FIELD EXPERIMENTS IN CANTERBURY ON GRASS-GRUB AND OXYCANUS

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FIELD TRIALS against grass-grub (*Costyletra zealandica*) and *Oxy-
canus* spp. have been going on continuously since 1946 but this
paper deals only with trials at Halkett in Canterbury over the past
three years because the materials used there include some of the
organophosphorus preparations not used previously, and also be-
cause these organophosphates present features not present with the
older hydrocarbon insecticides. Since insecticide application is
made solely to increase farm production, the trials are evaluated
in this paper on the basis of pasture cover comparisons on treated
and untreated areas.

PROCEDURE

Trials areas were selected for uniformity of infestations by samp-
ling prior to treatment. Plot size was $\frac{1}{2} \times \frac{1}{2}$ chain and three repli-
cates were used, the randomization being within replicates if there
was variation in infestation intensity in different parts of the trial
sites. Treatment application was by hand, two ways at right-angles
to one another. All plots had the same amounts of superphosphate.
Application was to dry, close-grazed sheep pasture in absence of
stock, and a portable anemometer was used to measure wind velo-
city. Rain was recorded actually on the sites.

Assessment of insecticide effects was (a) by counting larvae of
Costyletra zealandica, *Oxycanus* spp. and earthworms in 7 in. cube
samples ("spade squares") of which at least 6 were taken from each
plot; each officer took the same number of samples from each
plot to avoid individual differences in sampling, (b) by giving
the percentage pasture cover on plots. Assessments were made
independently on serial numbers of plots, never on treatment
numbers. Over half an inch parts of earthworms were recorded
as whole worms. Trials were left down for 3 years to see if side-
effects of treatments arose.

SERIES I: Applied June 21, 1962, against a low population

Pre-treatment Sampling

					<i>No. per spade square</i>	
					<i>Range</i>	<i>Ave.</i>
Grass-grubs	.....	.....	.....	.....	1-32	4
<i>Oxycanus</i>	.....	.....	.....	.....	0-12	1

1st Assessment August 29, 1962 (after 2 months): No significant
differences between materials.

Low Re-infestation

					<i>No. per spade square</i>	
					<i>Range</i>	<i>Ave.</i>
Grass-grubs	.....	.....	.....	.....	0-31	5
<i>Oxycanus</i>	.....	.....	.....	.....	0-8	1

2nd Assessment July 29, 1963 (13 months after treatment) — Table 1.

TABLE 1

Materials* (lb)	% Pasture Cover Statistical Means	Significance c.f. Control	Loss in Cover %
DDT wet-mix super. 2	94.9	***	5.1
DDT dry-mix super. 2	90.2	***	9.8
DDT granulated super. 2	86.8	***	13.2
"Telodrin" spray 2	84.4	***	15.6
DDT pellets (Ivory) 2	79.3	***	20.7
DDT prills (McKee) 2	75.7	***	24.3
Heptachlor pellets 2	70.4	***	29.6
Methoxychlor dust 8	57.1	N.S.	44.9
Trichlorfon gran. 2	51.6	N.S.	48.4
Control	48.4	—	51.6
Carbaryl prills 2	44.6	N.S.	55.4
Methoxychlor dust 4	43.0	N.S.	57.0
Dieldrin prills ¼	42.4	N.S.	57.6
"Zectran" pellets 2	41.3	N.S.	58.7
Diazinon pellets 2	30.7	***	69.3
Phorate pellets 2	17.6	***	82.4

Differences for significance:

N.S. = not significant

* = 5%–8.86

** = 1%–11.75

*** = 0.1%–15.2

* Rates in lb active ingredient per acre.

Examination of the figures in Series I shows that DDT wet-mix was not significantly different from DDT dry-mix or DDT granules, but was significantly different from "Telodrin" at the 5% level and from DDT pellets (Ivory) and the remaining materials at the 0.1% level.

DDT dry-mix was not significantly better than DDT granules or "Telodrin", but was significantly different from DDT pellets (Ivory) at the 5%, McKee DDT prills at the 1%, and from heptachlor and the rest at the 0.1% level.

DDT granulated super. was not significantly different from "Telodrin" or Ivory DDT pellets, but was significantly different from McKee DDT prills at the 1%, and from heptachlor at the 0.1% levels.

"Telodrin" was not significantly different from either Ivory DDT pellets or McKee DDT prills or heptachlor, but was from methoxychlor 8 and the rest at the 0.1% level.

Control was significantly better than diazinon and phorate at the 0.1% level, and pasture on phorate plots was worse than that on diazinon plots at the 1% level.

It is not known yet just why diazinon and phorate caused pasture deterioration at Halkett, as the same materials did not have this effect in Riwaka soils of high fertility, but the deterioration was so severe that it would be extremely unwise for the Agricultural Chemicals Board to give full registration for these two preparations till we know more about such side-effects. According to J. E. Cox of the Soil Survey Division of D.S.I.R. it is probable that at least 250,000 acres of similar Canterbury soil will react in the same manner, and that it is more likely that much greater areas will be involved. The effect is possibly on nitrifying bacteria during the short effective life of the above organophosphates.

SERIES II: Applied March 11-12, 1963, against a high infestation

<i>Pre-treatment Counts</i>					<i>No. per spade square</i>	
					<i>Range</i>	<i>Ave.</i>
Grass-grubs	.....	.....	.....	.....	8-48	36
<i>Oxycaus</i>	.....	.....	.....	.....	4-14	11

1st Assessment: June, 1963 (4 months after treatment) — Table 2.

TABLE 2

<i>Materials (lb)</i>	<i>% Pasture Cover Statistical Means</i>	<i>Significance c.f. Control</i>	<i>Loss in Cover %</i>
DDT wet-mix super. 2	89.2	***	10.8
DDT dry-mix super. 2	85.8	***	14.2
Diazinon pellets 2	74.8	***	25.2
DDT granular super. B.O.P. 2	73.8	***	26.2
Heptachlor pellets 2	72.6	***	27.4
DDT granul. super. H(B) 2	63.8	***	36.2
DDT granul. super. H(C) 2	61.0	***	39.0
DDT granul. super. F.F.E.C. 2	52.1	***	47.9
Dieldrin prills 6¼	51.1	***	48.9
DDT gran. super. H(A) 2	45.1	***	54.9
DDT McKee prills 2	32.3	***	67.7
Control	15.6	—	84.4

Differences for significance:

N.S. = not significant

* = 5%-7.4

** = 1%-9.9

*** = 0.1%-12.8

NOTE: B.O.P. = Bay of Plenty. H (A), (B), (C) = K. P. Hornby, formulae A, B, C. F.F.E.C. = Farmers Fertilizer Works, East Coast (Napier).

Examination of this table shows that DDT wet-mix super. was not significantly different from DDT dry-mix super. but was significantly different from diazinon pellets and the rest at the 0.1% level.

Diazinon was not significantly different from DDT granulated super. B.O.P. and heptachlor, but was different from DDT super. granules H(B) at the 1% level and from DDT super. granules H(C) and the rest at the 0.1% level.

DDT granulated super. B.O.P. was significantly different from DDT granulated super. H(B) at the 1% level, and from DDT granulated super. H(C) and the rest at the 0.1% level.

Heptachlor was significantly different from DDT granulated super. H(B) at the 5% level, and from DDT granulated super. H(C) at the 1% level, and from DDT granulated super. (F.F.E.C.) and the rest at the 0.1% level.

DDT granulated super. (F.F.E.C.) was not significantly better than dieldrin, but was significantly better than DDT granulated super. H(A) at the 5%, and than DDT prills at the 0.1% level.

In the two tables the last columns give the degree of pasture loss at these levels of significance, assuming that an uninfested, good composition pasture, with good leaf growth, is rated at 100% cover.

In regard to possible alternatives to DDT, current trials near Lincoln against high populations of *Oxycaenus* larvae have given satisfactory control by sprays of methyl parathion at ½ lb, diazinon at 1 lb, and trichlorfon at 1 and 0.8 lb. Table 2 shows that diazinon at 2 lb gave good results the previous year, as did the following in other trials: diazinon, trichlorfon, methyl parathion, azinphos methyl and fenthion, heptachlor and "Telodrin". Against grass-grubs possible alternatives to DDT are the hydrocarbons heptachlor and "Telodrin" both of which have long residual lives and which would therefore be subject to the same restrictions as for DDT. Others in the organophosphorus group are diazinon, trichlorfon, methyl parathion, azinphos methyl, phorate and fenthion at 2 lb; none of these materials would result in residues in export produce.

With the possible exception of trichlorfon, however, there are side-effects of organophosphorus preparations that have not yet been clarified. Trichlorfon has been tested for the same length of time as diazinon and phorate and it did not cause pasture deterioration, and as it is the only effective organophosphorus insecticide with full registration, it is in practice the only material that could be used as an alternative at present.

Among the DDT preparations, pelleted preparations such as prills, and concentrates as pellets or granules, as well as DDT granulated superphosphate have been gazetted for use without permits. At the moment, however, DDT prills are the only fully registered preparation immediately available.

It can be seen from the two tables that there is nothing to equal DDT wet-mix super. among the newer preparations, and the organophosphates would have to be applied each year.