Stage of Growth Leaves	Trial No.	Days after Spraying	oz MCPB			oz 2,4-DB			lb dinoseb (amine)			lb dinoseb (ammonium)			C of V	Sig.Diff.	
				20	28	36	20	28	36	1	2	3	1	2	3	%	5%	1%
Meteor	2 - 3	1	15	78	80	68	60	53	52	94	76	77				13	14	19
Gregory's Surprise	3 - 4	2	15	90	71	68	78	73	69	118	108	98				21	26	36
Not known	3 - 4	3	22	97	91	95				99	94	94	98	95	95	-	-	-
			43	98	98	103				100	100	103	99	100	104	-	-	-
Harrison's Glory	4 - 6	4	22	94	90	93				98	86	96	100	95	89	5	7	9
			43	81	79	81				108	95	109	92	93	89	10	14	19
Feltham First	4 - 6	5	15	100	100	100				100	100	100				-	-	-
Rondo	4 - 6	6	22	95	98	98				100	100	98				-	-	-
			43	85	85	80				94	100	96				10	14	N.S.
Onward	4 - 6	7	31	100	100	100				100	100	100				-	-	-
Not known	Just Flowering	8	14	94	95	94				100	90	77	95	81		3	10	14
			29	94	92	92				97	90	82	96	92		5	7	9
Onward	2 - 5	9	16	84	79	81				92	96	88				10	13	N.S.

Table 2 — Crop counts as percentage of control

Gregory's Surprise	3 - 4	2	35	93	88	90	90	77	84	85	91					9	12	N.S.

Table 3 — Weed gradings: Expressed as percentage of control

Variety	Stage of Growth Leaves	Trial No.	Days after Spraying	oz MCPB			oz 2,4-DB			lb dinoseb (amine)			lb dinoseb (ammonium)			C of V	Sig.Diff.	
				20	28	36	20	28	36	1	2	3	1	2	3	%	5%	1%
Meteor	2 - 3	1	15	47	49	42	47	40	46	73	81	83				4	11	14
Gregory's Surprise	3 - 4	2	15	Clean crop														
Not known	3 - 4	3	22	42	53	37				49	67	74	39	68	40	35	28	37
Harrison's Glory	4 - 6	4	22	60	63	69				53	76	88	16	33	63	23	16	22
			43	65	62	62				31	56	82	6	25	64	26	22	29
Feltham First	4 - 6	5	15	47	35	60				0	30	35				-	-	-
Rondo	4 - 6	6	27	63	67	47				37	77	77				53	38	51
			81	74	67	66				42	60	64				51	36	49
Onward	4 - 6	7	21	Clean crop														
Not known	Just Flowering	8	14	49	29	43				53	74	60	46	70		33	27	36
			29	34	26	33				21	51	45	36	66		40	15	21
Onward	2 - 5	9	16	57	46	60				27	69	69				41	33	45
Table 4		Gross yield results: total harvested expressed as a percentage of control																
Gregory's Surprise	3 - 4	2	61	85	84	73	72	65	64	96	80	73				14	16	21
Rondo	4 - 6	6	83	115	126	124				131	121	132				15	N.S.	N.S.
Onward	4 - 6	7	50	103	115	115				118	110	117				9	N.S.	N.S.
Table 5		Weight of peas from 100 pods as percentage of control																
Gregory's Surprise	3 - 4	2	61	87	79	78	70	60	60	110	92	78				12	14	19
Rondo	4 - 6	6	83	Harvested dry														
Onward	4 - 6	7	50	104	105	92				91	92	96				-	-	-

Table 6

Effect of MCPB and dinoseb on peas

All Treatments expressed as Percentage of Control

Pea Variety	MCPB Early Application			MCPB Late Application			Dinoseb Amine salt			Dinoseb Ammonium salt		
	a.e./ac			a.e./ac			a.e./ac					
	20 oz	28 oz	36 oz	20 oz	28 oz	36 oz	1 lb	2 lb	3 lb	1 lb	2 lb	3 lb
Effect on Yield												
Thomas Laxton	103	104	88	98	99	118	109	112	116	114	96	112
Onward	89	96	99	107	115	100	104	115	109	107	107	103
Gregory's Surprise	102	99	104	113	100	109	108	106	102	109	97	88
Alaska	103	99	102	117	100	103	96	101	108	102	90	88
Kelvedon Wonder	115	92	119	106	99	93	102	101	98	110	110	110
Meteor	79	103	112	110	99	113	75	61	82	111	109	111
Servo	101	122	102	128	102	122	101	123	118	100	118	108
Emigrant	93	101	110	111	119	110			Not Harvested			
Big Ben	108	129	102	114	115	122			"	"		
Effect on Ripening												
Thomas Laxton	93	54	54	103	102	111	115	104	96	102	90	105
Onward	93	111	108	111	119	119	113	128	122	116	116	111
Gregory's Surprise	99	89	95	117	123	125	112	105	101	108	93	103
Servo	94	110	102	110	100	114	97	106	99	96	102	105
Emigrant	96	112	105	107	109	101			Not Harvested			
Big Ben	93	115	112	110	110	84			"	"		

DISCUSSION ON THE PREVIOUS THREE PAPERS

Mr. K. Carpenter (Introduction to discussion)

Yield

Peas

1. Varieties

Altogether about fifteen varieties were treated and some differences in varietal response were noted. Most varieties are similar but two or three, e.g. Kelvedon Wonder and Meteor, have a borderline tolerance which is shown up at higher dose rates or in unfavourable conditions. All papers agreed that Gregory's Surprise had the lowest tolerance to MCPB.

There is a difference in views concerning the effect of MCPB on Thomas Laxton, and the question arises here whether this is due to differences in growth stage and maturity. There may be the possibility that early maturing varieties are more sensitive.

2. Relative Effect of MCPA

On threshed peas, yield is not significantly different (Reynolds). No direct comparison has been made on vining peas.

Vining peas are harvested long before full maturity at maximum yields, with an interval perhaps of only 4-5 weeks between spraying and harvest. In these circumstances, it is usually considered that the check caused by MCPA is too great to prevent sufficient recovery in such a short time. If the peas are left a further four to five weeks for dry harvest there is often time for this initial check to be overcome.

3. Dinoseb

The only comparisons on weed free crops are those given by Mr. Hirst, and these show no real differences.

Mr. Reynolds has demonstrated consistently high yields with dinoseb in circumstances where weed stands of hormone resistant species occur.

Maturity and Check to Development

This has been measured in three ways:-

(a) Effect on vigour or height of crop, as judged visibly

(b) Effect on weight of peas per 100 pods

(c) The Alcohol Insoluble Solids (A.I.S.) content.

All three methods are open to criticism.

We have found, in data still being analysed, that:-

(a) Effect on Vigour, etc.

Height and vigour are frequently reduced as compared with control and dinoseb, (e.g. in Onward and Dark Skinned Perfection), but this is not accompanied by a reduction in the number of pods produced or in the yield of these varieties.

(b) Effect on Weight of Peas per 100 Pods

In some of the weedy crops we have examined in detail, there has been an increase in the number of both immature and mature pods, which is proportionately greater for the immature pods. Pea weight per pod has thus decreased as compared with controls, but pea weight per mature pod has in all these experiments remained unchanged, and yield increase has been proportional to the increase in number of mature pods.

In completely weed free crops, however, the pea weight per pod could be expected to be a measure of maturity provided that the crops are harvested before the maximum yield point is reached.

(c) A.I.S. Method

This method is open to criticism only in circumstances where a relatively small number of mature peas are present by weight against the large number of immature peas. No loss in yield and no difference in A.I.S. content means that maturity cannot be materially affected in the practical sense. In fact, differences in maturity due to treatment were less than differences due to soil factors, aspect, etc.

However, there is undoubtedly a check to growth following spraying, and there is some evidence that in very late sown crops of early varieties, i.e. those due for vining in late August or September, the delay can be aggravated by this slowing down in growth rate. In main crops it would appear to have no significance.