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Chlorpyrifos-impregnated bunch covers and insecticides control banana rust thrips

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Abstract

Low density polyethylene (LDPE) banana bunch covers (bags) impregnated with chlorpyrifos were compared against standard untreated LDPE bags and bunch applications of either DDT–BHC dust and diazinon or chlorpyrifos sprays to control fruit damage by *Chaetanaphothrips signipennis* (Bagnall). Treated bags were a consistently effective treatment similar to dusting or spraying ($P>0.05$). One dieldrin spray before application of the untreated LDPE bags did not improve control. Untreated LDPE bags were partly effective and reduced the severity of thrips damage. Diazinon and chlorpyrifos bunch sprays provided equal control but high volume spraying of chlorpyrifos caused severe phytotoxicity to young fruit.

INTRODUCTION

The banana rust thrips, *Chaetanaphothrips signipennis* (Bagnall), are a serious banana fruit pest in north Queensland. Yearly dieldrin sprays to the base of plants (butts) and the surrounding soil, used since the early 1960s to control the banana weevil borer, *Cosmopolites sordidus* (Germar), (Braithwaite 1963; Franzmann 1977), reduced the incidence of rust thrips to very low levels and by 1977 it was no longer considered an economic pest. An increase in fruit damage during 1978 and the interest in removal of cyclodienes from agriculture prompted investigations into new methods for rust thrips control.

Leonce (pers. comm. 1974) reported that in the Winward Islands untreated low density polyethylene (LDPE) bunch covers substantially reduced fruit damage by rust thrips. In north Queensland, untreated LDPE bunch covers are applied primarily to protect young fruit from physical damage, increase fruit size and accelerate bunch development (Berril 1956) but their value in thrips reduction has not been investigated.

This paper reports results of trials in which chlorpyrifos-impregnated LDPE bunch covers (bags) were compared with untreated (non-impregnated) LDPE bags and with direct bunch sprays of chlorpyrifos and diazinon and bunch dusting with DDT–BHC for control of banana rust thrips.

MATERIALS AND METHODS

The experiments were conducted on Cavendish bananas at Mission Beach (17°52′S, 146°06′E) and South Johnstone (17°36′S, 145°50′E) between 1979 and 1982. Untreated LDPE banana bags and chlorpyrifos-impregnated LDPE bags (from Dow Chemicals, Philippines) were used. Treated bags contained 1% w/w chlorpyrifos incorporated into the LDPE polymer. Two extrusion thicknesses containing equal chlorpyrifos concentrations were used. Film thickness is unknown.

Dust and sprays were applied using Carpi®portable hand-operated dusters and sprayers respectively. Bunches received sufficient dust to achieve an even dust coating on fruit; sprays were applied to the point of run-off.

Individual banana hands were rated for rust thrips damage using an arbitrary scale (0 to 3) chosen to reflect market response where : 0=no damage; 1=slight damage which would not attract a price penalty; 2=localised severe, or extensive minor damage that would result in fruit downgrading during shortages or market rejection in oversupply situations; 3=severe and extensive blemish which would result in outright rejection of the fruit. Photographic standards were used to improve the accuracy of ratings and all assessments were carried out at or near harvest.

A similar rating scale was used to determine phytoxicity following treatment application in Trial 4. In all other trials phytotoxicity did not occur.

The proportions of fruit clusters (hands) within each rating group for rust thrips and phytotoxicity were transformed using the arcsin transformation. Analyses of variance were conducted on the transformed data. Equivalent treatment means are presented in Tables 1, 2 and 3. All analyses assumed bunches as replicates in a completely randomised design with unequal replication.

Trials 1 and 2

In two trials run concurrently in 1979 on adjoining plantations at Mission Beach, 20 newly emerged bunches (5 to 8 bracts fallen) were randomly selected for each treatment. Treatments were: thick and thin chlorpyrifos-impregnated LDPE bags and untreated LDPE bags used alone or with a pre-cover bunch-spray of dieldrin emulsifiable concentrate (e.c.) at 1g active ingredient (a.i.)/L of water.

Trial 3

This trial at Mission Beach in 1979 comprised 15 bunches per treatment (10 only for chlorpyrifos impregnated LDPE bags). Treatments were: chlorpyrifos-impregnated LDPE bags (thick); untreated LDPE bags; DDT–BHC dust (dust formulation consisting of 20g/kg a.i. p,p'-DDT plus 2.6g/kg a.i. gamma-BHC); diazinon e.c. at 0.04g a.i./L of water; and untreated (non-bagged). Two applications each of diazinon and DDT–BHC dust were applied to bunches at 3 weekly intervals.

Trial 4

In this trial at South Johnstone carried out during 1982 the number of bunches per treatment ranged from 35 to 54. Chlorpyrifos e.c. at 1 g and 1.25 g a.i./L of water and diazinon e.c. at 0.4 and 0.6 g a.i./L of water were applied four times to bunches at ten day intervals commencing when at least 3 bracts had lifted.

RESULTS

Trials 1 and 2

The number of fruit clusters (hands) assessed at harvest ranged from 158 to 226 due to bunch size variation and bunch losses subsequent to treatment.

The two extrusions of chlorpyrifos-impregnated LDPE bags provided equal ($P>0.05$) and effective protection against banana rust thrips. Treating bunches with dieldrin prior to bagging did not reduce damage when compared to normal untreated bags used without it.

Results are presented in Table 1.

Table 1. Trials 1 and 2, banana rust thrips fruit damage assessments by harvest showing percentage hands within each damage assessment category (0 to 3) and mean rating per bunch

Treatment	Trial 1 Damage rating (% hands/bunch)					Trial 2 Damage rating (% hands/bunch)				
	0	1	2	3	mean	0	1	2	3	mean
Chlorpyrifos impregnated LDPE bag (thick)	98.97*a**	0.69*a*	0.03*a*	0.00*a*	0.05*a*	99.17*a*	0.63*a*	0.04*a*	0.00*a*	0.04*a*
Chlorpyrifos impregnated LDPE bag (thin)	n.a.†	n.a.	n.a.	n.a.	n.a.	98.10*a*	1.21*a*	0.15*a*	0.00*a*	0.06*a*
Untreated LDPE bag+dieldrin	57.15*b*	17.90*b*	7.04*b*	8.07*b*	0.79*b*	n.a.	n.a.	n.a.	n.a.	n.a.
Untreated LDPE bag	60.43*b*	15.15*b*	10.47*b*	6.49*b*	0.73*b*	45.70*b*	18.16*b*	14.44*b*	8.40*b*	0.97*b*

* Within columns, means not followed by a common letter differ significantly ($P<0.01$).

† n.a. = not applicable.

Trial 3

Over 2500 fruit clusters were assessed at harvest and the results are presented in Table 2.

Chlorpyrifos-impregnated LDPE bags, DDT–BHC dust, and diazinon sprays were not statistically different from each other ($P>0.05$) but provided a significant level of protection against rust thrips ($P<0.05$) when compared to normal untreated bags and nil treatment. The percentage of unblemished and of rating 1 fruit was not significantly increased in the untreated LDPE bag treatments but the incidence of severe (rating 2 and 3) blemish was significantly reduced ($P<0.05$) when compared to control.

Table 2. Trial 3, banana fruit rust thrips damage assessments at harvest showing percentage hands within each damage category (0 to 3) and mean damage rating per bunch

Treatment	Damage rating (% hands/bunch)				
	0	1	2	3	mean
Chlorpyrifos impregnated LDPE bag (thick)	97.1*a**	2.3*a*	0.2*a*	0.0*a*	0.09*a*
Untreated LDPE bag	71.2*b*	12.0*a*	4.0*a*	1.0*a*	0.46*b*
DDT+BHC dust (20 g a.i./kg+2.6 g a.i. gamma-BHC/kg)	91.4*a*	1.7*a*	2.7*a*	0.1*a*	0.21*a*
Diazinon (0.4 g a.i./L)	92.5*a*	3.9*a*	1.0*a*	0.1*a*	0.18*a*
Nil treatment	65.3*b*	6.6*a*	13.9*b*	7.5*b*	0.72*c*

* Within columns, means not followed by a common letter differ significantly ($P<0.05$).

Trial 4

Chlorpyrifos and diazinon at high and low rates were effective against rust thrips when compared to control ($P<0.01$). Chlorpyrifos at both rates produced significant levels of phytotoxicity in fruit in comparison to the diazinon and control treatments, with the higher rate being the most phytotoxic ($P<0.01$).

Results are presented in Table 3.

Table 3. Trial 4, mean bunch rust thrips damage ratings and mean fruit phytotoxicity ratings at harvest

Treatment	Rust thrips damage rating	Phytotoxicity rating
Chlorpyrifos 1 g a.i./L	0.02*a**	0.26*a*
Chlorpyrifos 1.25 g a.i./L	0.02*a*	0.58*b*
Diazinon 0.4 g a.i./L	0.01*a*	0.02*c*
Diazinon 0.6 g a.i./L	0.02*a*	0.00*c*
Nil treatment	0.23*b*	0.00*c*

* Within columns, means not followed by a common letter differ significantly ($P<0.01$).

DISCUSSION

Chlorpyrifos-impregnated LDPE bags provided almost complete protection against rust thrips, irrespective of extrusion thickness. Treated bags are an effective alternative to conventional insecticide treatments and the savings in labour and chemical cost from the 3 or more chemical applications currently employed against rust thrips would adequately cover the increased cost of treated bags.

Untreated LDPE bags did not provide the high protection against banana rust thrips reported by Leonce (1974) in the Windward Islands. They significantly reduced ($P<0.05$) the extent of severe damage (rating 2 and 3) but did not significantly increase the percentage of damage-free or rating 1 fruit when compared to non-bagged fruit. This indicates that the environment created within the bags is not suitable for high population build up. One dieldrin application to the bunch before applying the untreated bag did not improve control. The ineffectiveness of dieldrin when used as a bunch spray is inconsistent with Franzmann's (1977) findings which showed dieldrin as a soil application to the base of banana plants as very effective. The different result may be due to the different application methods or to a reduction in effectiveness of dieldrin against this pest since 1972 when Franzmann carried out his investigations.

Chlorpyrifos bunch sprays were phytotoxic to fruit. It was observed that the severity of phytotoxic damage was related to high volume applications. Spray droplets coalescing into larger drops (due to excessive spray volume) on the lower curve of the fruit caused circular surface scars and the severity of damage was aggravated by slower drying of spray deposits during humid and overcast weather.

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