CONTROL OF WILD OATS IN PEAS: PROGRESS REPORT, 1957-58

by

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Six detailed experiments compared TCA and propham (both seasons) and CDAA and CDEC (1957 only) at two pre-drilling times of application, with and without heavy cultivations. In addition, propham was tested in 1958 in 28 half-acre strips on a wide selection of soils.

TCA was found to be much more consistent than propham in controlling wild oats but invariably affected crop growth at the rates tested. Its use is recommended where wild oat populations are high enough for the risk of some crop damage to be acceptable. Propham is recommended where populations are lower and the chance of a poorer control of the weed is preferable to the possibility of greater crop damage which is involved with the use of TCA.

Methods of application and dosage rates are suggested for both TCA and propham so far as maximum wild oat control with minimum crop damage is concerned. Some varietal differences in TCA are indicated.

CDAA and CDEC gave unsatisfactory results.

Experimental

The work, which followed on that of previous years,[1-3] was divided into two main sections: (i) replicated trials to assess the influence of time of application and intensity of cultivations on the effects on peas and wild oats of TCA and propham (both years), CDAA (1957, two centres) and CDEC (1957, one centre), and (ii) simple farmer-sprayed half-acre strips treated with 3 lb. (active) of propham/acre, to cover a wider range of field conditions and to obtain some impression of farmer opinion of the treatment (1958).

In other work—not reported in detail here—a selection of pea varieties was tested for susceptibility to TCA and propham. Some consideration is given to the results of this work.

Time of application/cultivation trials

Plot size approx. 24 ft. × 9 ft. Chemicals applied by Oxford Precision Sprayer.

Main treatments (both years)

1. E = Early chemical application followed by normal seed-bed cultivations.
2. EC = Early chemical application followed by *extra cultivations* prior to normal seed-bed cultivations.
3. L = Later chemical application followed by normal seed-bed cultivations.
4. LC = Later chemical application followed by *extra cultivations* prior to normal seed-bed cultivations.

In 1958 the early applications were made about one week earlier than in 1957 (approx. third and fourth weeks of February respectively), while the later applications were made about two weeks earlier (approx. first and third weeks of March respectively).

The interval between later applications and sowing was about seven days in 1957 but approximately three weeks in 1958. Because of the excellent seed-bed conditions in 1958, earlier sowing had been expected but was eventually delayed by bad weather.

Subsidiary treatments

1957

Each treated plot paired with an untreated plot.

(*a*) T10 = 10 lb./acre of commercial TCA*
(*b*) I6 = 6 lb./acre of active propham**
(*c*) A12 = 12 lb./acre of active CDAA†
(*d*) E12 = 12 lb./acre of active CDEC††
} in 40 gal. of water/acre

(*e*) H = Wild oats removed by hand

* Containing 94% trichloroacetic acid as the sodium salt.
** Used in the form of a 50% wettable powder.
† α-chloro-*N*-diallylacetamide as 47·7% formulation.
†† 2-chloroallyl diethyldithiocarbamate as 47·7% formulation.

Rates of TCA and propham were intended to be about 50% above the optimum (as judged by earlier work) in order that marked and therefore clearer effects might be expected

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from the main treatments. Rates of CDAA and CDEC were chosen on the basis of independent work where 12 lb./acre, the highest dosage tested, caused no damage to peas.[4]

1958

(*a*) T7½ = 7½ lb./acre of commercial TCA
(*b*) I3 = 3 lb./acre of active propham
(*c*) I5 = 5 lb./acre of active propham
} in 40 gal. of water/acre
(*d*) H = Wild oats removed by hand
(*e, f*) C = Untreated

Farmer tests with propham, 1958

Twenty-eight farmers co-operated in this work, useful data being obtained from 26 centres. Each was supplied with 3 lb. of 50% propham wettable powder and asked to spray half an acre, at low volume, two or three days before preparation of the seed-bed.

Results

These are set out in Tables I–IV.

Table I

Wild oat kill: main trials

Main treatment	Centre	% kill of wild oats Subsidiary treatments 1957 T10	I6	A12	E12	Wild oat plant density (per sq. yd.) on untreated plots
E	Debenham (Suffolk)	99	86	19*	—	182
	Saffron Walden (Essex)	95	28	8*	23	10
EC	Debenham	96	71	31	—	151
	Saffron Walden	97	24	48*	55	10
L	Debenham	98	96	42	—	163
	Saffron Walden	87	50	57	25	11
LC	Debenham	97	98	47	—	167
	Saffron Walden	97	92	13	76	6

* denotes an increase in wild oat numbers

Main treatment	Centre	% kill of wild oats Subsidiary treatments 1958 T7½	I3	I5	Wild oat plant density (per sq. yd.) on untreated plots
E	Takeley (Essex)	86	36	61	2
	Bluntisham (Hunts.)	73	60	67	1
	Stonham (Suffolk)	93	62	52	4
	Whittlesey (I. of Ely)	86	62	76	37
	Mean	85	55	64	
EC	Takeley	81	42	33	3
	Bluntisham	63	50	63	1
	Stonham	92	72	76	2
	Whittlesey	88	61	90	40
	Mean	81	56	66	
L	Takeley	72	26	39	2
	Bluntisham	90	90	48	1
	Stonham	98	67	91	5
	Whittlesey	94	49	66	38
	Mean	89	58	61	
LC	Takeley	96	55	57	2
	Bluntisham	90	50	90	1
	Stonham	92	94	94	5
	Whittlesey	96	63	80	34
	Mean	94	66	80	

Table II

Yields of wild oat straw (green) at harvest expressed as % reductions of untreated control plots

Debenham 1957 main trial only

Main treatment	Percentage reductions T10	I6	A12	H*	Mean of untreated plots, cwt./acre
E	99	64	11†	79	35
EC	93	55	12	81	29
L	98	87	27	85	33
LC	96	94	28	91	29

† increase in yield

* It was not possible to hand-weed early enough, nor to maintain complete freedom from wild oats. Some wild oat competition inevitably occurred on these plots.

(i) *Time of application/cultivations trials*

Detailed observations were made through the growing period on the effects of TCA on crop growth. At Debenham in 1957, cultivations greatly reduced damage from the chemical, particularly in the case of the earlier applications. Early application without cultivations was a little better than later application with cultivation.

Table III

Main trial pea yields (cwt./acre)

Main treatment	Centre	Controls	T10	I6	A12	H*
E	1957	10·3	15·0	15·7	9·8	15·0
EC	Debenham	10·1	14·1	14·9	9·4	13·7
L		9·6	14·1	17·4	12·8	14·6
LC		10·8	13·8	17·0	12·6	15·4
	Means	10·2	14·3	16·3	11·2	14·7
		(±0·59) (whole plot)		(±0·48) (sub-plots)		

S.E. for use in horizontal comparisons (excluding controls) ±0·96
S.E. for use in other comparisons (excluding controls) ±1·05

Main treatment	Centre	Controls	T7½	I3	I5	Whole plot mean
E	1958	19·3	19·4	21·6	20·6	19·9
EC	Takeley	18·5	18·1	17·9	19·6	18·5
L		19·1	16·2	19·7	19·6	18·8
LC		18·4	13·7	18·6	19·1	17·8
	Sub-plot mean	18·8 (±0·32)	16·9	19·5 (±0·55)	19·8	18·7

S.E. for use in horizontal comparison ±1·10 (±0·64 for controls)
S.E. for use in other comparisons ±1·31 (±0·95 for controls)

Main treatment	Centre	Controls	T7½	I3	I5	H*	Whole plot mean
E	1958	5·6	6·1	6·7	7·5	7·2	6·5
EC	Whittlesey	5·6	7·5	7·5	5·6	6·9	6·4
L		4·9	6·4	6·6	5·3	6·8	5·8
LC		5·9	8·2	6·5	7·4	6·8	6·8
	Sub-plot mean	5·5 (±0·25)	7·1	6·8 (±0·36)	6·5	6·9	6·3

S.E. for use in horizontal comparisons ±0·73 (±0·52 for controls)
S.E. for use in other comparisons ±0·71 (±0·50 for controls)

* It was not possible to hand-weed early enough, nor to maintain complete freedom from wild oats. Some wild oat competition inevitably occurred on these plots.

Although the order of damage was similar in 1958 at all centres, there was very little effect from cultivations, yet a marked difference between early and late application.

It was noted that treatment effects became more pronounced as the season advanced. Plant counts showed no clear effect of treatments except at Saffron Walden (1957), where late propham application reduced plant by 25–30%.

Discussion

CDAA and CDEC

In 1957 both CDAA and CDEC were far inferior to TCA and propham, when the degree of wild oat kill given by the former is considered in relation to the reduction in crop yield.

Bearing in mind the small size of plot, it is considered that treatment effects are of insufficient accuracy where wild oat populations are no greater than 10 per sq. yd.

TCA

(a) *Effect on crop.*—It now seems well established that crop damage from this chemical is reduced by cultivation and lengthening the time between spraying and sowing. It is of note that the comparatively small difference between the two dates of spraying in 1958 had a far greater effect on crop damage than did cultivations. In 1956 and 1957 cultivations appeared to be more important in spite of a greater interval between spraying and sowing. Heavy rainfall after the 1958 sprayings may account for the cultivations effect in that year being only slight.

The danger of excessive cultivations on a heavy soil in a wet season was borne out at Takeley (1958) where cultivations tended to reduce yield over all subsidiary treatments. Interaction of late TCA application and heavy cultivations gave a marked reduction in yield compared with that from heavy cultivations alone.

In a few instances TCA has caused far more serious crop damage than expected in the circumstances. Such a case was the field in which the Stonham trial was sited. The explanation

Table IV

Farmer tests with propham, 1958

Site ref.	Soil type	pH	Date of spraying	Cultivations	Days from spraying to sowing	Reduction in pea population, %†	Reduction in wild oat plant population, %	Wild oat plants per sq. yd. (untreated)	Yield as per cent of untreated
1	ZL	8·2	17 Mar.	Medium	2	2	40	3	—
2	PyCL	7·4	20 ,,	,,	13	4	79	21	200‡
4	PyL	7·9	14 ,,	,,	3	2*	56	4	—
5	ZyCL	6·6	14 Apr.	Light	3	2	—	Nil	—
6	ZL	6·5	18 Mar.	Medium	2	7	79	180	165‡
7	ZyCL	6·3	11 ,,	,,	4	4*	65	55	—
8	ZyCL	5·1	8 Apr.	Heavy	2	—	96	36	—
9	OrgZL	6·7	14 Mar.	,,	21	3	—	Nil	—
10	SCL	8·2	7 ,,	Medium	8	5	—	,,	—
13	OrgCL	6·2	21 ,,	Heavy	21	0	62	92	—
14	OrgL	7·8	8 Apr.	Medium	2	11*	82	1	—
15	SCL	8·2	22 ,,	,,	7	2*	64	7	—
16	OrgCL	6·8	25 Mar.	Heavy	18	1*	72	43	124‡
17	SCL	8·1	28 ,,	,,	6	9*	86	56	145‡
19	ZL	7·4	19 ,,	Light	3	22	66	7	—
22	L	7·1	18 Apr.	Heavy	6	1	82	12	—
23	ZL	8·2	21 Mar.	Medium	12	23	—	Nil	—
24	L	8·0	18 ,,	Light	15	4*	72	1	—
25	PyCL	8·1	17 ,,	,,	7	26	65	21	114‡
27	PyL	6·1	18 Apr.	Medium	18	1*	—	Nil	—
28	ZL	6·1	6 Mar.	,,	15	9	0	1	—
29	PyL	6·5	14 ,,	Heavy	3	12	79	362	164‡
33	L	7·8	28 ,,	Light	8	0	57	1	—
35	L	7·9	24 Apr.	,,	18	4*	59	1	—
36	SCL	7·3	21 Mar.	Heavy	45	1	63	1	—
38	PyL	8·2	25 ,,	Medium	6	8	77	25	—
				13 data from main trial sites (1958)					
Takeley	ZyL	8·2	19 Feb.	Medium	28	8*	36	2	110
			19 ,,	Heavy	28	9	42	3	97
			3 Mar.	Medium	16	7	55	2	103
			3 ,,	Heavy	16	9*	26	2	101
Bluntisham	L	8·0	21 Feb.	Medium	40	4*	59	1	91
			21 ,,	Heavy	40	6	50	1	
			5 Mar.	Medium	28	6	93	1	96
			5 ,,	Heavy	28	1	50	1	
Stonham	ZyL	—	20 Feb.	Medium	32	15*	62	4	—
			20 ,,	Heavy	32	11*	56	2	—
			7 Mar.	Medium	17	8	67	5	—
			7 ,,	Heavy	17	5	94	5	—
Whittlesey	PyL	8·2	21 Feb.	,,	39	—	62	37	119
			21 ,,	Very heavy	39	—	61	40	135
			5 Mar.	Heavy	27	—	49	38	136
			5 ,,	Very heavy	27	—	63	35	110

Mean reduction in wild oat plant population was 63·2% (37 results) with a range of from 0% (very low population) to 96% kill.

L=loam, Z=silt, Zy=silty, Py=peat, C=clay, Org=organic, S=sandy.

* Denotes an increase in pea population.

† See also effect of propham at Saffron Walden in 1957 (see below).

‡ Based on two random sample areas of 9–24 sq. yd., in both treated and untreated areas, at centres where wild oat population was particularly high.

may be that drainage on this heavy soil was so impeded that the chemical tended to persist to an unusual extent in the top layers of the soil.

It has been noted that peas grown on TCA-treated soil are more susceptible to attack by downy mildew (*Peronospera viciae*).

(b) *Effect on wild oats.*—In 1956 early application and extra cultivations led to greater kill of wild oats.[3] In 1957 control was equally good on all treatments, while in 1958 the later applications resulted in better wild oat control with no effect from cultivations. The latter could be explained by greater washing through the soil of the chemical in that year, especially since the early applications were made earlier than in the previous two seasons.

It would appear that TCA continues to exert an effect on wild oat growth well into the season. This is suggested by comparison of the wild oat kills and wild oat yields of the Debenham trial and is also supported by the same comparisons in the 1956 trial data.[3]

(c) *Varietal differences in susceptibility.*—All main trials were sown with Zelka (marrowfat) peas, by far the most widely grown variety of all classes of pea. In two experiments in 1958 (not reported here) it was found that Zelka was the only variety to show consistently serious

damage from TCA, while the following varieties were all comparatively unaffected: Dark Skin Perfection, Gregory's Surprise, Kelvedon Wonder, Lincoln, Meteor, Onward, Rondo, Thomas Laxton, Victory Freezer and Witham Wonder.

Limited field experience has tended to support these findings,[3] although greenhouse experiments did not show that Zelka (?) was so particularly susceptible.[5] It remains to be seen whether the other marrowfats (Big Ben and Emigrant) react similarly.

Propham

(a) *Effect on crop.*—Although, as discussed earlier, the plant-count data are not considered to be of great accuracy, it appears certain that propham tended to reduce plant numbers, occasionally to a marked extent as occurred in the 1957 Saffron Walden trial (25–30% depression with 6 lb. of active material). In this instance the losses were thought to be due to a lack of seed-bed cultivation and a short interval between spraying and sowing (4 days). In the cases of the three greatest depressions in 1958 (sites 19, 23 and 25—see Table IV), two received comparatively light cultivations and the interval between sowing and spraying varied from 3 to 12 days. On the other hand, a number of the tests were sown within 3 days of spraying without noticeable loss of plant. It seems clear that propham does not affect crop growth *after* emergence.

(b) *Effect on wild oats.*—In 1957 there was a clear indication that the later applications of propham (15th and 22nd March) gave better control than those applied 3 weeks earlier. There was no marked indication that the later applications in 1958 were superior to the earlier ones, but since both dates were earlier than in 1957—the later date was over 2 weeks earlier—this does not contradict the 1957 results.

While, in general, it may be considered that propham gives a fair control of wild oats, the impression is gained that optimum manner of usage has yet to be worked out. Further work on technique of application is clearly required.

In the only main trial centre in 1958 with an appreciable wild oat population, 5 lb. of propham gave only a slightly better kill than 3 lb.

(c) *Effect on broad-leaved weeds.*—It was noted, particularly in many of the farmer tests, that propham gave excellent control of broad-leaved weeds, particularly types of willow-weed (*Polygonum persicaria* and closely related species). This kill of broad-leaved weeds probably contributed appreciably in several cases (notably centres 2, 16 and 29—see Table IV) to the increased yields resulting from the treatment.

There was no discernible relationship between the effects of propham and soil type or pH. This is not unexpected in view of the wide variation in conditions of application over a relatively small number of tests.

Practical application of results

It would still appear premature to make a final assessment of the relative merits of TCA and propham for the control of wild oats in peas, particularly as it now appears that Zelka—on which all main trials have been carried out—is particularly susceptible to TCA.

TCA appears rather more reliable in its action than propham, and is therefore to be recommended where it is particularly desirable to rid the land of wild oats and some loss of crop can be tolerated, and especially where wild oat competition is likely to have more effect than herbicidal damage.

While propham is, in general, far less damaging to peas than TCA, occasions have occurred when it has seriously reduced emergence. A farmer treating a whole field is, however, unlikely to be aware of any loss from propham, whereas the TCA effect is likely to be seen until harvest. More information is required concerning the conditions under which propham can be used with minimum risk to the crop. At present there would appear to be a good case for using propham at not more than 3 lb. (active)/acre where wild oats are troublesome and where it is inadvisable to employ TCA.

While propham has the advantage of controlling many species of broad-leaved weeds, it is also unpredictable in this respect. Weeds can, however, be treated with normal rates of dinoseb following pre-sowing applications of propham, whereas this action is risky following TCA treatment because of the removal by this chemical of the protective wax layer from the leaf

surfaces. However, evidence has been presented[5] that TCA also renders weeds more susceptible to dinoseb so that, by considerably reducing the dosage, satisfactory weed kill may be obtained without appreciable increase in crop damage. A few crops of TCA-affected peas have, in fact, been treated with half-strength dinoseb quite effectively, but more field experience of such treatment is urgently required before firm recommendations can be made.

Procedure for use of TCA should be as indicated elsewhere[6] except that it is advisable to allow three weeks between spraying and drilling, except on light soils where the chemical can be thoroughly incorporated more easily.

Where, for the reason of high wild-oat density, TCA must be used on heavy soils, it is advisable to sow varieties other than marrowfats.

Cultivations on heavier soils, following TCA application, should not be carried out while the land is rather wet. While the wet condition in itself assists in the incorporation of TCA, it is probably wise to delay drilling until the land has dried out sufficiently to allow some moderate cultivation, without risk to the soil structure.

Propham would appear to be best applied rather later than TCA, preferably in the second or third weeks of March. While both chemicals require to be in contact with the wild oat seeds at the time of their germination, TCA appears to require time (modified by rainfall and cultivations) to become intimately mixed with the soil, whereas propham is rather volatile and probably diffuses comparatively quickly through the soil. In order to avoid losses from volatilisation it is suggested that the land should receive a moderate cultivation as soon as possible after the application of the latter chemical. Too early application of the chemicals means that they are lost from the zone of the wild oat seeds before the time of their germination.

With both TCA and propham, it would appear that sowing must be delayed until at least the middle of March. Thus vining pea crops scheduled to be sown before this date should not be preceded by applications of TCA or propham.

In areas where downy mildew (*Peronospera viciae*) is prevalent, it is particularly undesirable to sow varieties of peas susceptible to this disease after treating land with TCA. Marrowfats are especially susceptible to this disease.

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CONTROL OF WILD OATS (*AVENA FATUA*) IN SUGAR BEET, 1955-58

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A summary is given of experiments on the control of wild oats in sugar beet conducted since 1955. Of a range of chemicals tested, TCA has been the most reliable and satisfactory; propham has also shown promise but has given less consistent control. Evidence is presented to show that much of the variability with propham, and to a lesser extent with TCA, can be eliminated by more attention to the time and method of application. It is concluded that if this is done, propham becomes worthy of consideration as an alternative to TCA in many situations.

Introduction

Experiments have been in progress at the Norfolk Agricultural Station since 1952 on the control of weeds in the sugar beet crop and the results of earlier experiments have been communicated to previous Weed Control Conferences.[1-3] This paper will review the experiments carried out on the control of wild oats (*Avena fatua*) in the years 1955-58, Mr. C. Parker having been in charge of the work until 1956.

Materials and methods

In all experiments the chemicals were applied to the seed-bed and incorporated into the soil before drilling. An Oxford Precision Sprayer was used, applying 25 gal. of liquid/acre at a spraying pressure of 25–30 p.s.i. Plot size was 1/100 or 1/200 acre and only replicated trials are discussed. All herbicide dosages mentioned are in terms of acid equivalent.

Counts of wild oat and sugar beet emergence were made just before singling (beet in the 2–4 true-leaf stage); the trials were subsequently hoed and singled so that no further observations were possible on the wild oats. All sugar beet yield figures therefore represent the effect of the chemical on the crop in the absence of weed competition after the singling stage. Estimates of sugar beet vigour and wild oat cover were made at the same time as the counts by two observers scoring on a 0–10 basis. Plant population counts were made in July or August.

Results

At the 1956 Weed Control Conference the general conclusion in several papers dealing with the control of wild oats in peas, sugar beet and kale was that TCA was the most reliable chemical, and Holmes & Pfeiffer[4] reported that with a dose of 7·5 lb./acre an average control of about 75% was obtained, and that the probability of obtaining more than 70% control was 70%. There was, however, a small proportion of trials in which poor control was obtained (10% gave less than 50% control). Propham appeared to be less reliable, the average control in 20 experiments in 1956 being 49% and 66% with 3 and 6 lb./acre respectively. Dalapon had less selectivity than either propham or TCA when used as a soil treatment.

Table I summarises the results obtained since 1955 on various sites in Norfolk and Suffolk. The figures in brackets refer to the number of results of which the adjacent figure is a mean. All figures are expressed as percentages of the controls. The range of control obtained with each treatment is also given.

Propham and TCA were the most thoroughly tested chemicals and there is general agreement with the results of Holmes & Pfeiffer; control with 6 lb. of TCA/acre varied between 40 and 100%, average 80%; that with 3 lb. of propham/acre between 0 and 96%, average 60%. Doubling this dose of propham improved the results only slightly and they were still not as good as with 6 lb. of TCA/acre. Dalapon, tested in 1958 only, was slightly inferior to TCA for pre-sowing applications. A number of other chemicals were tested in individual trials and the results are given for the record. None are considered superior to TCA or propham, nor does a mixture of propham with TCA appear particularly useful. The results with endothal and a mixture of endothal with propham were encouraging, however, in view of results obtained in 1958 against broad-leaved weeds; further discussion of these treatments is dealt with in another paper.[5]

Table I

Results obtained with pre-sowing applications of various chemicals since 1955 in the control of wild oats in sugar beet

Chemical	lb./acre	Years in which tested	Wild oats, % survivors Mean	Wild oats, % survivors Range	Sugar beet, % emergence Mean	Sugar beet, % emergence Range	Sugar beet, % vigour before singling Mean	Sugar beet, % vigour before singling Range	Sugar beet, % final plant Mean	Sugar beet, % final plant Range	Sugar beet, % root yield Mean	Sugar beet, % root yield Range
TCA	3	1958	55 (1)	—	95 (1)	—	93 (1)	—	—	—	—	—
	4	1955–7	43 (8)	11–124	95 (9)	78–112	93 (7)	79–100	104 (6)	98–115	104 (2)	103–105
	6	1955–8	20 (27)	0– 60	92 (31)	73–113	84 (29)	65–103	102 (28)	93–121	98 (13)	90–103
	9	1955–8	13 (18)	0– 67	93 (19)	82–100	78 (17)	63– 97	102 (18)	93–115	98 (5)	94–105
	12	1956–8	3 (7)	0– 8	76 (10)	45–107	70 (10)	51– 96	96 (9)	86–102	91 (6)	88– 98
	13·5	1955	31 (4)	2– 91	84 (6)	68–110	75 (6)	57– 87	94 (5)	88–104	96 (3)	90–102
Propham	2	1955–7	47 (13)	4–115	99 (14)	59–120	83 (12)	64–101	102 (11)	84–120	100 (3)	93–105
	3	1955–8	40 (31)	4–119	93 (35)	44–131	83 (32)	30–102	102 (32)	68–127	98 (14)	85–105
	4·5	1955–8	35 (23)	1– 87	90 (24)	38–112	72 (21)	26–100	100 (23)	53–120	102 (6)	90–110
	6	1956–8	36 (7)	2– 79	93 (10)	76–106	90 (9)	17–108	104 (9)	97–113	100 (6)	95–112
	6·75	1955	14 (7)	0– 37	72 (9)	25–103	44 (9)	19–102	84 (9)	32–105	92 (4)	88– 94
	12	1958	9 (1)	—	83 (1)	—	70 (1)	—	101 (1)	—	—	—
Propham+TCA	1·3+2·6	1956	42 (1)	—	106 (2)	101–111	96 (2)	90–101	119 (1)	—	—	—
	1·5+3	1957	26 (3)	12– 43	77 (3)	72– 82	74 (3)	71– 80	101 (3)	93–107	—	—
	2+4	1956	28 (1)	—	107 (2)	96–118	88 (2)	80– 97	111 (1)	—	—	—
	2·25+4·5	1957	36 (3)	24– 40	98 (3)	94–103	88 (3)	78– 97	107 (3)	105–109	—	—
	3+6	1956–7	26 (2)	20– 31	91 (3)	79–101	75 (3)	60– 86	110 (2)	95–124	—	—
Dalapon	3	1958	31 (3)	19– 40	92 (5)	83– 97	89 (5)	70–107	108 (4)	94–122	98 (3)	89–107
	6	1958	15 (3)	13– 17	87 (5)	75– 94	78 (5)	52– 94	105 (4)	88–122	97 (3)	96– 98
5518†	2	1956–7	—	—	117 (1)	—	100 (1)	—	—	—	—	—
	3	1956–7	8 (1)	—	83 (1)	—	94 (1)	—	100 (1)	—	—	—
	4	1956–7	—	—	82 (1)	—	40 (1)	—	—	—	—	—
	4·5	1956–7	8 (1)	—	64 (1)	—	59 (1)	—	93 (1)	—	—	—
	6	1956–7	3 (1)	—	67 (1)	—	49 (1)	—	88 (1)	—	—	—
	8	1956–7	—	—	80 (1)	—	20 (1)	—	—	—	—	—
5522‡	3	1956–7	55 (1)	—	111 (1)	—	104 (1)	—	102 (1)	—	—	—
	4·5	1956–7	24 (1)	—	90 (1)	—	87 (1)	—	98 (1)	—	—	—
	6	1956–7	28 (1)	—	80 (1)	—	76 (1)	—	97 (1)	—	—	—
CDEC	3	1955	—	—	105 (1)	—	90 (1)	—	111 (1)	—	—	—
	4	1956	—	—	93 (1)	—	90 (1)	—	—	—	—	—
	6	1956–7	98 (1)	—	90 (2)	84– 96	80 (2)	70– 91	90 (1)	—	—	—
	6·75	1956–7	—	—	108 (1)	—	77 (1)	—	108 (1)	—	—	—
	9	1956–7	93 (1)	—	77 (2)	65– 89	76 (2)	50–103	107 (1)	—	—	—
	12	1957	147 (1)	—	95 (1)	—	91 (1)	—	99 (1)	—	—	—
CDEA	3	1955	58 (2)	57– 60	87 (2)	84– 90	70 (2)	60– 80	—	—	—	—
	6·75	1955	50 (2)	21– 80	68 (2)	65– 70	47 (2)	—	—	—	—	—
CDAA	3	1955	74 (1)	—	106 (1)	—	93 (1)	—	104 (1)	—	—	—
	6·75	1955	61 (1)	—	102 (1)	—	83 (1)	—	85 (1)	—	—	—
Endothal	3	1958	68 (4)	48–104	93 (4)	83–101	96 (4)	90–100	118 (3)	106–133	97 (1)	—
	3·75	1958	73 (1)	—	98 (2)	95–100	84 (2)	75– 92	102 (2)	—	99 (2)	98–100
	6	1958	79 (4)	44–124	106 (4)	96–112	90 (4)	83– 97	111 (3)	103–115	92 (1)	—
	7·5	1958	66 (1)	—	85 (2)	84– 86	78 (2)	59– 98	98 (2)	93–103	97 (2)	96– 98
	12	1958	46 (4)	29– 82	104 (4)	97–113	49 (4)	37– 70	119 (2)	108–128	89 (1)	—
Endothal+propham	1·5+1·5	1958	32 (1)	—	90 (1)	—	90 (1)	—	104 (1)	—	93 (1)	—
	3+3	1958	42 (1)	—	89 (1)	—	90 (1)	—	104 (1)	—	93 (1)	—
	6+6	1958	16 (1)	—	95 (1)	—	77 (1)	—	100 (1)	—	95 (1)	—

† 5518 = *iso*Propyl *N*-(3-methylphenyl)carbamate

‡ 5522 = 1-chloroprop-2-yl *N*-(3-methylphenyl)carbamate

The maximum doses which were safe on the crop were 9 lb. of TCA and 4·5–6 lb. of propham/acre. In general, a reduction in seedling emergence of 20–30% has been found to be permissible without loss of final plant, but the exact effect depends upon the seed rate, and greater care would be necessary with low seed rates applied with a precision drill. Similarly with most chemicals, reductions in vigour up to 30% in the early seedling stage seem to be tolerated without affecting the yield.

Effect of time of application

Proctor & Armsby[6] concluded from the results of a replicated trial and 50 unreplicated plots in peas that TCA gave the best control of wild oat when an interval of 2–3 weeks elapsed between spraying and drilling. Discussion with Mr. Proctor in 1957 indicated that the interval between spraying and drilling might also be important in the case of propham. Fig. 1 is a scatter diagram showing the relationship between this factor and the percentage of surviving wild oats for two rates of propham and TCA, the data being taken from all available trials since 1955, regardless of other factors such as season, rainfall, cultivation, etc.

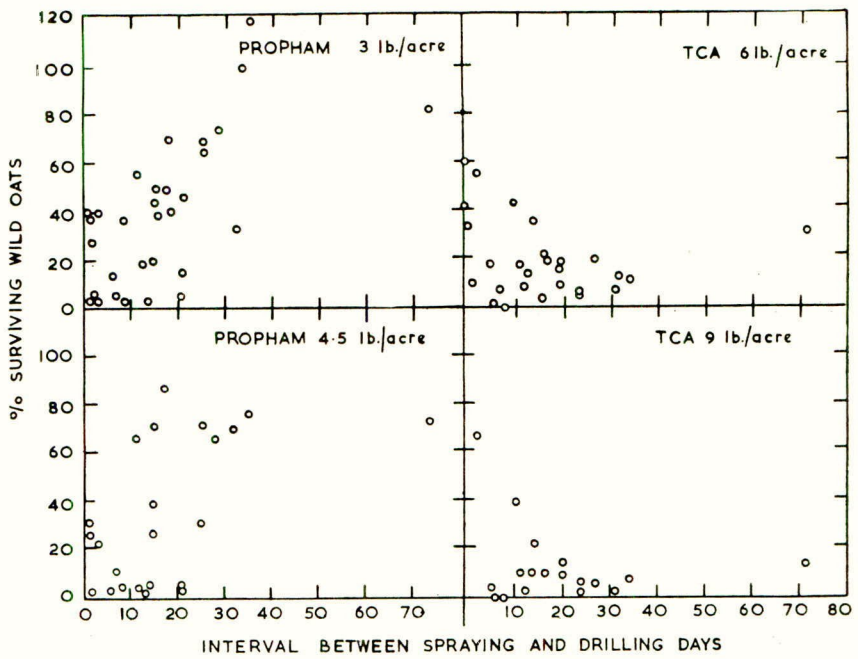

FIG. 1.—*Effect of interval between spraying and drilling on control of wild oats with propham and TCA*

It is clear that with propham much of the variation in degree of wild oat control which has been experienced is related to the interval between spraying and drilling. The correlation is highly significant, thus:

Propham	Correlation coefficient, r	Probability
3 lb./acre (31 cases)	0·64	$<0{\cdot}001$
4·5 lb./acre (23 cases)	0·54	$<0{\cdot}01$

It appears from these diagrams that by applying propham in the week preceding drilling there would be reasonable certainty of obtaining at least 60% control; applications made earlier than this are likely to be less successful.

With TCA the results are less striking and there is no significant correlation, but it is noteworthy that, although many of the applications made within 2½ weeks of drilling were successful, all of the instances of control less than 75–80% were from such applications (except one which was sprayed unusually early, 73 days before drilling). This supports the conclusions of Proctor & Armsby.

The effect of interval between spraying and drilling on sugar beet emergence is shown in Fig. 2. There is no evidence of any effect with TCA and no more than a slight suggestion that late application of propham may affect emergence.

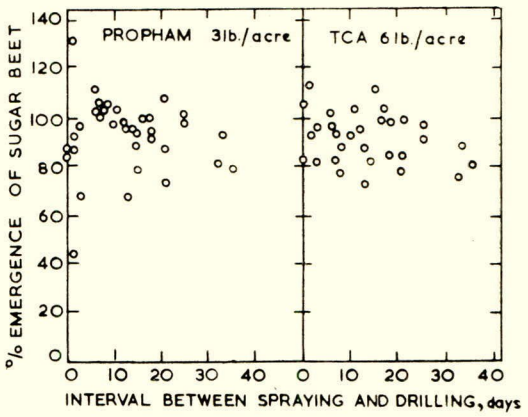

FIG. 2.—*Effect of interval between spraying and drilling on sugar beet emergence*

Incorporation of the chemical into the soil

Indications were obtained from several earlier trials that poor results might be obtained with propham if it were not mixed into the soil soon after application. However, in these experiments the effect was confused with time of application because delay in incorporation was achieved by applying the chemical at different dates and cultivating the whole trial area only after the last application. To clarify this point, a trial was laid down in 1958 in which plots were individually cultivated by means of a hand rotary cultivator; the results are in Table II.

Table II

Effect of times of application and incorporation of propham and TCA on the percentage of surviving wild oats (assessed by visual scoring)

Treatment	Propham 3 lb./acre		Propham 4·5 lb./acre		TCA 6 lb./acre		TCA 9 lb./acre		Control	
	%	Ang. trans.	%	Ang. trans.	%	Ang. trans.	%	Ang. trans.	%	Ang. trans.
(*a*)	74	59·3	31	33·9	10	18·4	2	8·6	100	90
(*b*)	69	56·0	65	53·9	8	16·6	3	10·4	100	90
(*c*)	3	10·4	1	6·1	16	23·9	13	20·8	100	90

Treatment (*a*): sprayed 27.3.58; incorporated 29.3.58; drilled 21.4.58
,, (*b*): ,, ,, ; ,, 17.4.58; ,, ,,
,, (*c*): ,, 15.4.58; ,, ,, ; ,, ,,

S.E. per plot as percentage of general mean = 17·7%

	P=0·05	P=0·01	P=0·001
S.D. for use within the columns of the table	=10·7	14·6	19·8
S.D. for use anywhere within the table	=15·9	22·1	30·7

The results of this experiment clearly bear out the above conclusions regarding time of application; further the response to early applications of propham was improved by working the chemical into the soil soon afterwards (upper dose only).

Less clear-cut evidence is available for the effect of thoroughness of incorporation of the chemical into the soil. A series of trials was conducted from 1955 to 1958 to compare discs with harrows for working propham and TCA into the soil. In 1956 no wild oats appeared on the site of the experiment. The results for the other years are shown in Table III.

Table III

Effect of post-spraying cultivations on percentage of wild oats surviving treatment with propham and TCA

		1955		1957		1958	
Interval between spraying and drilling		0–2 days		7–8 days		21 days	
Cultivation following spraying		Discs	Harrows	Discs	Harrows	Discs	Harrows
Propham	3 lb./acre	4	40	4	6	13	4
	4.5 lb./acre	—	—	4	10	3	3
TCA	6 lb./acre	11	60	0	1	14	22
	9 lb./acre	—	—	0	0	10	11
	13·5 lb./acre	8	91	—	—	—	—

In 1955 there was considerable benefit from incorporating the herbicides into the soil by discing, but in the other years this effect was much less marked. It is not possible to draw conclusions from these limited data but in view of results reported by Proctor & Armsby[6] it would appear that, in general, thorough cultivations such as discing will ensure a greater chance of success.

Soil type

Where experiments have been carried out for a number of years on the same or neighbouring farms the influence of soil type has become apparent. Thus on a farm at Ingham in East Norfolk propham has been consistently more effective than TCA, whereas on land at Dennington in Suffolk both chemicals have given only moderate control of wild oats. It is not possible to relate these differences to any obvious soil characteristics and much further work would be required to throw light upon this question. However, with one exception, soil type has not been responsible for major differences in response comparable with those due to time of application. The exception was on black fen soil with a high organic matter content. Here, propham was almost completely inactivated; TCA has not been used on this type of soil but the results of questionnaires circulated to farmers in 1957 and 1958 indicated that, although some successful results were obtained, the proportion of unsuccessful ones was high.

Weather conditions following spraying

There was no evidence that weather conditions following spraying influenced the results with propham; some damage to sugar beet was experienced in 1955, especially in one trial, but this is thought to have been connected with the formulation which was used in that season,* because the conditions prevailing in 1955 were similar to those of 1957—very dry with average temperatures. In the case of one trial where the damage was exceptionally bad, soil type may have contributed to the adverse result.

In the very dry spring of 1957 some damage to sugar beet was experienced with TCA at doses of 6–12 lb./acre but this effect was only permanent at the 12-lb. dose level. Little effect of weather conditions has been observed on wild oat control with TCA.

Discussion

It is probable that the majority of wild oats which infest the sugar beet crop are those whose germination is stimulated by the cultivations which immediately precede sowing. Those which germinate earlier, either naturally or as a result of early cultivations, are probably killed by later cultivations. In practice, little is usually done to the land between ploughing in the autumn or winter and preparing the seed-bed a day or so before drilling. This would account for the significance of the interval between spraying and drilling—it is really the interval between spraying and wild oat germination which is important. Proctor & Armsby[6] discussed the mode of action of TCA; they presumed that it was necessary for the chemical to be present near the wild oat seed when it began to germinate and, this being the case, application 2–3 weeks before sowing combined with thorough cultivations would ensure the best chance of success since TCA depends upon soil moisture for its movement. It appears likely that dry soil conditions would restrict this movement of TCA but no clear evidence to this effect has been obtained.

Propham differs from TCA in being highly insoluble (32 p.p.m. at 25°) and in having appreciable volatility. It is presumably able to spread through the soil in vapour form and will therefore reach the wild oat seed more quickly than TCA so that it may be applied later. Further, if applied too soon, much of the chemical will have evaporated from the soil by the time the wild oats destined to infest the crop are germinating. Timely incorporation will apparently reduce this loss but will not prevent it entirely. It is to be expected that propham will not be very dependent upon soil moisture but its diffusion through the soil might be reduced under extremely wet, cold conditions. These have not been experienced so far, but might be a possible cause of occasional crop damage or poor wild oat control in the future.

The choice of TCA by Holmes & Pfeiffer as being the most reliable chemical for the control

* A 'home-made' oil–water–acetone emulsion which was not very stable; an oil–water emulsion (Fisons CR 1249) was used subsequently.

of wild oats has been borne out by the results of this work. However, TCA has certain disadvantages in use, two of which are—

(1) the necessity to apply it and work it thoroughly into the soil 2–3 weeks before drilling. Farmers like to make their earliest sowings of sugar beet as soon as the land is fit and this precludes the most efficient use of TCA on the earliest fields. It is also undesirable to cultivate the soil more than is absolutely necessary before sowing because of the risk of losing moisture from the seed-bed; the majority of complaints received from farmers about the use of TCA in the dry season of 1957 were concerned with this point;

(2) the fact that it gives little control of broad-leaved weeds.

Propham may well be a useful alternative to TCA in many situations. It can be applied during the process of seed-bed preparation and thus involves no more cultivation than would normally be performed. If applied at this time it would give a level of control of the same order as TCA. It has the further advantage of being toxic to a number of important broad-leaved weeds, notably knotgrass (*Polygonum aviculare*) and other Polygonaceae, and chickweed (*Stellaria media*).[2,5] Its use would therefore appear to be justified in the following situations at least: early drilled crops; on land where susceptible broad-leaved weeds are also important; and in seasons when it is important to conserve moisture in the seed-bed.

Acknowledgments

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CHEMICAL CONTROL OF WILD OATS BY PRE-SOWING TREATMENTS

by

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Six trials on peas and sugar beet were laid down in Suffolk in 1958, using TCA, propham, CIPC and CDEC at different dose rates.

Only TCA and propham at 4 lb./acre proved to be consistently satisfactory for both wild oat control and minimal crop damage. TCA generally gave rather better wild oat control than propham (68–95% as compared with 62–92%), but only in one case was there a marked difference. Propham reduced the germination of beet by 20% in one trial, but had little effect in the other five. TCA did not affect germination, but caused about 20% reduction in vigour of peas. Propham gave rather better control of broad-leaved weeds than TCA.

Propham at 2 lb./acre and CDEC at both rates gave unsatisfactory control of wild oats. CIPC at both rates and propham at 8 lb./acre, although giving excellent weed control, were too severe on the crops.

Introduction

The extent and severity of the wild oat problem was fully discussed at the B.W.C.C. of 1956.[1] Little progress in the field of chemical control has been made since that date and, with the failure of CDAA to live up to earlier promise for the pre-sowing treatment of barley, sugar beet and peas remain the only main crops in which chemical control is commercially practised. That TCA, which has been widely used for this purpose, does not give a complete or consistent kill of wild oats is probably due to the difficulty of ensuring thorough incorporation in the soil. Nevertheless, TCA does suffer from certain other disadvantages. Notable amongst these is the damage it causes to peas, which may lead to a loss in yield of up to 2 cwt./acre. Secondly, the recommended 3-week interval between spraying and sowing may be difficult to fit into the farming programme, especially under difficult weather conditions. Thirdly, TCA gives no control of broad-leaved weeds. Fourthly, TCA by affecting the 'bloom' of peas makes them more susceptible to dinoseb sprays.

Previous work has indicated that propham, although not giving quite such a good control of wild oats as TCA, does not damage peas. Furthermore, propham does control broad-leaved weeds, does not make peas more susceptible to dinoseb spraying and can be applied about a week before sowing without any danger to the crop.

The trials reported here were laid down to obtain further detailed comparison of propham with TCA, with particular attention to damage to peas. At the same time it was felt that CIPC should be further investigated for wild oat control and that CDEC should be included in view of promising results with this chemical.[2]

Experimental

A four-replicate randomised block lay-out was used, with 2-yard pathways between plots of 20 yd. × 4 yd. The chemicals were applied at 60 gal. with an experimental row crop sprayer mounted behind a Land Rover. A pressure of 35 p.s.i. was used with Allman's No. 4 jets. In every case the chemicals were sprayed on to the broken-down plough furrow and incorporated with medium harrows during the first 18 hours after spraying. All the trials were sprayed during the last fortnight in March.

Treatments were as follows (all lb./acre): TCA, 7½; propham, 2, 4 and 8; CIPC, 2 and 4; CDEC, 4 and 8; and an untreated control.

Weed control assessments were carried out by counting the wild oats and broad-leaved weeds in three 1-yard quadrats per plot. Crop germination was assessed by counting six 6-ft. row lengths per plot. Further visual gradings of crop vigour were taken throughout the growing season.

There was a mixed population of weeds on every site, comprising various *Polygonum* spp., *Chenopodium album*, *Stellaria media* and *Veronica* spp.

Records were kept of soil temperature at spraying, soil type, and the extent of cultivation between spraying and sowing. These factors varied very little from site to site and can hardly have had much effect on the results, apart from the fact that the soil was rather lighter in two trials.

Results

Control of wild oats (Table I)

TCA in these trials gave a level of control that was always above 70%. Propham at 8 lb./acre was at least as good and at 4 lb./acre was only slightly inferior, but at 2 lb./acre it was not satisfactory. CIPC at both rates achieved much the same level of control as TCA, but CDEC at 4 and 8 lb. was very inconsistent.

It should be noted that in the first trial in Table I there was an abnormally high count of wild oats in one plot treated with CDEC at 8 lb./acre.

Control of broad-leaved weeds (Table II)

TCA, as expected, gave hardly any control of broad-leaved weeds. CIPC at 4 lb./acre was the outstanding treatment, giving 77–99% control, but at 2 lb./acre it was not consistent.

Propham at 2 lb./acre was unsatisfactory, at 4 lb./acre was not consistently good and at 8 lb./acre was successful except in one trial. CDEC was again extremely inconsistent.

Table I

% Control of wild oats
(dosages in lb./acre)

TCA	Propham			CIPC		CDEC	
7½	2	4	8	2	4	4	8
88·4*	38·6	65·3	72·2	—	61·0	47·3	48·1
98·4	70·3	92·0	99·3	83·0	96·4	46·5	85·0
68·3	8·9	80·2	92·1	67·3	73·3	42·6	74·3
87·2*	44·8	89·0	93·9	86·3	98·5	−3·4	12·4
96·8	60·8	66·7	92·5	84·9	92·5	10·2	76·3
71·3	52·0	62·9	75·6	78·2	67·6	33·1	58·5

* Rather lighter soil

Table II

% Control of broad-leaved weeds
(dosages in lb./acre)

TCA	Propham			CIPC		CDEC	
7½	2	4	8	2	4	4	8
63·7	84·9	89·6	90·4	—	95·0	66·7	84·6
40·6	67·6	91·1	97·7	86·3	98·0	43·5	73·1
25·5	31·6	75·5	88·8	86·3	96·3	41·3	59·3
−18·2	−43·6	45·8	74·2	77·8	89·5	−8·8	−2·9
33·8	1·3	34·9	46·8	21·2	82·3	−5·2	51·1
46·0	34·0	38·5	73·0	68·7	77·0	34·5	75·0

Crop damage (Table III)

TCA, propham at 2 lb./acre and CIPC at 2 lb./acre had little effect on crop germination. In one trial, propham at 4 lb./acre caused a marked reduction of beet germination. In one trial, CDEC at 8 lb./acre caused large reductions and the highest rates of propham and CIPC both led to serious reductions, although not in every trial.

At the time of counting, propham at 8 lb./acre and both rates of CIPC had delayed germination to some extent, except on the site where the spraying/sowing interval was 42 days.

Table III

% Reduction in crop germination relative to control
(dosages in lb./acre)

Crop variety	Interval in days between spraying and sowing	TCA	Propham			CIPC		CDEC	
		7½	2	4	8	2	4	4	8
Peas									
Maple	15	−2·0	−8·1	−3·0	41·5	−6·1	30·0	−6·7	−3·5
Lincoln	27	−1·1	−10·4	−11·0	−2·3	−3·8	−4·4	3·2	11·6
Canner's Perfection	42	−13·5	−14·9	−15·9	−17·8	−2·3	−4·3	−20·2	−17·4
Sugar beet									
Sharpes	11	2·6	4·2	20·4	30·0	—	64·6	16·6	25·2
Kleine	20	5·7	3·5	10·5	41·2	39·9	18·4	19·1	−12·7
'E'	27	5·3	5·8	10·0	9·1	11·7	38·1	12·7	9·0

Results for visual gradings of crop vigour taken 5–9 weeks after sowing are shown in Table IV.

It can be seen that TCA had a serious effect on the vigour of peas in two out of three trials and this effect was particularly noticeable in one trial where the interval between spraying and sowing was only 15 days. Where this period was 6 days longer than the recommended 3-weeks period, a fair amount of damage was still noticed.

Propham at 2 lb. and CDEC at 4 lb./acre gave no depression of vigour. In only one trial was a slight depression noticed from propham at 4 lb. or CDEC at 8 lb./acre, the former on peas, the latter on beet. Propham at 8 lb., CIPC at 4 lb. and, to a lesser extent, CIPC at 2 lb./acre were all seriously damaging.

Table IV

% Reduction in crop vigour relative to control
(dosages in lb./acre)

Crop variety	Interval in days between spraying and sowing	TCA	Propham			CIPC		CDEC	
		7½	2	4	8	2	4	4	8
Peas									
Maple	15	23·7	5·0	10·0	43·7	18·7	58·7	2·5	6·2
Lincoln	27	17·1	−3·9	-1·3	2·6	2·6	23·7	2·6	0
Canner's Perfection	42	8·1	−5·4	0	0	16·2	5·4	−5·4	−2·7
Sugar beet									
Sharpes	11	5·2	−5·3	−1·3	20·0	—	53·9	1·7	8·0
Kleine	20	5·1	2·6	1·3	6·4	5·1	17·9	1·3	2·6
'E'	27	2·6	5·2	7·8	9·1	19·5	50·6	3·9	15·6

Discussion

These trials confirmed that TCA at 7½ lb./acre gives a slightly better control of wild oats than propham at 4 lb./acre, and that propham gives superior control of broad-leaved weeds under most circumstances. TCA appears to have no effect on sugar beet and its superiority for wild oat control makes it the most suitable chemical for use in this crop. In peas, however, the position is rather different. It is generally accepted that TCA gives a depression of yield of about 10% and sometimes more. Yields were not determined, but considerable depressions of crop vigour were noted, even in the trial where the spraying/sowing interval was 6 days longer than the recommended 3 weeks.

Propham reduced crop vigour slightly in one trial only, and this confirms the impression gained during the course of these trials that very little crop damage has been observed during commercial use of this chemical. Commercial results also seem to confirm that propham can be applied about one week before sowing without damaging the crop, which is another advantage over TCA. This latter point was not confirmed by these trials, and although some relation between time of application and crop damage can be observed in the tables, it is considered that there were not enough trials to draw a valid conclusion.

It would appear that the choice between TCA or propham for peas must depend on the extent of the wild oat population to be expected. Where it is thought to be very serious the slightly better control of wild oats given by TCA may well compensate for the yield depression caused by this chemical. Where the wild oat infestation is not serious, then propham should be used, since it seems to be rather more selective. Neither chemical gives a complete control of wild oats so that some measure of culture control will always be necessary after chemical treatment.

Among other treatments, propham at 2 lb./acre can be ruled out because of its poor control of both wild oats and broad-leaved weeds, while propham at 8 lb./acre and CIPC at 4 lb./acre, though both giving excellent control of wild oats, are obviously too damaging to the crop. CIPC at 2 lb./acre does not give any better control of wild oats than propham at 4 lb./acre or TCA at 7½ lb./acre, and there is a very narrow margin between a rate that does not damage the crop and one that does so severely. Under these circumstances it seems safer to use one of the two more selective chemicals.

The results with CDEC in these trials were disappointingly inconsistent. It has been mentioned that little difference in soil types was observed in these trials, but that, on the two sites where the soil seemed slightly lighter than the others, CDEC at 8 lb./acre gave least control of wild oats (12% and 48%) and most crop damage. On one of these sites there was an abnormally high wild oat count on one plot of the 8 lb./acre rate, possibly where a harvester was cleaned out in a previous year. Thus the figure of 48% control on this site is perhaps unfairly low. However, it is clear that further work is required with this chemical before it can be decided whether in fact its effect is too inconsistent to be commercially acceptable.

References

[1] Butler, A. J., *Proc. Brit. Weed Control Conf., 1956*, I, p. 43

[2] Blackett, R. D., *Proc. Brit. Weed Control Conf., 1956*, I, p. 55

Discussion on the three preceding papers

Mr. R. G. Heddle (Edinburgh and E. Scotland College of Agriculture).—These papers cover a rather wide range of crops, but they have this in common, that they are all crops in which traditional methods of weed control have been by mechanical means. Only in very recent times have chemicals become available, which offer promise of permitting chemical weed control.

Dr. Woodford pointed out (see above) that systems of crop husbandry have been to a large extent developed around the central problem of the necessity to control weeds, and drew the interesting conclusion that, if the efficiency of chemical methods can be sufficiently improved, we may have to reconsider our methods of husbandry. I think it will be generally agreed, however, that so far as most of the crops under consideration in these papers are concerned, we still are some way from achieving this end, and our immediate problem is rather that of assessing the value of chemical control methods and integrating such as are found to be useful into existing systems of husbandry. In this connexion, two aspects require consideration—the relative efficiencies of different methods, and relative costs. It would, however, be wrong to regard the two approaches to the problem as necessarily opposed, rather I would suggest it is by the intelligent combination of both that progress in the near future is likely to come.

Mr. C. V. Dadd (N.A.A.S.) in reply to Mr. T. C. Breeze.—In the Eastern Region we have carried out during 1957 and 1958 approximately six small-scale and two large-scale experiments with CDAA on spring barley and spring wheat. The results on the whole were disappointing, and there was crop damage without sufficient wild oat control on occasions. We do not think this technique sufficiently promising to merit further trials.

Mr. A. J. Butler.—Now that we are discussing sugar beet, I feel that my experience with contact pre-emergence weedkillers on this crop might be added to the previous discussion about this type of weedkiller in peas. While searching for sites this spring, the help of a large number of commercial representatives and sugar beet fieldsmen was enlisted. Furthermore, examination was made of all roadside beet fields during a thousand-mile drive in East Anglia. Only one field was discovered where the weeds (charlock) emerged before the beet. During the course of extensive discussions with the people concerned, the strong impression was gained that only in exceptional years is there any need for this type of weedkiller.

Mr. R. G. Hughes (N.A.A.S.).—Since the last conference, two years ago, work carried out in the South East on the control of wild oats in cereals has given disappointing results. The 1957 work was on the lines of that reported by Dr. Blackett (Blackpool Conference, 1956) when the maximum control obtained was 40% panicle reduction. In 1958 many factors such as soil temperature, moisture and dates of application, were considered on the same site (barley). The best results were obtained with early spraying, on 19th March, followed by mid-April sowing, but at the 60% maximum panicle control the result is not sufficiently satisfactory to warrant any recommendations for the use of CDAA for the control of wild oats in spring cereal.

For the control of wild oats in spring oil-seed rape, good results were obtained (95% control of panicles) with TCA at 8 lb./acre five weeks before sowing. Yellowing of the plant occurred with loss of bloom, but the effect of the removal of the wild oat far outweighed the toxic effects on the crop, to give an ultimate increased yield. Dalapon was also tested at 2–4 lb./acre post-emergence, pre-stem extrusion stage. Control of wild oats was poorer than that obtained with TCA, but both rates gave increase of oil-seed yield.