OBSERVATIONS ON THE CONTROL OF WEEDS IN PEAS FOLLOWING EXPERIMENTS CARRIED OUT FROM 1948-1953

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Summary

The original aim of the investigation was to find a chemical weedkiller suitable for the pea crop but the work developed mainly into a comparison between dinoseb and hoeing. On the whole, though yields were equal, dinoseb gave somewhat greater weed kill than mechanical hoeing. The cost of a single hoeing by tractor tool bar may be reckoned at 7/6d. per acre while the cost of contract spraying with dinoseb is between £3 - £4 per acre: the economic advantage of the former method is obvious.

MCPA as a 1% powder seemed useful for the control of charlock at rates less than 2 cwt. per acre. There is a good case for the inclusion of a little liquid MCPA with dinoseb where brown mustard is prevalent but in other circumstances it is likely to be very detrimental to the crop.

Introduction

Weeds have always been a major problem in pea growing. The open sprawling habit of growth of the plant makes it a very poor smother crop; it neither forms a dense canopy nor does it grow erect above the weeds. Apart from the unsightliness of a weedy crop, enough to injure the pride of any good farmer, they take away a great deal of his profit.

Hand hoeing - the traditional method of cleaning peas - having become too expensive, and since the mechanical hoe leaves so many unsightly weeds in the row, there arose a considerable demand for a chemical weedkiller for peas following the success of MCPA and DNC in cereals. Both these materials were tested for peas by both farmers and contractors, but far too many cases of serious crop damage occurred, even when quite low dosages were applied.

Experimental Work

In 1947 the Home Grown Threshed Peas Joint Committee tested 1% MCPA powder at various rates and stages of crop growth. No yields were obtained but it appeared that up to 2 cwt. per acre did little damage to the crop while giving quite promising control of weeds.

1948

In that year the Home Grown Threshed Peas Joint Committee and Messrs. Pest Control Ltd., began a joint programme of full scale replicated field trials.

The first step was to compare those weedkillers thought likely to have some value in the crop and the work is summarised in Table I. Dinoseb was applied at the rate recommended by the (U.S.A.) manufacturers, DNC at half normal corn strength and liquid MCPA at full strength.

TABLE I

	Treatment	Percentages of active ingredient	Dosage per acre	Yields (cwts. per acre) Mixed weed centre	Brown Mustard centre
1.	Control (Hoed late)	-	-	6·2	10·0
2.	DNC	10%	1 gal.	6·2	10·5
3.	Dinoseb	27%	3 pts.	8·0	9·0
4.	MCPA liquid	10%	1 gal.	4·8	11·4
5.	" powder	1%	1 cwt.	6·5	6·9
6.	" "	1%	2 cwt.	7·0	10·3
	Significant difference (P = 0.05)			1·5	-

Note: All work was carried out on marrowfat peas while, except where otherwise stated, all spray treatments were applied at high volume (60-100 gal. per acre) and low pressure (approx. 30 lbs. p.s.i.) and the ammonium salt of dinoseb employed. All powder applications were made by hand.

Chemical treatments were applied when the peas were 5" high at the mixed weed site (heavy soil) and 11" high at the other site (silt). The weeds at the former site were small when treated while at the latter, the brown mustard was well-established with some plants nearly at crop height. At both sites the crop was in wide rows so that little damage was caused by the wheels of the spraying machine.

Treatment yields were clearly a function of both weed control and crop damage and were closely related to weed density (estimated visually) at harvest.

The results at the brown mustard site were not considered to be of high value owing to experimental error, lateness of treatment in relation to weed size and the predominance of a single localized weed species. The trial did indicate that brown mustard is resistant to dinoseb though susceptible to liquid MCPA. From both experiments it would appear that the lower rate of MCPA powder was insufficient, but that 2 cwt. per acre showed some promise.

The striking feature with respect to the mixed weed centre was the complete superiority of dinoseb over the other materials under test. Although DNC gave a better initial kill of weeds, it so damaged the crop that it was unable to smother new germinations of weeds. Liquid MCPA visibly checked the crop. In contrast, dinoseb killed the bulk of the seedling weeds, principally charlock, fathen and black bindweed, and left a remarkably clean and healthy plant, which contrasted strongly with the rest of the treatments throughout the season.

1949.

DNC and liquid MCPA were excluded from the 1949 work on the evidence of the preceding year, but MCPA powder was thought to warrant further investigation since such a material could be readily applied with equipment found on most farms.

From that season onwards, sprays were applied by means of a small, hand propelled machine, mounted on bicycle wheels with spray pressure obtained by means of compressed air. This was constructed by Pest Control Ltd., and made it possible to employ smaller plots and also to reduce wheel damage to the crop.

Treatments were applied at two stages of crop growth and it was decided that more realistic comparisons could be made by including plots hoed, according to the practice of the farm where the trial was sited, besides untreated controls. The dosage of dinoseb was adjusted according to weather conditions.

TABLE II

Height of peas and weeds (in brackets) at time of:-		Charlock centre	Knotgrass and Chickweed centre	Low weed population centre
Early application:-		5" (5" across)	3½" (6" high: 8" across)	14"
Late application:-		16" (18" high)	12" (large)	24" (in flower)
Treatment	Dosage per acre	Yield (cwts. per acre)		
1. Control	-	26.4	19.5	19.3
2. Hoed (twice)	-	30.2	25.7	-
3. Dinoseb	1-1.7lb Early	30.4) 30.1	24.5) 23.0	18.9) 18.4
	Late	29.8)	21.5)	17.9)
4. 1% MCPA powder	1.5cwt. Early	29.9) 30.2	18.3) 18.8	19.3) 18.9
	Late	30.4)	19.3)	18.4)
5. "	2.5cwt. Early	29.7) 30.3	20.4) 19.4	19.2) 18.2
	Late	30.9)	18.5)	17.2)
Significant difference (P = 0.05) between:				
(i) Control or Hoed, and any other main treatment		1.1	3.3	-
(ii) Control and Hoed		1.3	3.8	-
(iii) Between any main treatment other than Control and Hoed		0.9	2.7	-
(iv) Early and Late applic.		-	-	1.2

At the site where charlock predominated it would appear that this weed was satisfactorily controlled by all treatments even though there was considerable variation between treatments in their degree of eradication. At the knotgrass/chickweed site, there were insufficient MCPA-susceptible weeds for this material to do much good and there was so much dinoseb-resistant knotgrass that hoeing far outyielded this treatment. At the third centre, the whole area had been hoed before the trial was established, and treatments were applied at a late stage in crop growth. The only fact which emerged was that very late applications are likely to give even more inferior results than late application. At all centres early application of dinoseb gave better results than late application, especially at the centre where resistant weeds (knotgrass and chickweed) predominated.

1950

In order to undertake a greater number of trials and to do them more efficiently the design was simplified and the sites were obtained in the Huntingdon area. All trials were on heavy soil with the exception of B, which was on a light loam. Treatments were applied when the weeds were small and dinoseb dosage adjusted according to weather and growth conditions. Only one rate of MCPA was considered necessary since there was very little difference between the rates tested in 1949.

TABLE III

Yields in cwts. per acre

Centre	Height of peas at time of treatment	Control	Dinoseb (dosage given in brackets as lbs. per acre)	MCPA (2 cwt. per acre 1% powder.)	Hoed (Once except A)	Significant difference (P = 0.05)
A	5"	4·3	6·6 (2·0)	5·3	9·8	4·7
B	7"	16·0	18·7 (1·7)	14·7	18·2	2·4
C	3½"	3·4	1·0 (1·9)	0·5	2·0	1·2
D	4"	8·5	13·4 (1·2)	7·7	11·8	2·3
E	3½"	9·1	18·0 (1·7)	14·0	17·2	3·5

Centre C became so waterlogged that growth was severely stunted. The yield data might suggest that treatment aggravated the bad conditions unless the higher yield of Control is due to the uncontrolled charlock holding the peas off the wet soil. The results obtained from this centre may well be ignored.

With regard to the other centres it would appear that in general dinoseb gave the best results, followed closely by a single hoeing. MCPA powder gave very poor results; only where charlock was present (sites A and E) did it out-yield controls. At centre E charlock was the dominant weed and the increase over control was very appreciable. Although lower yields from MCPA than dinoseb might have been expected in view of the presence of resistant weed species, there is clear evidence from sites B and D that the MCPA has a severe depressing effect on the crop itself. Such an effect had not been revealed in the previous seasons' work and may well have been due to weather conditions.

Costings

Treatments were costed according to conditions prevailing on the farms where the trials were conducted. None of these farmers possessed a high volume sprayer so that a typical contractor's charge according to field size, was employed, but for comparison, the cost when using a farm sprayer is included (1).

MCPA powder is reckoned as having been applied by the farmers' own manure distributors. The resulting crop was valued according to waste content, employing current contract prices.

Treatment costs (approx.)

Dinoseb:	by contractor	£3	14	0d.
	by farmer	£2	5	6d.
MCPA		£1	17	6d.
Horse hoeing			10	6d.
Tractor hoeing			4	0d.

Profit from Treatments

Centre:-		A £	A s	A d	B £	B s	B d	C £	C s	C d	D £	D s	D d	E £	E s	E d
Dinoseb:	by contractor	1	13	0	3	12	0	-9	0	0	7	4	0	20	7	3
	by farmer	3	1	6	4	18	6	-7	13	6	8	10	6	21	15	9
MCPA			7	4	-5	10	0	-8	5	2	-3	9	3	10	11	7
Hoeing		9	13	8	5	9	10	-3	10	4	5	3	0	21	18	6
		(4 times by horse hoe)			(by tractor tool-bar)			(by tractor tool-bar)			(by hand)			(by tractor tool-bar)		

When expressed in these terms, the economic advantage of hoeing over contract spraying is placed beyond doubt, as is also the superiority of dinoseb over MCPA.

1951

Three different experiments were carried out in that year. One dealt with in a separate paper (2) concerned the application of dinoseb at different volumes and pressures, the second was an attempt to find a cheap material for the control of charlock and the third to compare several materials, not hitherto tested in this investigation, on a mixed weed population.

In the first trial it may be noted that hoeing gave only half the yield increase given by the best dinoseb treatment. This is at least partially due to the fact that the plots could not be arranged to coincide with whole drill widths, thus making toolbar hoeing very difficult.

Charlock Centre

TABLE IV

	Treatment	Dosage per acre	Extent of charlock control	Yield (cwts. per acre)
1.	Control	-	-	1·3
2.	Potassium cyanate	7½ lbs @ 60 gal.	Very poor	1·5
3.	Cupric sulphate	20 lbs. @ 60 gal.	Poor	1·1
4.	Cupric chloride (75%)	15 lbs. & 100 gal.	Fairly good	1·3
5.	MCPA	2% powder @ 1 cwt.	Very poor	1·0
6.	Dinoseb	1.0 lb. @ 60 gal.	Fairly good	2·0
7.	Hoed (once)	-	Fairly good	3·0
	Significant difference (P = 0.05)			0·8

Treatments were applied when the peas were 4 inches high and the charlock up to 6 inches across, except MCPA which, on the manufacturer's advice, was applied later, the peas then having doubled their height and the charlock being up to 12 inches high and in flower. Growth conditions were exceptionally poor and resulted in very low and irregular yields. The charlock was abnormally hard and resistant due to drought conditions which persisted, and was therefore killed with difficulty even by dinoseb. Although in these circumstances the results were of little value, the poor control of charlock given by treatments 2, 3 and 4 indicated that, in view of their price, they were not sufficiently promising to warrant further testing. Hoeing and dinoseb gave very similar degrees of weed kill but though the latter did not appreciably damage the peas, the former gave a much better yield; it is conjectured that hoeing may thus have increased yields by improving soil conditions.

Mixed Weed Centre

TABLE V

	Treatment	Dosage per acre in lbs.	Extent of Weed Control	Yield (cwt./acre.)
1.	Control	-	-	2.7
2.	Sodium isopropyl xanthate	10·0	Very poor	3·7
3.	Potassium cyanate	7·5	Poor	3·9
4.	Dinoseb (ammonium salt)	2·04	Very good	7·3
5.	" (sodium salt)	2·46	Good	6·6
6.	" (triethanolamine salt)	3·44	Excellent	7·5
7.	Hoed (once)	-	Fair	6·5
	Significant difference (P = 0.001)			3·0

The crop at time of treatment was 3-4 inches high and the weeds quite small. The low yields were the result of the summer drought.

Treatments 2 and 3 can be seen to have been valueless, and since higher dosages would have been uneconomical, these materials were not considered to be of further interest.

Treatment 4 was applied at twice the intended dosage, yet caused no damage to the crop. It was originally intended to apply treatments 5 and 6 at twice and three times respectively, the rate for treatment 4. Although treatment 6 proved more selective than 4, a greater dosage was necessary to attain this end. Hoeing was done under the same difficulties that prevailed at the volumes/pressures centre; in the rest of the field hoeing gave an even cleaner plant than treatment 6.

1952-53

Although the work in these two years was concerned with the low volume application of dinoseb (2) it is relevant to report here on hoeing versus dinoseb. Of the three trials carried out in 1952, a single hoeing outyielded the best of the dinoseb treatments at two centres. The third trial was laid down on the field which provided the brown mustard centre in 1948. This weed again predominated and in spite of good initial kills by most treatments, the whole trial was eventually smothered. The rest of the field, however, was sprayed with dinoseb containing a little MCPA; as a result hardly any brown mustard survived.

Of the three trials completed in 1953, hoeing was carried out at two sites and gave slightly higher yields than the best dinoseb treatments. At one of the centres there was some evidence that the benefits of hoeing were not due to weed kill alone, but to improvement of the condition of a heavy soil. At the third centre, sown in narrow rows, harrowing was done in place of hoeing and gave no yield increase.

DISCUSSION

This investigation has shown beyond doubt that of the materials tested, dinoseb is the only one really suitable for controlling weeds in marrowfat peas. Evidence from the 1949 trials (supported by other work (3) and practical experience of contractors) indicates that it should be applied when the weeds

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are small. Although no work was done on dosage in relation to weather and growth conditions, the dosages employed (except in 1948) were calculated according to the field experience of Messrs. Pest Control Ltd. Since no case of crop damage occurred in the trials under review, it may be concluded that where care is taken the margin of selectivity of dinoseb (ammonium salt) is sufficient under most conditions.

MCPA powder would seem of value where there is a high population of charlock. Although 1 cwt. of 1% MCPA powder appeared insufficient as a general weed killer in 1948, 2 cwt. caused serious yield depressions in 1950. 1½ cwt. per acre gave a kill of charlock approximately equal to 2½ cwt. per acre at two sites in 1948. It would seem that where charlock is the predominating weed that there is a case for applying about 1 cwt. per acre of the 1% powder; this should give sufficient control of weed without causing serious damage to the crop.

With regard to liquid MCPA yields obtained from the mixed weed site in 1948 (supported by even more convincing field reports), indicate that it is likely to seriously depress yields. On the other hand, evidence from the brown mustard site in 1948 and 1952 indicates that this weed cannot be controlled satisfactorily by dinoseb alone. It is also evident that this weed, with its large spreading leaves can seriously depress yields. It would, therefore appear that where brown mustard is troublesome, a small quantity (say one-third pint of 30% MCPA concentrate per acre) could, with advantage, be added to the dinoseb spray.

Unfortunately it is not possible to make as accurate a comparison of hoeing and dinoseb spraying as might be wished. The hoed plots were sometimes dealt with by hand in a manner simulating toolbar work and it might be suggested that this unfairly favoured this treatment. On the other hand when the work was done by tractor toolbar it was not always possible to do this as well as in the rest of the field due to the difficulty of arranging for the plots to coincide with whole drill widths. In some such cases the hoed plots looked far worse than the rest of the field. There was no wheel damage on the sprayed plots as occurs in commercial practice, except in 1948.

Yields per acre (* indicates significant difference)

Year	Dinoseb		Hoed	
1948	8.0)	wheel *damage	6.2	once, late, by tractor toolbar.
	9·0)	incurred	10·0	
1949	30·1		30·2	twice, handwork simulating tractor toolbar.
	23·0		25·7	once by toolbar, once by hand simulating tractor toolbar.
	18·4		19·3	all plots hoed before treatments applied.
1950	6·6	*	9·8	four times by horse.
	18·7		18·2)	once, by tractor toolbar
	1.0		2·0)	
	13·4		11·8	once, by hand.
	18·0		17·2	once, by push hoe simulating tractor toolbar.
1951	2·0	*	3·0	once, handwork simulating tractor toolbar.
	7·3		6·5)	once, by tractor toolbar. Work difficult
	16·5	*	14·3)	and poor job done.
1952	11·2	*	4·4)	once, handwork simulating tractor toolbar.
	26·5	*	29·6)	
	13·4	*	14·9	once, by tractor toolbar.
1953	2·9		3·3	once, by tractor toolbar.
	25·2		26·1	once, handwork simulating tractor toolbar.
Mean yield:	13·96		14·03	

It would seem that tractor hoeing may be expected to give yields equal to dinoseb spraying. There is in fact some justification for concluding that in most circumstances, a single thorough tractor hoeing may give yields equal to dinoseb spraying. These are the most striking findings of the investigation being especially so when the relative costs of hoeing and contract or even farm spraying with dinoseb are considered.

On the other hand dinoseb does kill weeds in the rows and in general has resulted in rather cleaner crops than hoeing, and the prevention of weeds from seeding may well make the more expensive treatment worthwhile in some circumstances, especially where the weed population consists mainly of susceptible weeds. Thus, where there is much charlock present, it may well be advisable to apply a weedkiller, preferably dinoseb. Hoeing should probably be done in any case, since dinoseb can better control a low weed population than a dense one, and on heavy soils the cultivation itself may be valuable.

Where the weeds are resistant to dinoseb, the case for hoeing is of course indisputable.

On stony soils hoeing may result in cutter bar blockage at harvest due to stones being raised by the inter-row cultivations. In these circumstances it is considered that dinoseb should be employed.

The equality of yield returns of hoeing and dinoseb spraying may be explained by the following points:-

(i) The last 10-20% of many a weed population probably exerts little influence on yield.

(ii) Slight damage to the foliage caused by the spray.

(iii) Hooing may improve the condition of heavy soils in some circumstances.

Conclusions

It is considered that hoeing is generally the best means of controlling weeds in peas because it is much cheaper. Where it is impracticable to hoe, the crop should be sprayed with dinoseb when the weeds are small. Dinoseb may well be used in conjunction with hoeing where very susceptible weeds are present and it is desired to prevent reinfesting the land with weed seeds.

1% MCPA powder at about 1 cwt. per acre may be employed to control charlock where this is the predominating weed.

None of the other materials tested in these trials have been found to be worth employing as weedkillers in marrowfat peas.

References

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AN INVESTIGATION INTO THE POSSIBILITIES OF LOW VOLUME APPLICATION OF DINOSEB FOR WEED CONTROL IN PEAS

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Summary

1. Eight experiments, involving a total of 480 plots were carried out from 1951-53 to compare low versus high volume application of dinoseb for the control of weeds in peas. The investigation also included some comparisons of pressures (1951).

2. Results showed that while high volume is more reliable and effective, the dangers of low volume application have been overrated.

3. There was evidence from the 1951 trial that low pressure (30 lb. p.s.i.) is safer and more effective than high pressure (100 lb. p.s.i.)

4. Smaller yield increases associated with reduction in volume are more likely to occur at extremely low volumes i.e. 15 galls/acre.

5. Highest yields at both high and low volume were not necessarily related to treatments producing the best weedkill, since at higher dosages toxicity to the crop was greater.

6. For a given dosage, results from 5 out of 7 experiments showed that low volume application was not markedly less effective than high volume application, but there was evidence that to obtain comparable results a smaller dosage is necessary at low volume by comparison with high volume.

Introduction

It has been reported (1,2) and is generally accepted that dinoseb is unsafe to apply at low volume in peas on the grounds that selectivity is reduced with consequent higher risk of scorch to the crop. Since, however, the comparatively cheap small low volume sprayer is rapidly becoming a standard item of equipment on many farms for dealing with weeds in cereals and grassland, it seemed worth while to verify the alleged dangers of low volume application. It would be a great advantage if the farmer could extend the use of his low volume sprayer to include dinoseb spraying with effective results; the tremendous saving in water cartage is another important factor which has to be taken into account.

Experimental Methods and Results

A joint programme of experiments was carried out from 1951 onwards. Results have already been summarised elsewhere (3,4).

1951 experiment

A single experiment, of randomised block design, was laid down to compare various combinations of volumes and pressures using a constant dosage rate of (1.3 lb. acid equivalent) of dinoseb (ammonium salt).

The spray treatments (A-F) were applied by means of a small lightweight hand-pushed machine mounted on bicycle wheels, constructed by Pest Control Ltd. and operated by means of compressed air. Pressure was adjusted by means of reducing valves, and speed of travel in conjunction with a range of Teejet nozzles were used to control volume.

The peas (variety: Zelka marrowfat) were 6 ins. high with about 7 expanded leaves. The weather from two days before until three days after the date of spraying was sunny and warm. Spray retention was good in most cases. The smaller orifices of the Teejets used for treatment F produced very fine droplets and resulted in considerable retention by the peas; this was not the case with the higher volume applications.

Counts of the principal weeds were made before treatments were applied and again 10 days and 5 weeks after spraying. Results are presented in an Appendix (Table A).

The effect of spray treatments and hoeing on the weed population and their influence directly and indirectly on the crop are reflected in the yield obtained. These are shown in Table 1 below, together with details of the actual treatments.

Table 1

Mean Yield of Treatments: 1951 Experiment (Waresley).

	Treatment		Yield	
	Volume galls/acre)	Pressure (lb.p.s.i.)	cwt./acre	Untreated control = 100
A.	100	100	15.7	127
B.	100	30	16.4	132
C.	100*	100	15.6	126
D.	60	30	16.5	133
E.	30	30	15.7	127
F.	15	30	13.9	112
X.	Hoed control (by tractor tool-bar)		14.3	115
Y.	Untreated control		12.4	100
	Sig. diff. at P = 0.05		: 1.2	-

Unbiased visual observations made without reference to a treatment key produced the following very general findings when individual plots were grouped according to spray treatment:

Treatment key letter	Degree of scorching to peas	Extent of weed control
A	Slight or none	Moderate
B	None	Poor
C	Moderate - severe	Good
D	Slight - moderate	Poor - moderate
E	Moderate	Good
F	Very severe	Very good

1952 experiments

The investigation was continued, three experiments being laid down on contrasting soil types with differing weed populations. Each experiment comprised eight treatments arranged in a Latin Square, and spraying was done by means of the same machine as in 1951. At the time of spraying the peas (marrowfats) varied from 4 ins. high with 4 expanded leaves at one centre (Terrington) to 6-8 ins. with 6-7 leaves at another (Godmanchester). Treatments were as follows:-

* Owing to a timing error a rate of 100 gall. per acre was applied instead of 60 gall. as intended, giving a dosage rate of 2.2 lb. dinoseb instead of 1.3 lb.

Treatment key letter	Dinoseb dosage (lb./acre acid equivalent)	Volume (galls./acre)
A	1.0-1.3 † (Rate I)	60) High
B	1.2-1.7 † (Rate II)	60)
C	0.25	15)
D	0.4	15) Low
E	0.65	15)
F	1.0	15)
X	Hoed control	
Y	Untreated control	

The treatment A dosage was that judged to be the optimum in relation to conditions at each site. The purpose of the higher dosage (treatment B) was to check the accuracy of the rate chosen for treatment A. Pressure was kept constant at 30 lb. p.s.i. Hoeing was done by tractor tool-bar at Godmanchester and by hand - between the rows only, to simulate mechanical hoeing - at the other two sites. Details of weather conditions are given in the Appendix (Table B).

Results of counts of principal weeds made in permanently defined areas chosen at random within each plot on the day of spraying and again 1-2 weeks later are set out in the Appendix (Table C). Yields are compared in Table 2 below.

Table 2

Mean Yields of Treatments: 1952 Experiments

Treatment			Terrington		Welney		Godmanchester	
	Volume	Dosage	cwt./acre	Untreated control = 100	cwt./acre	Untreated control = 100	cwt./acre	Untreated control = 100
A	High	Rate I	11.2	386	26.5	115	13.4	108
B	"	Rate II	15.5	534	27.6	119	14.7	119
C	Low	0.25 lb.	5.4	186	25.5	110	12.6	102
D	"	0.4 lb.	4.8	166	25.1	109	13.4	108
E	"	0.65 lb.	8.5	293	27.9	121	12.8	103
F	"	1.0 lb.	12.9	445	27.0	117	12.6	102
X	Hoed control		4.4	152	29.6	128	14.9	120
Y	Untreated control		2.9	100	23.1	100	12.4	100
Sig. diff. at P = 0.05:			3.0	-	2.8	-	1.5	-

1953 experiments

Similar experiments to those in 1952 were carried out to compare three high- and three low-volume dosages of dinoseb (ammonium salt) with the aim of embracing the optimum concentration at both rates of application. Four experiments were established on different soils, each carrying a different weed flora. One centre (Colmworth) was selected by virtue of its low weed population in order to

† According to conditions prevailing at each site.

assess the effect of treatments on the crop itself. A Latin Square design was again employed, treatments being as follows:

Treatment key letter	Dinoseb dosage (lb./acre acid equivalent)	Volume (galls/acre.)	
A	0.9	60)	
B	1.65	60)	High
C	3.0	60)	
D	0.5	15)	
E	0.9	15)	Low
F	1.65	15)	
X	Hoed control		
Y	Untreated control		

The peas (marrowfats) were sprayed in the same way as previously when they were 5 - 10 ins. in height with 5 - 7 expanded leaves, using a constant pressure of 30 lb. p.s.i. Hoeing was done by hand at Colmworth, and by tractor tool-bar at two other sites (Postland and Gedney). At Waldingfield a spring-tined weeder was employed, the narrow row width at this site precluding inter-row cultivation.

Weather conditions around the time of spraying and observations on spray retention and contact angle on the peas at three centres are presented in the Appendix (Tables D and E).

Weed counts assessed by the same method as used in 1952, are also shown in Appendix (Table F).

Yield data in respect of the three experiments successfully harvested are shown in Table 3 which follows.

Table 3

Mean Yields of Treatments: 1953 Experiments

Treatment		Postland		Colmworth		Waldingfield	
Volume	Dosage	cwt./acre	Untreated control = 100	cwt./acre	Untreated control = 100	cwt./acre	Untreated control = 100
A High	0.0 lb.	2.8	200	25.2	101	14.7	101
B "	1.65 lb.	2.9	207	25.0	100	15.0	103
C "	3.0 lb.	2.8	200	24.3	98	12.3	84
D Low	0.5 lb.	2.9	207	25.6	103	13.9	95
E "	0.9 lb.	3.1	221	25.1	101	13.5	92
F "	1.65 lb.	2.1	150	25.2	101	13.5	92
X Hoed control		3.3	236	26.1	105	14.6	100
Y Untreated control		1.4	100	24.9	100	14.6	100
Sig.diff. at P = 0.05:		0.9	-	1.0	-	0.8	-

General observations on each plot revealed the following general spray treatment effects when grouped:

Treatment key letter	Degree of scorching to peas	Extent of weed control
A	Slight	Moderate
B	Slight-moderate	Moderate - good
C	Severe	Excellent
D	Slight	Very poor - poor
E	Slight - moderate	Poor -moderate
F	Severe	Good - excellent

DISCUSSION

Reviewing the results of the 1951 experiment an examination of Table A (Appendix) shows that, in terms of weed control, treatment C was best due to the higher dinoseb dosage applied. High pressure gave a better kill than low pressure but caused some damage to the crop, reflected in the yield. At 30 lb. p.s.i. weed control improved as volume declined.

Table 1 indicates that, for a given pressure, high volume tended to outyield low volume. With regard to pressure, treatment C is not valid for comparisons because of the higher dinoseb dosage applied in error, but contrasting treatments A and B reveals that higher yields were given by the lower pressure, though the difference did not reach significance. At the lower pressure, there was no difference in yield between 100 and 60 galls. Moreover, the lower yield increase recorded in respect of the 30 gall. treatment (E) did not differ significantly from the 100 and 60 gall. rates, but 15 galls. (treatment F) yielded significantly less than all three higher volumes and hoeing. The lower yield from treatment F was associated with severe injury to the crop.

Results of the 1952 series of experiments showed the extent of weed eradication (see Table B in Appendix) to be related to dosage, irrespective of volume, the most effective treatment being B (1.2 - 1.7 lb. active ingredient). This treatment was intended to be an overdose but its effect on yield, shown in Table 2, illustrates that the crop was more resistant than thought at the time.

Yields also followed dosage rate and weed kill. Hoeing gave highest yields at two centres, this probably being attributable to better weed kill or less crop damage by comparison with the spray treatments. At low volume the resulting yields showed that the optimum dosage was exceeded at two centres. At high volume no excessively high dosage was employed so it is not possible to contrast optimum low volume dosage with optimum high volume dosage. To obtain equivalent results, however, the yields obtained suggested that dosage should be less with low volume application.

At the same dosage (treatments A and F) highest yields were given at low volume, although the difference was not significant; at Godmanchester treatment A dosage was 0.3 lb. more than treatment F and this may explain the superiority of the high volume treatment at this centre.

The low yields at Terrington were due to the smothering effect of a dense Brown Mustard population, the only aggressive weed species present. There was a regrowth of this weed but yields indicate that this occurred after the spray treatment effects had influenced crop growth. The heavy surviving infestation on the untreated control plots accounts for the substantially higher yields given by the other treatments. Hoeing did not give as good results at this centre, probably because it was carried out some days _after_ spraying and did not affect the many weeds left in the rows as did the spray treatments.

In the 1953 experiments the weed population declined with increasing dosage both at high and low volume but, at the same dosage, weed control was a little better at high volume.

At the three centres harvested, the highest dosage at both volumes (3 lb. in 60 galls. and 1.65 lb. in 15 galls.) were excessive, as was intended. Further evidence was provided to show that for equivalent results a smaller dosage is needed at low volume. On the average of all experiments, there was a trend for high volume to give slightly higher yields than low volume, at a given dosage. Hoeing was the highest-yielding treatment at two centres; at the third (Waldingfield) the reduction in the weed population achieved by the spring-tined weeder was almost certainly balanced by the peas inevitably pulled up, resulting in no effect on yield. Much shedding occurred at Postland, and yields were low as a result. The insignificant effect of treatments at Colmworth was not surprising since the crop was a vigorous one and contained few weeds.

Conclusions

Results of the 1951 experiment indicated that reducing volume from 100 to 60 galls. caused no effect on yield. There was only a slight decrease in yield between 60 and 30 galls. but a significant decrease between 30 and 15 galls. A pressure of 30 lb. p.s.i. gave better results than 100 lb. p.s.i.

At the same dosage, the six experiments completed in 1952-53 showed (except for Waldingfield, 1953) that, in terms of weed control and yield, low volume was not appreciably less effective than high volume. Effect on yield of the different treatments at all centres harvested is presented in diagrammatic form in the Appendix (Table G).

Results as a whole suggested that the alleged dangers of low volume application have been exaggerated, but confirm that high volume is more reliable and effective in the long run.

It is relevant to report that results of experiments carried out in 1954 do not contradict these findings.

References.

1. DEARBORN, C. H. (1950)
"Chemical Weed Control in Peas, Sweet Corn and Beets Grown for Processing." N.Y. St. Agric. Exp. Sta. Bull. 741, 13.

2. Min. of Agric. & Fish. (1953)
"The Control of Weeds in Peas with Dinoseb (DNBP)" Advisory Leaflet 376, 2.

3. Home Grown Threshed Peas Joint Committee. (1952)
Second Progress Report on Field Experiments, 1950-1951, 21-2.

4. ———— Ditto ———— (1954)
Report for 1952-1953, 39-44.

APPENDIX

Table A

Results of Weed Counts: 1951 Experiment (Waresley).

(eight 12 in. random quadrats per plot count)

Weed	Mean population per 12 sq. yd. prior to treatment (1st count)	Population as percentage of 1st count								
		Treatments								
			A	B	C*	D	E	F	Xø	Y
Black Bindweed (P. convolvulus)	185	2nd count:	25	25	7	38	28	21	25	34
		3rd "	21	37	2	29	13	14	30	30
Fat Hen (C. album)	43	2nd "	57	55	5	27	0	0	60†	78†
		3rd "	50	64	42	27	0	8	0	33
Sowthistle (Sonchus sp.)	959	2nd "	9	56	2	19	2	3	73	70
		3rd "	10	28	4	16	3	8	50	33
Scarlet Pimpernel (A. arvensis)	486	2nd "	12	72	6	35	2	7	144	123
		3rd "	16	63	15	36	6	19	66	47
Fluellen (K. spuria)	276	2nd "	34	40	8	64	48	24	289	100
		3rd "	71	55	11	76	22	49	244	83

Table B

Weather Conditions: 1952 Experiments

	Terrington	Wilney	Godmanchester
2 days before:	Cloudy, heavy rain.	Cool, dry. Rain in early evening.	Bright, mild, windy. Some rain.
1 day before:	Sunny, little rain.	Bright, cool, windy.	Bright, mild, cooler, with some wind.
Day of spraying:	Sunny and dry.	- do - Heavy rain at end of afternoon.	Sunny and warm.
1 day after:	- do -	Cloudy, cool. Rain in night.	- do -
2 days after:	- do -	Sunny, mild, windy. Heavy rain in night.	Cloudy, cool, slightly windy. Slight rain.
3 days after:	Sunny, dry, very warm.	Cloudy, cool, windy.	Cloudy, cool, windy.

* Owing to a timing error a rate of 100 gall. per acre was applied instead of 60 gall. as intended, giving a dosage rate of 2.2 lb. dinoseb instead of 1.3 lb.

ø Hoeing was carried out before the date of 1st count, so numbers of weeds on hoed plots have been omitted in assessing the population prior to treatment.

† Population of species so small that percentage effect cannot be regarded as reliable.

Table C

Results of Weed Counts: 1952 Experiments

(permanent sample area per plot comprised row width x 36 or 54 ins., depending on row width)

Weed	Mean population per 12 sq. yd. prior to treatment (1st count)	Population at 2nd count as percentage of 1st count — Treatments							
		A	B	C	D	E	F	Xø	Y
Terrington									
Brown Mustard*	899	14	3	72	70	33	10	46	153
Welney									
Chickweed (S.media)	301	40	21	77	92	97	37	48	85
Black Bindweed (P.convolvulus)	127	112	114	116	95	106	117	81	130
Common Orache (A.patula)	1359	82	67	86	83	66	63	65	117
Knotgrass (P.aviculare)	121	89	104	75	138	67	81	44	133
Cleavers (G. aparine)	86	48	44	118	79	111	116	33	112
Scentless Mayweed (M.inodora)	112	68	77	190	173	67	67	44	143
Common Hempnettle (G.tetrahit)	67	113	17	125	81	22	250	87	91
Godmanchester									
Charlock (S.arvensis)	232	8	2	29	25	14	11	omitted data	87
Speedwell (Veronica spp.)	1460	44	29	116	77	70	62		91
Field Bindweed (C.arvensis)	37	46	38	67†	58	113†	75†		250†
Knotgrass (P.aviculare)	34	10†	25†	76	30†	0†	41		75
Scarlet Pimpernel (A.arvensis)	19	43	0	50†	17†	67†	133†		53
Groundsel (S. vulgaris)	129	100	35	163	119	130	62		67

* Only species of importance present. Sown as a crop in a previous year.

ø Hoeing carried out between the 1st and 2nd counts except at Godmanchester. At latter, hoeing carried out before 1st count so relevant data omitted in table.

† Population of species so small that percentage effect cannot be regarded as reliable.

Table D

Weather Conditions: 1953 Experiments

	Postland	Colmworth	Gedney	Waldingfield
2 days before:	Cloudy, mild. Heavy rain.	Cloudy and windy. Sunny later.	Cloudy. Sunny and warm later.	Dry, sunny Some cloud.
1 day before:	Cloudy, little sunshine, windy.	Sunny and windy Warm later.	Cloudy and windy. Sunny and warm later.	Dry, sunny.
Day of spraying:	Dry and warm.	Cloudy. Sunny and warm later.	Dry and very warm.	Dry, sunny. Cloudy later.
1 day after:	Cloudy and windy. Sunny and warm later.	Cloudy, mild, slight rain.	Dry and very warm. Windy.	Dry, sunny.
2 days after:	Cloudy, windy.	Cloudy, slight wind. Sunny later.	- do -	Dry, very warm.
3 days after:	Cloudy. Sunny and warm later.	Dry and warm.	Dry and sunny. Windy.	Sunny, very warm.

Table E

Observations on Spray Retention and Contact Angle on Peas: 1953 Experiments

	Postland	Colmworth	Waldingfield
Spray retention			
High volume:	Moderate (much spray in leaf axils).	Considerable.	Very high.
Low volume:	Poor (very small droplets).	High.	Good (in respect of small droplets).
Contact angle			
High volume:	Fairly low.	Low-very low.	Very low.
Low volume:	High.	Very low.	Medium.

Table F

Results of Weed Counts: 1953 Experiments

(permanent sample area per plot comprised row width x 36 or 54 ins. depending on row width)

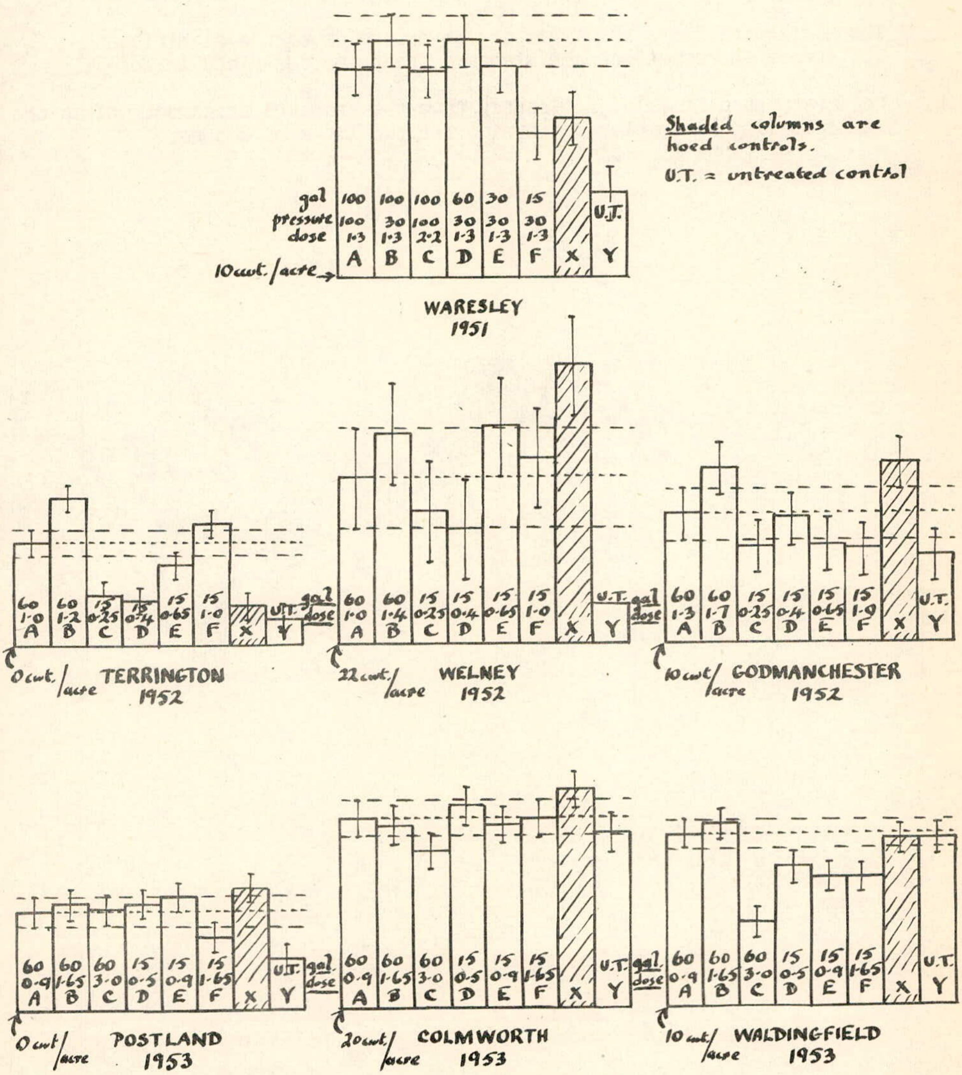
Weeds	Mean population per 12 sq. yd. prior to treatment (1st count)	Population at 2nd count as percentage of 1st count							
		Treatments							
		A	B	C	D	E	F	X*	Y
Postland									
Chickweed (S.media)	594	65	36	54	90	72	58	84	Too numerous to count.
Speedwell (Veronica spp.)	191	41	29	45	104	67	47	107	
Black Bindweed (P.convolvulus)	695	44	20	27	62	39	37	68	
Fat Hen (C.album) } Common Orache (A.patula) }	566	16	3	1	8	8	2	37	
Scentless Mayweed (M.inodora)	26	22	18	50†	21	50†	33†	-†	
Annual Nettle (U.urens)	98	75†	11	45	183†	58	82	92†	
Gedney									
Chickweed (S.media)	194	77	43	20	87	69	39	283†	109
Speedwell (Veronica spp.)	160	59	51	12	76	62	24	233†	128
Black Bindweed (P.convolvulus)	328	16	10	2	45	66	28	75	105
Thistle (Carduus sp.)	43	92	167†	45	92	109	79	62	100
Horsetail (Equisetum sp.)	41	100†	180	57†	129	163†	157†	200†	110
Colmworth									
Charlock (S. arvensis)	28	No data available.							
Chickweed (S. media)	117								
Speedwell (Veronica sp.)	42								
Black Bindweed (P.convolvulus)	13								
Fat Hen (C. album)	42								
Scarlet Pimpernel (A. arvensis)	78								
Fluellen (L.spuria)	14								
Waldingfield									
Chickweed (S.media)	195	No 2nd count made.							
Speedwell (Veronica spp.)	206								
Black Bindweed (P.convolvulus)	55								
Fat Hen (C.album) } Common Orache (A.patula) }	321								
Knotgrass (P.aviculare)	267								
Fumitory (F.officinalis)	183								
White Campion (M. album)	1333								

* Hoeing carried out before 1st count so values merely give effect of natural conditions on a weed population initially reduced by hoeing.

† Population of species so small that percentage effect cannot be regarded as reliable.

TABLE G

DIAGRAMMATIC SUMMARY OF TREATMENT YIELDS.



(Method of presentation after R. Pfeiffer)

NOTES ON DIAGRAMS SHOWN ON PREVIOUS PAGE

1. For each trial the horizontal line of dots represents an extension of the yield given by a dosage of 0.9 - 1.3 lb./acre, (ammonium) dinoseb (acid equivalent) at a volume of 60 galls./acre and at a pressure of 30 lb. p.s.i.

2. Each half of the vertical line projecting both ways from the top of each yield column is equivalent in length to half the significant difference at P = 0.05.

3. The horizontal lines of dashes are an extension of the significant difference in respect of the standard treatment described in Note 1.

4. No treatment differs significantly from the standard treatment unless the vertical line is completely outside the two lines of dashes.

PRELIMINARY EXPERIMENTS ON CHEMICAL CONTROL OF WILD OATS IN PEAS

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Summary

Seven chemicals were tested, at three main sites. They were:- propham, CIPC, TCA, CMU, maleic hydrazide, dinoseb and PCP. Two subsidiary sites were also used, at one of which 2,4-D was tested as an additional chemical. Materials were applied at several rates as pre-sowing, pre-emergence and post-emergence treatments.

TCA at 7½ lbs. per acre and at 15 lbs. per acre applied as a pre-sowing spray gave up to 99% control of wild oats. Maleic hydrazide as a post-emergence treatment gave some kill of wild oats.

No other chemical, nor time of application, gave a marked reduction of wild oats.

Where wild oats were not present, a depression of yield of peas was recorded for TCA at 10 lbs. and 15 lbs. per acre. Where dense wild oats were controlled by TCA no yield depression occurred at the 7½ lb. rate.

CMU at ½ lb. and 2 lbs./acre gave good control of charlock when applied as a pre-sowing treatment.

Very severe damage to peas was obtained with post-emergence applications of maleic hydrazide. TCA invariably had a marked influence on pea foliage. Little or no damage to peas was observed for very high rates of dinoseb (triethanolamine) applied as a post-emergence spray.

Introduction

Wild oats are a major problem in arable crops, and the density and frequency of the weed is increasing(1). Whilst it is in wheat and barley crops that wild oats are most troublesome, so far no satisfactory method of control has been found in these crops(2).

The weed may be tackled with some success in the root break, but it is not so easy to control in peas or beans, unless very careful hand hoeing and pulling is practised as well as the normal inter-row cultivation.

In practice, wild oats are not completely eradicated by the mechanical hoeing methods even where peas are grown in wide rows. Where peas are grown in narrow rows they are often not removed at all. Applications of dinoseb are reported sometimes to reduce the number of wild oats(1) but other workers(3) suggest that dinoseb applications, by reducing broadleaved weed competition, may increase, if not the number, at least the vigour of the wild oats.

It is probable that dense wild oats have a considerable depressing effect on the pea yield(3) although reduction in yield may be of less importance to the farmer than their ability to re-infest the land with wild oat seeds. It seemed worth while, therefore, to test some of the chemicals which have been reported by various workers to have shewn signs of promise in wild oat control (4, 5, 6, 7, 8, 9).

With this in view, it was decided that in addition to our more detailed dinoseb experiments we should carry out at least three joint preliminary trials of a fairly simple type, mainly for observational purposes, during the 1954 season.

The objects of the trials were to find out if, under our conditions, we could:-

(i) obtain a reasonable control of wild oats:
(ii) do so without excessive damage to the pea crop:
(iii) obtain any useful control of other weeds:
(iv) select the best materials for closer study in the following year.

Not all the materials that we hoped to use were obtained in time for the trials and it proved none too easy to pick sites which would later bear an even and dense population of wild oats.

Experimental Data and Results

We chose three main sites near Huntingdon, all on boulder clay soils. There seemed to be, as far as we could ascertain, a reasonable expectation of numerous wild oats appearing. The fields chosen were to be cropped with marrowfat peas for harvesting dry.

A very simple randomised block design was used, there being only two replicates for each time of treatment.

Application of chemicals was made by knapsack sprayer and all were applied in water at 50 Imperial gallons per acre.

Three applications were made:-

(i) pre-sowing (before the land was worked down for sowing);
(ii) pre-emergence (just before emergence of the peas);
(iii) post-emergence (when the peas were 2"-3" high).

The treatments at the main sites were as follows:-

Treatment No.	Name of Material & formulation	Active material/acre
1A	propham - 50% wettable	2 lbs.*
1B	propham - 50% wettable	4 lbs.*
2A	CIPC - 50% wettable	2 lbs.*
2B	CIPC - 50% wettable	4 lbs.*
3A	TCA - 94% (sodium)	7½ lbs.
3B	TCA - 94% (sodium)	15 lbs.
4A	CMU - 80% wettable	½ lb.
4B	CMU - 80% wettable	2 lbs.
5A	maleic hydrazide 40%	3 lbs.
5B	maleic hydrazide 40%	6 lbs.
6A	dinoseb (triethanolamine) 21% a.e.	2½ lbs. a.e.
6B	dinoseb (triethanolamine) 21% a.e.	5 lbs. a.e.
6C	dinoseb (triethanolamine) 21% a.e.	15 lbs. a.e.†
7A	PCP miscible oil 15%	3 lbs.**
7B	PCP miscible oil 15%	6 lbs.**
0 (2 plots)	untreated controls	

* Applied only to pre-sowing and pre-emergence.

** Applied immediately after sowing and at pre-emergence date.

† Applied only at post-emergence date.

Brief Description of Sites

At main Site I, the mean wild oat density of the control plots was 106/sq. yd. and distribution was fairly even.

At main Site II, the crop was tractor hoed between the rows by the farmer, so that observations had to be confined to the effect of treatments on the crop and counts of wild oats occurring in the pea rows. The mean density of wild oats on the hoed control plots at this site was about 9 per sq.yd. Because of the hoeing, post emergence spraying was not justified at this site and a subsidiary site (IV) heavily infested with wild oats was chosen to take its place for the post-emergence treatments.

Main Site III developed a very uneven stand of wild oats, so that observations on wild oat control were of little value. No post-emergence treatment was carried out there.

Subsidiary Site IV had a wild oat density of over 500/sq.yd. and was very even. Wild oats varied between 2" and 8" in height at the time of post-emergence application.

Subsidiary Site V was devoid of wild oats and was used to test the effect of the chemicals on the pea yield. Only a pre-emergence treatment was carried out, but a wider range of rates was used and the treatments were replicated four times.

Treatments at Site V were as follows:-

1A	propham	2 lbs./ac.	6A	dinoseb (triethanolamine)	2½ lbs./ac.
1B	propham	4 lbs./ac.	6B	dinoseb (triethanolamine)	5 lbs./ac.
1x	propham	6 lbs./ac.	6x	dinoseb (triethanolamine)	7½ lbs./ac.
3x	TCA	5 lbs./ac.	7A	PCP miscible oil	3 lbs./ac.
3y	TCA	10 lbs./ac.	7B	PCP miscible oil	6 lbs./ac.
3B	TCA	15 lbs./ac.	7x	PCP miscible oil	9 lbs./ac.
4A	CMU	½ lb./ac.	8x	2,4-D (sodium) 90%	1 lb./ac.
4x	CMU	1 lb./ac.	8y	2,4-D (sodium) 90%	2 lbs./ac.
4B	CMU	2 lbs./ac.	8z	2,4-D (sodium) 90%	4 lbs./ac.
5A	maleic hydrazide	3 lbs./ac.	0)		
5B	maleic hydrazide	6 lbs./ac.	0)	untreated controls	
5x	maleic hydrazide	9 lbs./ac.	0)		

Records of rainfall and spraying conditions were kept but, owing to limitation of space, are not reproduced in this paper.

Results

In considering the results obtained, reference will be made to the following three tables:-

Table I shews the total numbers of wild oats counted at Sites I and II. It also includes the numbers of other weeds counted. Counts of emergent peas were made, but are not included, as there were no treatment effects.

Table II shews the yields obtained from two samplings of the TCA and Control Plots at Site I. Similar samplings were made at Site II[†] and at this site a yield depression was recorded for all TCA treated plots. The differences in this table are not statistically significant.

Table III gives the mean yields at Site V where no wild oats appeared. Significant yield depressions were obtained at this site by both TCA and 2,4-D at the higher rates.

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† Very few wild oats were left at this site on any plot after hoeing had been done.

TABLE I

Total numbers of wild oats and broadleaved weeds counted on both replicates of each treatment on a total area of 28 sq.ft. per treatment.

		Propham		CIPC		TCA		CMU		Maleic hydrazide		Dinoseb		PCP		Untreated
		2lbs.	4lbs.	2lbs.	4lbs.	7½lbs.	15lbs.	½lb.	2lbs.	3lbs.	6lbs.	2½lbs.	5lbs.	3lbs.	6lbs.	(mean of 2)
SITE I Pre-sowing	Wild Oats	151	170	97	84	0	2	215	120	116	113	293	242	114	111	143
	Charlock	99	114	87	37	85	80	14	2	84	76	45	16	57	60	106
	Black Bindweed	59	41	29	16	28	41	12	3	56	41	53	60	45	48	52
	Other weeds	376	352	268	252	123	68	178	106	309	258	274	172	277	295	363
SITE I Pre-emerge																(mean of 2)
	Wild Oats	315	212	279	211	243	220	192	259	301	202	346	318	327	198	258
	Charlock	121	153	45	5	93	93	57	19	62	76	77	30	84	75	158
	Black Bindweed	65	67	34	19	65	58	82	22	40	65	71	48	73	47	112
	Other Weeds	317	306	302	254	278	199	252	216	277	295	266	223	322	270	342
SITE I Post-emerge														15 lbs.		(mean of 4)
	Wild Oats					449	359	386	372	497	526	455	532	432		458
	Charlock					165	141	48	47	97	84	0	1	0		144
	Black Bindweed					87	71	7	13	97	69	3	3	0		83
	Other Weeds					407	300	304	317	418	441	67	48	14		474

Mean Weed Density at Site I (Controls) = 309/sq.yd., including 106 Wild Oats/sq.yd.

Total numbers of wild oats counted in four x 3 ft. row lengths of peas in both replicates.

		Propham		CIPC		TCA		CMU		Maleic hydrazide		Dinoseb		PCP		Untreated
SITE II	Wild Oats Pre-sowing	9	5	11	8	5	5	20	24	20	47	8	10	32	21	(mean of 2) 30
	Wild Oats Pre-emergence	25	21	41	15	20	13	16	16	11	11	9	13	24	17	

TABLE II

Sample Yields of Peas: Site I

Treatment	1st Sampling Mean Yields in oz. Green Peas		2nd Sampling Mean Yields in oz. Dry Peas	
	Full Pods	Peas		
Pre-sowing:				
7½ lbs. TCA	7.0	3.1	4.25	) Wild Oats controlled.
15 lbs. TCA	3.5	1.5		)
Untreated	6.3	2.4	5.0ǂ	)
Pre-emergence				
7½ lbs. TCA	3.75	1.3	1.35	) Wild Oats not controlled.
15 lbs. TCA	3.5	1.1	1.25	)
Untreated	6.5	2.0	2.4	)

ǂ This was not from an untreated control but from 2 lbs. CMU treatment where nearly all charlock was controlled.

TABLE III

Mean Yields of Dry Peas in lbs./200 sq.yds.

Pre-emergence Treatments: Site V.

	Dosage+			
	Low	Medium	High	Mean
propham	58	55	61	58.3
TCA	49	44	33	41.9
CMU	54	38	52	47.8
maleic hydrazide	64	54	74	63.9
dinoseb	65	67	58	63.3
PCP	61	56	57	57.8
2,4-D	62	45	14	40.4
Untreated		60.3		60.3
Significant Differences:				
P 0.05		16.60		9.58
P 0.01		22.07		12.74

+ For actual rates see page 3.

The main sites were not designed to give yield data. Their purpose was to provide observation plots where the effects of the chemicals could be checked visually on the pea, wild oat and broadleaved weed populations. In the interpretation of the results this must be borne in mind, since further, more detailed studies must be made before the full effects of the materials can be properly judged.

Results were obtained mainly from Site I: the other sites, being of considerably less value for the reasons given above, have been used mainly to check the effects observed on the pea crop itself at Site I.

A. Wild Oats.

Control of wild oats was 99 percent at Site I and 83 percent at Site II with both the 7½ lbs. and 15 lbs. per acre rates of TCA applied as a pre-sowing spray. No other treatment or time of application gave a marked control of wild oat, nor was such complete control obtained at Site III with the same treatments and time of application. Nevertheless, at this site the lowest counts of wild oats were recorded in the pre-sowing TCA plots.

Some control of wild oats may have been obtained from propham and CIPC as a pre-sowing treatment, but if so, it was insufficient to be of practical importance.

Maleic hydrazide as a post-emergence spray, though not always completely killing the wild oats, did delay or prevent flowering to a considerable extent. Its effect on the crop, however, at both Site I and Site IV was so serious as to rule it out as a post-emergence spray in peas.

Dinoseb as a post-emergence spray, and especially at the very high rate of 15 lbs. acid equivalent per acre scorched back the leaf of the wild oat plants, so that an almost complete kill of top was obtained at both Site I and Site IV. Nevertheless, regrowth was such that by harvest time these plots were almost as badly infested with wild oats as were the controls.

(B) Broadleaved Weeds.

Not unexpectedly, dinoseb as a post-emergence treatment gave by far the best control of broadleaved weeds in general, and the few which survived were mainly perennial weeds.

CMU at the 2 lbs. per acre rate gave very good control of charlock when applied as a pre-sowing treatment. The material gave some control of charlock (Brassica sinapis) at other times and at the lower rate. Black bindweed (Polygonum convolvulus) was also well controlled by this chemical as both pre-sowing and post-emergence spray. Control of other broadleaved weeds was moderate.

CIPC at the 4 lbs. per acre rate gave good control of charlock and some control of black bindweed, especially at the pre-emergence application.

No other chemicals gave satisfactory control of broadleaved weeds at any site.

(C) Peas

TCA, at all times of application and at all rates and all sites had a very marked effect on the pea foliage. The leaves and stems were without bloom and of a yellow-green somewhat oil-soaked appearance. There was some "Cabbage-like" bunching of the leaves in the early stages. The symptoms were more acute with higher dosage levels. At the 15 lbs. per acre rate pea growth was definitely retarded, but at the 7½ lbs. per acre rate (and at the 5 lbs. rate at Site V) pea growth was only slightly checked. The yellow coloration gradually disappeared as the season advanced, and the peas became more normal in appearance towards harvest. Reference to Tables II and III will shew that yield depressions were recorded, except in the case of the lower rate at Site I, where fairly dense wild oats were almost completely controlled by this treatment.

CIPC gave some check to peas in the early stages, especially at the higher rate. In general the peas on these plots were rather dwarfed throughout the season.

Dinoseb as a post-emergence treatment gave some scorch to peas at the higher rates, but pea growth on these plots was not as seriously checked as might have been expected. Samples of pea vine bearing pods taken from Site IV shewed a slight delay in ripening and filling of the pods as compared with an adjacent hoed control strip, but they bore no fewer pods, and the vine was not dwarfed in any way.

Maleic hydrazide had a very serious effect on peas when applied as a post-emergence treatment, especially at the 6 lb. per acre rate. Peas became very dwarfed, dark blue-grey in colour, and growth was slowed down or stopped altogether. The peas on these plots did not recover. Weed growth and wild oat growth was seriously affected by this treatment, but actual death of plants was very slow and is not recorded by the weed counts.

No other materials or times of application had any marked effect on pea growth.

DISCUSSION

The results obtained from Sites I and II shew that TCA at both 7½ lbs. and 15 lbs. per acre when applied as a pre-sowing spray, gave respectively 99% and 83% control of wild oats.

The pre-sowing samples taken at Site I indicate that, where dense wild oats were controlled, the lower rate of TCA gave no yield decrease. At the same time, pea yield reductions are indicated for the higher rate.

The pre-sowing samples taken at Site II, where the wild oat density was low, and the pre-emergence samples taken at Sites I and II where control was not obtained, indicate the yield-reducing effect of the chemical in the absence of wild oats and where the treatment was not effective.

Confirmation of yield reduction in the absence of wild oats at rates above 5 lbs. per acre is given by the yield figures from Site V (Table III). A significant yield depression of 27 percent is recorded for the 10 lbs. per acre rate of TCA at this site.

The fact that 7½ lbs. per acre of TCA gave almost complete elimination of wild oats at Site I suggests that lower dosages may be found useful. This, taken together with the indication that the toxicity of the chemical to the pea crop, as reflected in yield reduction, may be offset by control of dense wild oats, suggests that further trials of this chemical are well worth while.

The lower degree of control indicated at Site II may be connected with the possibility that the period of maximum germination of wild oats occurred before the TCA had reached the appropriate soil zone.

It is probable that under dry soil conditions and during periods of drought difficulty might be experienced in getting the material in contact with the germinating oats in time for it to exert its maximum effect.

It might be argued conversely that excessive rainfall during this period would wash the TCA past the germination zone too soon.

In any event, a series of pre-sowing applications should be made in any future trial.

The almost complete failure of the more insoluble propham, CIPC and CMU to give control of wild oats may also be connected with the inability of the material to reach the wild oats at the critical time at Site I, where TCA was successful. No rain fell at this site for 10 days after the pre-sowing treatments. Earlier cultivation might have helped in this respect, although it is not easy to see how it could have been practised in the wet, sticky soil conditions prevailing at the Site at the time of the first application of chemicals.

It does not seem likely that the other materials tested will be of value for the control of wild oats in the pea crop unless higher dosage levels prove safe to the crop and more toxic to the wild oats.

Conclusions

Only TCA at 7½ lbs. and at 15 lbs. per acre applied as a pre-sowing spray gave a satisfactory control of wild oats.

Control was equal with both rates, but only the higher rate indicated a yield depression where fairly dense wild oats were controlled. In the absence of wild oats, it appears that crop depression is to be expected from rates above 5 lbs. per acre.

CMU at from ½ lb. to 2 lbs. per acre appears to be a possibility as a pre-sowing treatment for certain broadleaved weeds.

Very high post-emergence dinoseb (triethanolamine) rates appear to have caused relatively little damage to marrowfat peas and given excellent control of broadleaved weeds.

Severe damage to peas was obtained by the post-emergence treatments of maleic hydrazide. TCA had a marked influence on the pea foliage at all times and at all rates used.

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DISCUSSIONS ON SIX PREVIOUS RESEARCH REPORTS

Dr. K. Holly: I think this little group of papers illustrates very well the present trends in herbicide research in this country.

A few years ago we were faced with a great many weed problems and some new tools to try out on them. We tried these tools on many of these problems and if we achieved initial success we pressed on; if we met with failure we put that problem to one side and went on with some of the others which looked promising. At the present time, we are still tidying up some of the odds and ends left over from the first successes and amongst these is, of course, the use of dinoseb on peas. Mr. Reynolds' paper on the volume rate of application of dinoseb to peas is an illustration of this sort of tidying up.

We are now also able to turn back to some of the more difficult problems and here we can either look for new chemicals, as Mr. Gregory has done, or we can take some of our older compounds and try either to improve their weed killing efficiency or to use them under conditions where damage to the crop does not occur, as Mr. Ochiltree is doing with the effects of growth regulators on clover.

I have one or two points regarding individual papers. Firstly, I would like to ask Mr. Ochiltree about this effect of competition on the damage to clovers, which shows up strikingly in some of his histograms. Do the grasses that he was sowing with his clovers compete with the clovers for light as well as nutrient, or was only nutrient competition involved? This is of considerable importance with regard to the application of his results to the spraying of under-sown cereals.

With regard to Mr. Evans' paper, I am going to commit a heresy and ask whether he thinks it might be advisable under the conditions in which he is trying to do these trials, to forget about doing scientific experiments and to conduct something like a user survey, merely asking the contractor or farmer to leave an unsprayed strip in the field? In this way many more fields could be covered.

Finally, with regard to Mr. Reynolds' comparison of hoeing and spraying of peas, I would ask him whether this comparison is quite fair? It seems to me that one of the advantages of spraying dinoseb as compared with hoeing techniques is that spraying allows the peas to be sown in much closer rows and thus provides optimum conditions for higher yields.

Mr. W. Ochiltree: It may not be valid to compare the results for clover growing in competition with grasses and cereals. The grass is able to spread to a much greater degree than the cereal. Once the cereal has tillered, there is still a certain amount of light left, whereas grass tends to crowd in on the clover resulting in a greater competitive effect.

Mr. S. Evans: The joint programme of experiments on which I reported is, in fact, based on a compromise between a survey and the carrying out of many simple trials in different parts of the country. The great necessity, as we fully appreciated, was for a large number of trials but, unfortunately, these did not materialise. Surveys of a common practice are less troublesome to carry out and it is possible that this method of evaluation might under the circumstances have given more information. Whichever system is adopted, however, the observations are the most important part and take up most of the time. The laying down of small plots, as in these trials, does not take up much time, as there is the great advantage that it is possible to obtain information on two or three (in one trial this year there were four) treatments, whereas in a field survey there would be only the one treatment in each observation. In addition, these trials yield more precise information than could be obtained by an ordinary survey system. The disappointment is that the numbers of trials carried out has been small.

Mr. J. Elliott: To add to what Mr. Evans said about this programme of joint experiments on undersown crops, the object was to provide field experience as background to the more critical work which was being carried out by the A.R.C. Unit in co-operation with the N.A.A.S. We have sprayed, this year, about 500 plots of undersown clover. These small simple contractor-experiments were designed to give us background information on the normal spraying practice that is being carried out in this country and to help pinpoint those factors responsible for good or bad results. I think that they will give us more information than a survey because as Mr. Evans said more than one chemical and various doses have been used in many of the experiments.

Mr. J. D. Reynolds: I realise that I am risking a lot of criticism from spraying contractors when I give all this information about hoeing versus dinoseb, but one has to face facts. Those are the results of the trials. We did some years ago some small-scale experiments to compare different row widths and also different spacings within the row. We found that you tend to get a somwhat higher yield in narrow rows for a given seed rate but the position is complicated by the fact that seed density in the row is important. I think that you have got to consider how infinitely cheaper it is to inter-row cultivate. There still is a case for dinoseb of course, but one has to consider the difference in cost of inter-row cultivating even if you do not destroy the last ten or perhaps twenty per cent weeds, and obviously hoeing does not destroy the weeds in the row. If you are not unduly concerned about the weeds seeding, does the last ten or fifteen per cent of the weeds really matter in terms of final yield?

Mr. J. L. Hunt: I should like to ask Mr. Reynolds whether he has any information, apart from those reported in his trials, on the susceptibility of other varieties of peas. Also I should like to ask whether he has any experience of the application of intermediate volumes of around 30 gallons per acre? I believe that 30 gallons per acre is often not as good as 15 gallons or higher volume rates.

Mr. J. D. Reynolds: We have so far only been concerned with varieties grown for harvesting dry and there is very little difference between them. We have done no work with varieties grown for canning or quick freezing, however, I think the general consensus of opinion is that they are more susceptible. On the question of intermediate volumes, we used a volume of 30 gallons per acre only in one trial and in that particular trial, which is presented in my report, it was not significantly different from the other volumes.