CONTROL OF PASTURE INSECTS

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Summary

Recent trials indicate that the best and safest method of control of crickets still lies in the use of baits. Wheat baits appear successful and are less troublesome and costly to prepare and apply than the bran and molasses baits. The only successful sprays and dusts were the objectionable hydrocarbons. Organophosphorus compounds were not reliable and carbamates not effective enough. Organophosphorus compounds, however, were very successful against army caterpillars. Hydrocarbons appear to be the only compounds showing promise against grubs in the soil. This paper deals mainly with the black field cricket because most of the recent trial work in the Auckland area has been carried out on this primitive, voracious and destructive pest.

BLACK FIELD CRICKET

(Acheta commodus)

THE BLACK FIELD CRICKET does some damage every year on clay soils in northern districts of New Zealand and the damage assumes plague proportions in dry seasons, when cracks developing in the soil provide adequate hiding places and shelter. Crickets eat seed and the destroyed pasture cannot be replaced until the crickets are killed.

Trials carried out soon after World War 2 showed that crickets could be killed by the then new products lindane and DDT sprayed on. They were also successfully used in a bait comprising 24 lb bran or sawdust plus 4 lb molasses, with minimum rates of 1½ oz of DDT and ¼ oz lindane. (Quantities given throughout are in terms of active ingredient per acre.) Lindane and DDT dusts proved ineffective. Partly because of less danger to bees, the baits were recommended and were used with complete satisfaction for several years on the Hauraki Plains, until the unfortunate introduction of dieldrin. This material was used as a spray at 4 oz and as a dust in fertilizer at 6 oz per acre on the Hauraki Plains in place of the baits and its use was extended to throughout North Auckland. Subsequent trials showed that the rate of dieldrin spray could be reduced to ¾ oz per acre with slower but effective results.

Additional materials were tried out in baits in 1957 including dieldrin, malathion, heptachlor and toxaphene and these all proved satisfactory against crickets. Little use was made of this information because of the then expanding use of dieldrin in spray form, and in fertilizer in place of baits.

With the recent impact of insecticide regulations, farmers were for a while forced to return to the use of baits. Many farmers, being unused to them, were reluctant to employ them and as a result treatment was delayed with disastrous results in some areas this autumn. On one farm, where land operations are difficult because of topography and area involved, crickets destroyed 1,000 acres of pasture which will cost roughly £7,000 in restoration costs and loss of production.

Several trials were laid down this year, mostly with the co-operation of firms including Ivon Watkins Ltd., Ivory Spray Chemicals Ltd., Henry York and Co. Ltd., and Shell Oil Co. (N.Z.) Ltd. These

firms and others provided much of the materials used and helped to plan and lay down the trials and assess the results—a truly co-operative effort, that must commend itself to all. Most of the work fell on E. N. Honore of the Department of Agriculture, Auckland, who planned interesting trials.

The following is an abbreviated outline of the results.

BAITS

Because of their lasting effect and because crickets are voracious feeders, baits are extremely effective, and in our trials the best of these proved equal in effect to dieldrin sprays, which, of course, cannot be used. Dieldrin in fertilizer probably gives as satisfactory results and can be used with a withholding period of three months.

Several materials were incorporated in baits and of these “Zectran” at 2 and 4 oz per acre gave negligible results and azinphos methyl at 8 oz in one trial was ineffective. Other materials used were all effective and included:

Parathion methyl	at 10 oz
Fenthion	at 12 oz
Heptachlor	at 2 and 4 oz
DDT	at 1.6 oz, 2 oz and 4 oz
Malathion	at 1.6 oz and 3.2 oz
Dieldrin	at 2 oz
Diazinon	at 4 oz
Lindane	at 4 oz

Of these, DDT and malathion baits in a very short term trial gave slightly worse results than parathion methyl and fenthion. In longer term, well-conducted trials, heptachlor, DDT, dieldrin and malathion at equal rates gave similar and first-class results, with heptachlor having a slight edge on the other three. Heptachlor also appeared better than diazinon and lindane in one trial, where, however, the results are suspect because of design of the plots which were long and narrow.

TABLE 1: RESULTS WITH BAIT TREATMENTS
(Treatments Randomized)

Treatment Rate (oz)	Replicates		Average
	A	B	
	(O = 100% kill & 5 = useless)		
Control A	4	5	4½
Control B	5	5	5
Azinphos methyl 8	4	2	3
Fenthion 12	1	2	1½
Parathion Methyl 10	1	1	1
DDT (wetable) 1.6	2	2	2
DDT (non-wetable) 1.6	3	1	2
Malathion 1.6	2	2	2

TABLE 2: RESULTS WITH BAIT TREATMENTS

Treatment Rate	Counts of Dead Crickets		
	One Day Later	4 Days Later	8 Days Later
1. Malathion 3.2 oz in Bran 20 lb + Sugar 5 lb	2	3	6
2. Malathion 1.6 oz Wheat 10 lb	2	9	2
3. Heptachlor 2 oz Bran 20 lb + Sugar 5 lb	32	19	8
4. Dieldrin 2 oz Bran 20 lb + Sugar 5 lb	15	11	1

TABLE 3: RESULTS WITH BAIT AND SPRAY TREATMENTS
(Not randomized or replicated)

<i>Treatment Rates</i>				<i>From 5 counts up to 18 days after Treatment</i>		<i>Rating</i>
				<i>No. Dead</i>	<i>No. Alive</i>	
1.	DDT 1% in 25 lb Bran	.....	.....	11	0	Excellent
2.	DDT ½ % in 25 lb Bran	.....	.....	19	1	Excellent
3.	Heptachlor 1% in 25 lb Bran	.....	.....	2	0	Excellent
4.	Heptachlor ½% in 25 lb Bran	.....	.....	6	2	Excellent
5.	Diieldrin spray					
	2 oz in 25 gal water	.....	.....	12	30	Good
6.	Chlordane spray					
	1 lb in 25 gal water	.....	.....	10	65	Fair
7.	Chlordane spray					
	1½ lb in 25 gal water	.....	.....	19	30	Very good
8.	Control A	.....	.....	2	51	
9.	Control B	.....	.....	0	54	

Crickets are very mobile. They crawl and can fly several yards at a time. Therefore, large square plots are desirable. Bags laid down enable counting to be carried out prior to laying down of the trial and at intervals afterwards. Nevertheless, a good technique for field cricket trials has yet to be devised.

From these trials one could recommend heptachlor baits at 2 oz in bran and molasses for speedy, long-lasting and effective results. Wheat at 10 lb instead of bran and molasses appeared at least equally effective when incorporating malathion, and is much more easily prepared and applied. If sawdust is used instead of bran, the kill is not so certain and is slower. Sawdust should be used only when there is not much pasture. Crickets would be best attacked in the nymphal stage, but generally there is plenty of pasture about then and the bait has to be very attractive. Crix bait comprising malathion, DDT and lindane was also most effective, but was not compared with other baits. Because of danger to birds, diieldrin baits should not be employed.

DUSTS

Trichlorphon at 1 lb was useless in two trials. The other dusts were tried out almost entirely in one trial only, which was examined only one or two days after it was laid down. Further examination was of no avail because a contractor applied DDT dust over the whole area. Nevertheless, this trial was laid down in duplicate and randomized and the results seem to be reasonably indicative of at least the short-term effects of the materials. In this trial trichlorphon dust at 1 lb and parathion methyl dust at ¼ lb were useless; finely divided DDT dust was effective at 12 and 24 oz. At 6 oz the results from DDT dust were inferior. DDT-superphosphate at 6 cwt supplying 6 lb of DDT per acre was effective but at 2 cwt the results were inferior. Finely divided 80% DDT dust has given satisfactory results at 10 oz over 4,000 or 5,000 acres in the Warkworth district. It would appear that the DDT dusts originally tried out and the DDT in superphosphate is too coarse to give good results. However, DDT does affect our stock products and another dust less harmful in that respect is needed.

GRANULES

Trichlorphon, parathion methyl and coumaphos were used as granules at 1 lb with poor results in a trial examined only a day or two after application.

TABLE 4: RESULTS OF DUST TREATMENTS
(Treatments randomized. Only assessed one or two days after treatment)

Treatment Rates	Replicates		Average
	A (O = 100% kill & 5 = useless)	B	
1. Trichlorphon dust 1 lb	5	5	5
2. Parathion dust 1 lb	5	5	5
3. DDT 40% dust 6 oz	3	3	3
4. DDT 80% dust 6 oz	4	3	3½
5. DDT 40% dust 12 oz	2	3	2½
6. DDT 80% dust 12 oz	1	2	1½
7. DDT 40% dust 24 oz	2	2	2
8. DDT 80% dust 24 oz	2	2	2
9. DDT-superphosphate 2 lb	3	3	3
10. DDT-superphosphate 6 lb	1	3	2
11. Control A	4	5	4½
12. Control B	5	5	5

SPRAYS

It was hoped that one of the carbamates or organo-phosphorus compounds would be successfully employed but this did not happen and they cannot apparently yet be recommended as suitable sprays for cricket control.

Carbamates

"Zectran" used at 1 lb in two trials gave some results and seems worthy of further attention.

Carbaryl used in 7 trials at 1 and 2 lb gave unsatisfactory results except in one trial where the kill was estimated at 50%.

Chlorinated Hydrocarbons

Methoxychlor in five trials at 2 lb gave poor results with only a small reduction in cricket numbers.

Dieldrin at 4 oz gives first-class results; it has been used in trials down to ¾ oz with progressively slower but ultimately quite good results. On one farm ½ oz has proven satisfactory.

Lindane in one unsatisfactory trial sprayed on at ½ lb gave poor results.

DDT in three trials sprayed on at 2 lb has given variable results. In two trials at Dargaville, DDT at 2 lb gave sudden kills especially at the nymphal stage.

Chlordane in one trial at 1 and 1½ lb was slightly inferior to dieldrin at 4 oz but the effect was examined for only one day after the trial was laid down. In another trial dieldrin at 2 oz gave results in between chlordane at 1 and 1½ lb. Chlordane is therefore a very effective material at 1 lb or over.

Toxaphene gave poor control in two trials at 1½ lb. The use of chlorinated hydrocarbon sprays should be avoided because of their

TABLE 5: RESULTS OF SPRAY TREATMENTS
(Treatments randomized. Only assessed one or two days after treatment)

Treatment Rates	Replicates		Average
	A (O = 100% kill & 5 = useless)	B	
Dieldrin 4 oz	1	1	1
Chlordane 1½ lb	1	3	2
Chlordane 1 lb	3	2	2½
Control A	4	5	4½
Control B	5	5	5

adverse effect on the sale of New Zealand produce on overseas markets.

Organo-phosphorus Compounds

Parathion methyl used at 6 and 8 oz has given good results at Whangarei and poor results at Thames.

Azinphos methyl at 6 and 8 oz has given similar results to parathion methyl at Whangarei, but at Auckland and Thames has given little or no control. At Kaikohe it gave a contact kill but results were inconclusive on a denuded trial area.

Trichlorphon in seven trials gave poor control at ½, 1 and 2 lb. *Malathion* in one trial used at 2 lb gave 50% control; in five trials at 1 and 2 lb it gave poor control. It has been sprayed on 4,000 acres in the Hauraki Plains at 5 to 10 oz with variable results.

Diazinon applied in three trials at ¼, ½ and 1 lb appears slightly inferior to malathion at equal rates.

Dioxathion applied at 1 and 2 lb in two trials gave slight control.

Dichlorvos gave poor results in one trial only at 2 lb.

Fenchlorphos in two trials at 1 and 2 lb gave poor results.

Mevinphos applied at 1.2 oz, 2.4 oz and 4.8 oz gave no apparent control on a denuded area.

Fenthion was promising in trials at Thames which, however, showed that it should be sprayed on to dry pasture in fine weather. The final trial with half-acre plots indicated that 16 oz were required for 70% control. However, the material has given poor control at Auckland and Whangarei at 2 lb. Fenthion gave some results but was inferior to DDT in two trials at Dargaville. Other formulations of the same material have also given poor results at Whangarei. "*Dibrom*" at 1 and 2 lb gave poor control because of poor lasting effects.

Coumaphos was ineffective in three trials.

Organo-phosphorus compounds generally do not appear to last long enough to give adequate control. It has been considered that better results might be obtained if they were applied in the late afternoon and early evening.

SUMMARY

Though much has been learnt about the effect of different materials on crickets, the trials show that little change in practice can be safely recommended. Certainly wheat baits are much easier to prepare and sow than bran baits and probably will therefore largely replace bran baits. Finely-divided DDT dust appears almost as effective as baits, but probably should not be recommended because of the danger to stock products.

It seems to be difficult to get away from the use of these objectionable hydrocarbons, unless baits are used. Baits were recommended for use at the beginning of the 1962 cricket season and apparently must remain the recommendation in 1963.

There is certainly no need to use dieldrin products for cricket control.

ARMY CATERPILLAR

(*Pseudaletia separata*)

Early trials had shown that hydrocarbons dusted or sprayed on were effective enough, but baits seem to be speedier in action and more effective. In trials carried out in 1957, cereal and sugar baits containing dieldrin were best, heptachlor as good but slower-acting, toxaphene next best and malathion baits were unsatisfactory against army caterpillars. As mentioned previously, all these were effective against crickets.

Diazinon was tried out in 1959 against army caterpillars with indifferent results.

Only one trial was laid down this year with the following results (all treatments in lb a.i. per acre were applied in 15 gal of water):

Malathion at 1 lb: 25% effective

Carbaryl at 1 lb: 90% effective in 36 hr

Trichlorphon at $\frac{3}{4}$ lb: 90% effective in 18 to 24 hr

Mevinphos at 2 oz: 90% effective in 36 hr.

Field evidence indicates that trichlorphon sprayed on at $\frac{3}{4}$ to 1 lb has given first-class results in maize and pasture. Good results have also been reported from parathion methyl. Trichlorphon dusts at 1 lb have not been effective. In country infested with grass grub, DDT dusts applied to control this grub will also control army caterpillars.

BLACK BEETLE

(*Heteronychus sanctae-helenae*)

WHITE-FRINGED WEEVIL

(*Graphognathus leucoloma*)

Early trials in the Dargaville district against the grub of the black beetle showed that they could be destroyed by aldrin, lindane and dieldrin in that order of effect at 3 lb a.i. per acre, that DDT up to 6 lb was useless, and that toxaphene was of questionable value. It is understood that trials since carried out by the Department of Scientific and Industrial Research have shown that 8 oz of dieldrin or less will destroy the larvae. Four trials have been laid down so far this year to see whether the black beetle larvae and, incidentally, the larvae of white-fringed weevil occurring together can be destroyed with less rates of different hydrocarbons, some of them in prill form.

It is not likely that control of the larvae will be obtained from materials other than hydrocarbons and these in prill form may prove effective and safe. The results of these trials will not be known until later and not until 1963 in the case of black beetle larvae. However, one trial has indicated that the treatments dieldrin 1 lb, lindane 2 lb and DDT 2 lb applied in fertilizer have controlled the adult weevil and beetles so that the oversown new pasture has been protected. It is known from past trials that the adult black beetle can be killed by rates as low as 2 oz of aldrin, dieldrin and lindane and $1\frac{1}{2}$ lb of heptachlor sprayed on pasture. The adult black beetle is also readily killed by using dieldrin-superphosphate and by spreading sawdust and molasses baits containing 1.6 oz of dieldrin or lindane. One farmer has mixed $\frac{3}{4}$ oz of dieldrin when undersowing with his grass and clover seed, which has protected the establishing pasture quite effectively.

These pests are slowly spreading throughout the Auckland province and black beetle now extends from Kaitaia to Whakatane, with white-fringed weevil following in its wake. These larvae cause most damage on the lighter textured soils. The hydrocarbons seem most likely to supply the answer to these two difficult pests.

OTHER INSECT PESTS

ARGENTINE STEM WEEVIL (*Hyperodes bonariensis*) is causing much damage, particularly on the Hauraki Plains and is most difficult to combat.

SOLDIER FLY (*Altermetaponia rubriceps*) is spreading more extensively from the Bay of Plenty. Trials are proceeding against this insect, first, to evaluate the damage it does to pasture.

GRASS GRUB (*Costelytra zealandica*), probably New Zealand's worst insect, has not been dealt with in this paper, mainly because there is little new to report. One or two trials aimed at bacterial infection have been laid down against this grub and the grub of black beetle.