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FINAL REPORT

ON

INSECTICIDES - SPECIAL PROBLEMS

(March 1, 1953 - April 15, 1954)

JOB NO. 117-2542

Monsanto Chemical Company
Organic Chemicals Division
St. Louis Research Department

Work done by: W. E. Spring
P. P. Wallace

Work reported by: P. P. Wallace

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INTRODUCTION

Certain problems which can only be solved by biological tests occur periodically. It is generally cheaper and more accurate to assay pest control chemicals by chemical means but in some instances it is impossible to make the required determinations except by use of biological procedures.

The evaluation of combinations of lindane with Aroclors, the testing of the combination pesticide formulations and the evaluation of parathion formulations made by Bayer Company of Leverkeusen are reported here.

SUMMARY

Aroclors 1248, 1254, and 5460, were formulated with lindane in equal proportions to form an emulsifiable concentrate. Parathion was formulated with Aroclor 5460 as a dusting powder. These preparations have been evaluated against various species of insects in the greenhouse and in replicated field plots. In no case did the addition of any of the Aroclors tested enhance the activity or the length of the period of residual effectiveness of lindane or parathion.

Acetone solutions of Aroclor 5460 + parathion sprayed on glass plates depressed the activity of parathion.

In testing the combination pesticides the following points were confirmed:

1. Ovatran, p-chlorophenyl p-chlorobenzene sulfonate, is too toxic for use on many garden plants.

2. Sulfur at more than ten per-cent of the formulation injures cucurbits and some other tender plants under some weather conditions.

3. Technical DDT is decidedly phytotoxic to some cucurbits and to young tomatoes.

4. Pesticide #4 was the most satisfactory formulation of those tested.

Bayer E605 parathion was found equal but not superior in insecticidal activity to the Monsanto technical product.

EXPERIMENTAL WORK AND DISCUSSION

Aroclor 5460-Parathion Laboratory Tests

In the first laboratory trials, Aroclor 5460 and parathion in the

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ratios 1-1 and 2-1, were dissolved together in acetone and sprayed on petri dishes at four dilutions. Sufficient applications were made to allow for dishes in triplicate at each concentration to be held for 0 hours (as soon as the acetone had volatilized), one week, two weeks and four weeks.

Test insects, Tribolium confusum, that were exposed to the treated glass surfaces about an hour after application were quickly killed by Aroclor 5460 alone. At this time #5460 compared favorably with parathion in toxicity to the insects.

Seven days later:

1. The residue from Aroclor 5460 alone gave no indication of toxicity.

2. The residue from parathion alone was highly toxic at 1-2800 dilution.

3. Parathion-Aroclor 5460, 1-1 ratio, was about half as toxic as parathion alone.

4. Parathion-Aroclor 5460, 1-2 ratio gave no indications of residual toxicity.

Two weeks later:

1. Parathion alone was the only treatment in which toxicity to Tribolium persisted.

Four weeks later:

1. None of the treatments retained any apparent toxicity.

It appears that Aroclor 5460 forms a hard protective surface coating with parathion, inhibiting its volatilization and preventing the insects from coming in contact with appreciable quantities of parathion. As the ratio of Aroclor 5460 to parathion is increased the toxicity of the residue is reduced.

From these observations, it appeared possible that the Aroclors might still possess a distinct advantage where the combinations were applied to plant foliage upon which insects would feed and presumably ingest the inhibited parathion along with the plant foliage, even though contact toxicity was reduced.

Aroclor 5460-Parathion Dust

To determine the effect of Aroclor-parathion formulation on feeding insects, a dusting powder containing approximate 1 one per cent parathion + one per cent Aroclor 5460 on Pyrax ABB was prepared.

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In memo 4-29-53 [illegible] PPW, Mr. Morrill states that the parathion and Aroclor were dissolved in sufficient acetone to make a thick slurry with Pyrax ABB. After volatilizing the acetone, the dry powder was pulverized in a hammermill through an 0.75 mm (1/32") screen.

In the greenhouse, bean and cotton plants were dusted with this combination dust and with 1.% parathion dust similarly prepared.

Army worms were placed to feed on the cotton and Mexican bean beetle larvae on the beans. Tests were replicated.

Insects exposed two hours after treatment were all dead on all tests within sixteen hours.

At six and at eight days after treatment, mortality was incomplete but there was no significant difference between the treatments. Bean beetle larvae were much more susceptible to parathion than were the Southern army worm larvae.

Field Plot Tests

Aroclor Lindane Spray Formulations

Three emulsifiable Aroclor-Lindane formulations and a lindane emulsion alone were prepared by L. Goldman and H. L. Morrill. Xylene was used as the solvent with Emulsifier L. Each contained one pound Lindane and one pound of the respective Aroclor per gallon. Aroclors #1248, 1254 and 5460 were used. The concentrates contained 12.% Lindane and 12.% Aroclor by weight.

Since Lindane preparations are recommended at one pound of twenty-five per-cent gamma per one hundred gallons H_2O (1-3332) the formulations were diluted 1 to 400 H_2O (.12:400=1:3400). At this rate each was applied to ten plants each of young cabbage, egg plant and older cabbage.

A few other compounds of interest that were included with these field plot trials are included in the tabulation of results.

Each plant was examined and records were taken at three intervals after treatment, though only the most significant observations are included here.

The cabbage plants either were infested at the start or later became very generally infested with aphids, cabbage worms and thrips. The egg plant was heavily infested with aphids, two species of weevils, lacebugs, tortoise beetles and mites. Due to closeness of plants to the ground, the persistence of thrips may have been due to inadequate covering of the lower leaves.

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Results

1. Parathion Spray, 0.3#/100 gallons:

   Good initial control of all species; after fourteen days no control of any pests.

2. Parathion-Aroclor 5460 Dust (1% of each):

   Comparable to the parathion spray.

3. Parathion Dust 1#:

   Comparable to the parathion spray.

4. CP 5815 - S-2(2-pyridylethyl) 0,0-diethyldithiophosphate:

   Only a low degree of effectiveness even at the start; particularly poor against aphids.

5. DDT 1 lb/100 gallon:

   Ineffective against aphids, mites, tortoise beetle and poor on thrip control. Very persistent effectiveness on cabbage worms.

6. CP 3897 <u>unsym</u>. Diethyl tetramethyl diamido pyrophosphate, 1#/100 gallons:

   The control of all pests even at the start was surprisingly poor. Aphids were not satisfactorily controlled.

7. Rotenone Dust, 0.75%:

   Very good initial insect control except that aphids were not eliminated. Plants had become heavily infested with all the listed insects fourteen days after treatment.

8. Lindane Spray:

   Good initial insect control except that aphids were hardly affected. No control after fourteen days.

9. Aroclor 1248-Lindane Spray:

   Did not differ significantly from Lindane.

10. Aroclor 1254-Lindane Spray:

    Did not differ significantly from Lindane.

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11. Aroclor 5460-Lindane Spray:

Did not differ significantly from Lindane.

The composition of the pesticide formulations is tabulated:

	Percent Composition (Active ingredient)			
	#1	#2	#3	#4
DDT	5.0	5.0	5.0	5.0
Lindane	1.0	1.0		
Rotenone			0.75	0.75
Ovatran	3.0	3.0		
Sulfur[1]	27.2	27.2	25.0	
Captan		5.0		
Zineb			5.0	5.0
Milmer 1[2]	5.0			
Santomerse 80	5.0	5.0	5.0	5.0
Sodium Citrate	3.0	3.0	3.0	3.0
Disodium Phosphate	2.0	2.0	2.0	2.0
Attasorb	48.8	48.8	36.91	62.41

[1] Palmetto dusting sulfur and Crater dusting sulfur

[2] Laboratory sample containing no free Cu++

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Since the pesticidal activity of the ingredients is well known it was considered that application to plants growing in the field with observations of phytotoxicity would be adequate. The proper dosage of the formulation in water spray was calculated on the basis of one pound of technical DDT per 100 gallons of water. Plants sprayed were tomato, summer squash, and broccoli.

Both sprays caused severe injury to tomato and squash and slight burn on broccoli.

To segregate the ingredient that was causing phytotoxicity, Mr. Morrill prepared the following four mixtures which were again applied at the same rate as above to field-growing tomatoes, cucumber, and string beans (24 grams/gallon):

1. Attasorb (the carrier-diluent) caused no injury to any of the plants.

2. Attasorb 90% - Wetting agent 10%: caused a trace of injury only to the new growth of tomato. It was inconsequential.

3. Attasorb 65% - Wetting agent 10% - Sulfur 25%: slight injury to the new growth and blossoms of tomato only.

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4. Attasorb 87% - Wetting Agent 10% - Ovatran 3%: severe injury to foliage and blossoms of tomato, trace of injury to cucumber and to beans. The damage to tomato was prohibitive.

It is widely recognized that sulfur is injurious to tender plants under high temperature conditions, such as occurred in these tests, in spite of the fact that sulfur is often used in one-shot garden preparations.

Ovatran is used with caution even on hardy shrubs and trees, although it does appear that one application during the season might be safe on some crops.

Although DDT is the basic insecticide in most garden sprays it has often damaged cucumbers, melons and related plants with excessive dosage or repeated application. It should be included because DDT is so very effective but a warning should appear on the label.

Ovatran is not safe; a miticide may not be imperative.

Sulfur could better be omitted, using a fungicide such as Zn ethylenebis dithiocarbamate.

Rotenone would be the indicated control for aphids. It is also a good treatment for bean beetles which DDT does not control. These are both extremely important pests.

Pesticide formulation No. 4 caused little or no foliage injury and was judged the best of the preparations.

Bayer E605 parathion was evaluated by the conventional laboratory procedure of exposing Tribolium beetles to dried spray residues on glass in triplicate at five concentrations. Activity of this product was comparable to Niran.

RECOMMENDATIONS

An exhaustive study of Aroclor combinations with various agricultural chemicals is indicated.

Philip P. Wallace

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