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CONTROL OF APHIDS IN SEED POTATO PRODUCTION

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SUMMARY

The systemic effects of 11 chemicals for control of the vector aphids *Myzus persicae* (Sulz.) and *Macrosiphum euphorbiae* (Thomas) were evaluated in the laboratory and field.

In the laboratory trials, demeton-s-methyl was the most consistent material in reducing populations of *M. persicae* and showed longest residual effect. Endosulphan at a high strength gave good early kills only, while other materials were inferior. Systemic materials applied in solid form to the soil of growing plants required more than 5 days to show any influence on aphid populations.

In the field trial, both weekly and fortnightly spray with high strengths of demeton-s-methyl and vamidothion, and a single soil application of disulfoton granules, gave satisfactory reduction in numbers of *M. euphorbiae*.

I. INTRODUCTION

Potatoes grown in the Lockyer Valley of south-eastern Queensland are attacked by several aphid-transmitted virus diseases, of which leaf roll is the most troublesome. The use of seed supplies from southern States for alternate crops, has in the past, kept the disease in check. The industry in Queensland

now favours the local multiplication and maintenance of seed stocks from varieties selected as most suitable for Queensland conditions. The practicability of this depends on keeping the incidence of virus diseases at a reasonably low level.

Control of aphid vectors by insecticidal sprays is generally accepted as an important means of minimizing the incidence of virus diseases in plants. The major aphid species associated with virus diseases of potatoes in Queensland are the green peach aphid (*Myzus persicae* (Sulz.)) and the potato aphid (*Macrosiphum euphorbiae* (Thomas)). An evaluation of some of the newer aphicides, systemic in nature, for use against these species on seed potato crops has been made in both the laboratory and the field.

II. MATERIALS AND METHODS

The following materials were tested:—

DDT.—An emulsion concentrate containing 25·0% w/v *p.p'*isomer, used as a 0·1% spray.

Demeton-s-methyl.—An emulsifiable concentrate containing 25·0% w/v active constituent, used as 0·025% and 0·1% sprays.

Diazinon.—A granular preparation containing 5·0% w/w active constituent, used at 4·0 p.p.m. of soil.

Dimethoate.—A wettable powder containing 20·0% w/w active constituent, used as 0·03% spray.

Disulfoton.—A granular preparation containing 5·0% w/w active constituent, used at 1·0 p.p.m. of soil and 3 lb/ac.

Endosulphan.—An emulsifiable concentrate containing 35·0% w/v active constituent, used as 0·06% and 0·125% sprays.

Heptachlor.—A granular preparation containing 10·0% w/w active constituent, used at 3 p.p.m. of soil.

Mevinphos.—A liquid concentrate containing 100·0% w/v active constituent, used as 0·06% spray.

Nicotine sulphate.—A liquid concentrate containing 40·0% w/v nicotine as nicotine sulphate, used as 0·05% nicotine spray.

Phorate.—A powder preparation containing 40·0% w/w active constituent, used at 2·0 p.p.m. of soil.

Vamidothion.—An emulsifiable concentrate containing 25·0% w/v active constituent, used as 0·04% and 0·1% sprays.

In laboratory trials potato plants were grown from small tubers in 8-in. clay pots and treatments were applied 3 weeks after the appearance of shoots above ground. Granular insecticides were distributed on the soil surface then watered in, and sprays were applied with a hand atomizer, using sufficient volume to ensure wetting of the terminal and leaves.

Trial 1, a 7 x 3 randomized layout, was commenced on May 19, 1965. Chemicals used are shown in Figure 1. Insecticidal activity was assessed under temperature conditions in the range 60–62°F, 5 days after the application of chemicals, by placing approximately 25 alate *M. persicae* on excised leaves held in 3½-in. diam. plastic petri dishes. Test leaves were selected for uniformity of size from the third, fourth or fifth below the terminal. Living, moribund and dead aphids were recorded at 6, 18, 24 and 42 hr after placement of the insects on the treated leaves.

Trial 2, a 7 x 3 randomized layout, was commenced on June 7, 1965, with the application of chemicals as in trial 1. The insecticides are listed in Table 1. Leaves were excised as in trial 1 at 3 hr, 24 hr and 7 days after treatment, and approximately 25 apterous *M. persicae* adults were placed immediately upon them. The leaves were held under temperature conditions in the range 58·75–60°F and insecticidal activity assessed 24 hr later by recording numbers of living, moribund and dead aphids.

The field trial area was at Gatton Research Station and comprised Sebago potatoes planted on July 15, 1965. The treatments applied are given in Table 2. An 8 x 3 randomized block layout was used, with plots containing 5 rows each 39 ft long and 2 ft 10 in. apart. Plots were separated by 6 ft of row and the two outer rows were lateral guards. A sowing rate of 0·75 ton of 2-oz sets per acre gave approximately 120 plants per plot. Stand counts were made on September 2, seven weeks after planting, to check for possible phytotoxic effects. The treatments applied are given in Table 2.

The granular insecticide was applied as a side-dressing on July 23, eight days after planting. Insecticide spray applications commenced on August 25, and continued either weekly or fortnightly until October 6. All sprays were applied by knapsack to give thorough coverage.

Leaf samples for aphid population assessments were collected at weekly intervals immediately prior to spray applications where these were to be made. Initially the unit sample per plot comprised 30 leaves, one taken from each of 30 random plants. From September 15, the unit sample was increased commensurate with plant growth to three leaves (one top, one middle and one lower) per plant from 30 random plants, giving a total of 90 leaves per plot. The

samples were collected into an alcohol preservative. Aphid counts were made in the laboratory by examination of each leaf under a x3 table magnifier and by filtering the preservative to complete each count.

The strength of all insecticidal materials except nicotine sulphate was high, since the main purpose was to prove whether systemic effect in the field could be demonstrated. Details are given in Table 2.

III. RESULTS

The results of laboratory trial 1 are presented graphically in Figure 1 and the data obtained in trial 2 are summarized in Table 1.

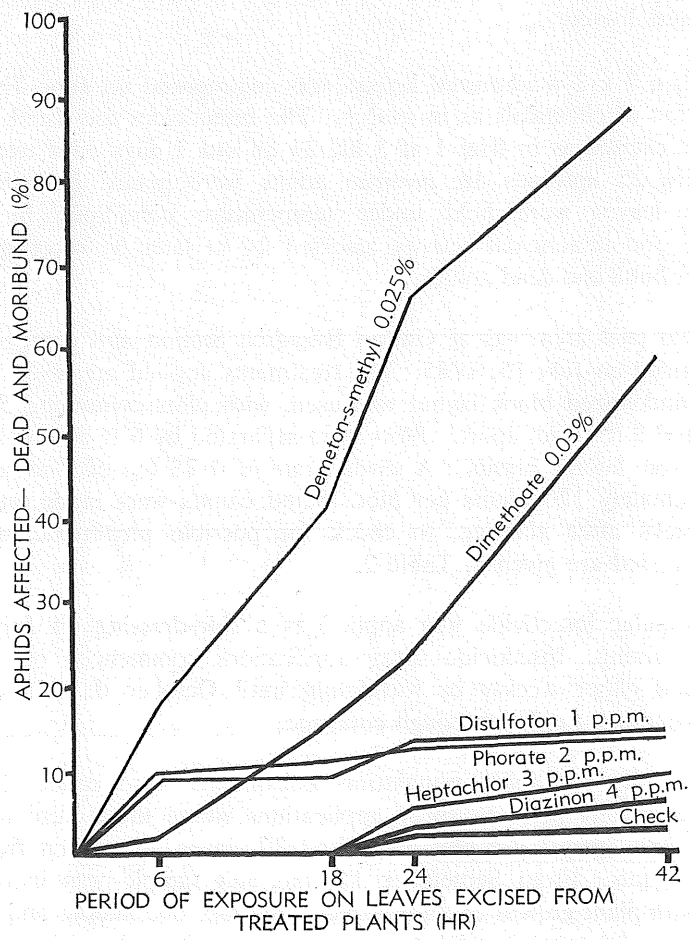

Fig. 1.—Laboratory Trial 1: Relation of exposure time to percentage *M. persicae* affected.

TABLE 1

TRIAL 2: MEAN LIVING, MORIBUND AND DEAD *M. persicae* PER PLOT 24 HOURS AFTER PLACEMENT ON SPRAYED LEAVES

Treatment	Period from Spraying to Aphid Placement								
	3 hr			24 hr			7 days		
	Living	Moribund	Dead	Living	Moribund	Dead	Living	Moribund	Dead
No treatment				19·7	0	(5·3P*)	24·3	0	(3·0P*)
					0			0	
DDT 0·1% spray				21·7	0	(2·7P*)	24·3	0	1·0
					0			2·7	
Demeton-s-methyl 0·025% spray	0·3	0	19·7	9·3	1·0	(2·0P*) 12·0	5·7	8·3	12·3
		98·3			58·2			78·5	
Vamidothion 0·04% spray ..				2·0	3·0	(6·3P*) 13·0			
					85·7				
Endosulphan 0·06% spray ..				10·3	9·7	7·7	21·0	0·7	(0·7P*) 3·0
					62·7			14·9	
Endosulphan 0·0125% spray ..				2·3	11·3	(5·0P*) 6·3	23·0	0·7	(3·3P*) 0·7
					88·3			5·5	
Mevinphos 0·06% spray ..				5·0	4·0	15·0	24·0	0·3	(2·3P*) 0·3
					79·2			2·7	

* P = parasitized aphids which were recorded for presence but excluded from calculations of percentage aphids affected.

The figure below the bracket in each case represents the percentage of the total number of insects which was affected.

Field trial results expressed as mean number of aphids per unit sample each week from September 15 to October 13 are given in Table 2. Stand counts and field observations showed that the disulfoton granules had no adverse effect upon either plant numbers or plant growth, and spray applications had no phytotoxic effects.

TABLE 2

FIELD TRIAL: MEAN APHIDS PER SAMPLE PER PLOT

Treatment	Mean Aphids per Sample of 90 Leaves per Plot			
	Sept. 15	Sept. 22	Sept. 29	Oct. 6
No treatment	30·0	47·0	19·0	15·0
Disulfoton 3 lb/ac/granules	0·7	2·3	0·7	0·7
Vamidothion 0·1% spray, weekly	0·3	1·0	0·7	0·3
Vamidothion 0·1% spray, fortnightly	0	2·0	0·7	3·0
Demeton-s-methyl 0·1% spray, weekly	0	0	0·7	0
Demeton-s-methyl 0·1% spray, fortnightly ..	0	1·7	0·3	0·7
Nicotine sulphate 1 oz–3 oz soap–5 gal water, weekly	5·0	11·3	18·0	10·0
Nicotine sulphate 1 oz–3 oz soap–5 gal water, fortnightly	12·3	18·7	17·7	15·3

IV. DISCUSSION

In trial 1 in the laboratory, the data indicated that the insecticides applied as granules and watered into the soil did not become noticeably active against *M. persicae* for at least 5 days after the application. The effect was comparatively rapid with spray applications.

Under the methods of application and assessment in trial 2, DDT was ineffective for kills of *M. periscae;* endosulphan and mevinphos treatments resulted in good immediate effects but gave virtually no response 7 days after the insecticide application; vamidothion was initially effective; and demeton-s-methyl gave both immediate effect and residual action at 7 days.

Virtually all aphids encountered in the field trial were *Macrosiphum euphorbiae.* Populations were low during the first weeks of plant growth; they increased in mid September, then declined in October. From field observations made over a number of years it was evident that the populations experienced during this trial were comparable to those normally encountered in the Lockyer Valley, the major potato production area in the State.

The results demonstrate that demeton-s-methyl and vamidothion applied weekly or fortnightly at the rate of 0.1% spray can give a good crop protection from *M. euphorbiae.* Disulfoton granules at 3 lb/ac can give similar protection for a period of 12 weeks following a single application. As a significant time lag between treatment and effect was shown for this type of treatment, the application time should be at or near planting.

The main purpose of the trials, to prove that potatoes can be produced virtually free from aphid attack, was achieved. Since the successful materials were used at high strengths, the trials form a firm basis for further investigation.

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