ETRIMFOS – A SAFE NEW INSECTICIDE

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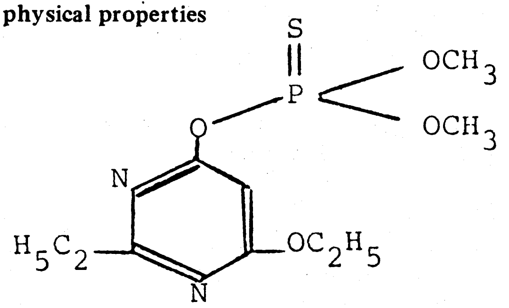
Summary

Etrimfos (San 1971) is a broad spectrum organophosphate insecticide developed in Switzerland. It is a stomach and contact poison but has no systemic action. The particular advantages of etrimfos include a low mammalian toxicity, a wide spectrum of activity, good crop safety, lack of unpleasant odour and an expected short waiting period. New Zealand trial work has shown it to be particularly active against greedy scale *(Hemiberlesia rapax)*, leaf roller caterpillars *(Ctenopseustis obliquana* and *Epiphyas postvittana)*, white butterfly *(Pieris rapae)*, and diamondback moth *(Plutella xylostella)*.

INTRODUCTION

Etrimfos was developed in 1972 by Sandoz Ltd in Basle, Switzerland. Worldwide trials since 1973 have shown that it is effective against a wide range of chewing, sucking and biting pests, particularly those within the orders of Lepidoptera, Coleoptera, Diptera and to a variable extent, Hemiptera.

Chemical and physical properties



Empirical formula : $C_{10}H_{17}N_2O_4PS$

Etrimfos in the pure state is a colourless oil with a slight smell. It has low solubility in water (1% at 20°C) but is soluble in most organic solvents. Formulations include a 50% w/w EC, 10 and 5% w/w granules. A dust, microgranule, wettable powder and ULV formulation are under development.

Biological properties

Etrimfos is a foliar insecticide with contact and stomach activity. It is non systemic but has moderate translaminar properties. It has been shown to have a wide spectrum of activity at rates of between 0.25 and 0.75 kg/ha; mainly on fruit and vegetables, rice, maize and lucerne.

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Toxicity

Animal studies have shown that etrimfos has a very low mammalian toxicity. The acute oral LD_{50} for male rats is 1800 mg/kg and the acute dermal LD_{50} for male rats is greater than 2000 mg/kg. In a 26 week feeding study with beagle dogs, the no effect level was 12ppm. Etrimfos is relatively safe to fish (96 hr Tl_{50} carp is 13.3ppm) but is toxic to bees, and must not be used on crops in flower.

Residues

The metabolism of etrimfos in plants, animals and soil follows one major pathway to 6-ethoxy-2-ethyl-4-hydroxy-pyrunid (EEHP). This product is rapidly excreted from animals and does not accumulate in tissues or organs. In soil it is degraded to volatile fragments (e.g., CO_2) or organic matter ingredients. When applied as recommended, resulting residues in harvested fruit and vegetables dissipate rapidly, and are usually below 0.4ppm

Overseas tolerances

Etrimfos tolerances have only been established in Switzerland. The material has been introduced to France, Great Britain, Italy, Germany and Holland under an experimental licence. It is expected that a tolerance of about 0.5ppm will be granted in the latter two countries in 1980-81. A product containing 50% w/w etrimfos EC has an experimental registration in New Zealand.

METHODS

New Zealand trials have been conducted on a variety of crops over three seasons. Trial data shown is a summary of this work and excludes some treatments that are not directly relevant to the paper.

Kiwifruit

(Actinidia chinensis). The main pests affecting kiwifruit in New Zealand are greedy scale and a complex of lepidoptera, comprising leafroller caterpillars and larvae of the native moth, *Stathmopoda skelloni* (Ferguson and Stratton 1978) Trials were laid down in Tauranga in 1977 and 1978 on a block of mixed variety vines (mainly var. 'Abbott'). Plots comprised 3.6m of vine, with each treatment randomized within each of four blocks in 1977 and five blocks in 1978. All treatments were applied by handgun to runoff, from both sides of the vine, according to the recommended timing of the Ministry of Agriculture and Fisheries' spray programme. This consisted of nine sprays in 1977-78 (pre-bloom, post-bloom, and seven cover sprays at 2 weekly intervals) and six sprays in 1978-79 (pre-bloom, post-bloom and four cover sprays at 3 weekly intervals). Greedy scale were assessed under a microscope from leaf samples taken during the season, and scale numbers and leaf roller damaged fruit were determined at harvest.

Apple.

Trials were carried out over two seasons on a property in Nelson. Single tree plots were randomized within each of five blocks. Treatments were applied by handgun to runoff (2000 litres/ha) at approximately 2 weekly intervals. This involved nine sprays in 1977-78 and ten sprays in 1978-79. Windfalls were examined during the season and fruit at harvest was inspected for leafroller and codling moth *(Laspeyresia pomonella)* damage and the presence of mealybug *(Pseudococcus* spp) and European red mite *(Panonychus ulmi)* (ERM) eggs.

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Cabbage

This trial was laid down in Nelson during 1978 to evaluate the effect of etrimfos and several other materials on white butterfly and diamondback moth. Plots were 9 m long, one row wide, randomized within each of four blocks. Five applications were made at 10 day intervals using a commercial boom sprayer which applied 850 litres/ha. Five cabbages from each plot were assessed for larvae 3 days after the fourth spray. The percentage of marketable heads was determined at harvest.

RESULTS AND DISCUSSION

TABLE 1. Control of greedy scale and leafroller on kiwifruit.

1977-78		Live scale/100 leaves		% Fruit damaged at harvest	
Treatment	Rate g/100 litres	After 3 sprays	After 7 sprays	Scale	Leafroller
etrimfos	100	3.3 c	0 b	0 b	0 b
phosmet	112.5	18.2 b	0 b	0 b	0 b
untreated		110.4 a	203 a	48 a	5.5 a
CV%		34.5	51.3	37.7	69.4
1978-79		After 2 sprays	After 4 sprays		
etrimfos	37.5	58 b	13 b	1.5 b	1.0 b
etrimfos	50	21 c	5 bc	0 b	0.5 b
etrimfos	75	17 c	3 c	0 b	1.0 b
phosmet	112.5	19 c	8 bc	1.0 b	0.5 b
untreated		167 a	536 a	57.0 a	5.0 a
CV%		29.4	46	26.5	32.8

Etrimfos at rates of 50g/100 litres or greater gave a rapid reduction in the number of live greedy scale on leaves, resulted in clean fruit at harvest and was consistently as good or better than the standard material, phosmet. Leafroller control, even with the lowest rate of etrimfos, was good.

TABLE 2. Leafroller and European red mite damage to apples.

Treatment	Rate g/100 litres	% Fruit damage		
		Leafroller 1977-78	Leafroller 1978-79	ERM eggs 1978-79
etrimfos	25	–	1.2 b	12.4 c
etrimfos	37.5	–	0.8 b	32.0 ab
etrimfos	50	1.3 b	0.4 b	17.5 bc
azinphos-methyl	50	2.4 b	0 b	60.9 a
untreated		14.2 a	7.2 a	25.6 bc
CV%		39	67	54

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Excellent control of leafroller species, comparable to that given by the standard material azinphos-methyl, was obtained with etrimfos in two seasons. European red mite control was not obtained, but the high population of ERM eggs in the azinphos-methyl treatments has probably occured due to an adverse affect on mite predators. Etrimfos may be considerably less toxic to these than azinphos-methyl (Knutti and Reisser 1975).

Insufficient codling moths or mealybugs were present to allow a valid evaluation of these pests.

TABLE 3. Control of white butterfly and diamondback moth on cabbages.

Treatment	Rate kg/ha	Mean No. per plant		% marketable heads
		Diamondback moth*	White butterfly	
bacillus thuringiensis	1	2.8 b	0.9 b	54.6 c
acephate/ naled	1	1.3 c	0.1 b	82.4 b
etrimfos	0.5	0.5 d	0.05 b	100.0 a
untreated		5.7 a	7.3 a	3.7 d
CV%		11.7	28.7	23.2

* Includes pupae and larvae.

Etrimfos gave significantly better control of diamondback moth than the other materials tested. It also gave excellent control of white butterfly and a full yield of marketable heads.

ACKNOWLEDGEMENTS

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