MEALYBUG CONTROL IN GRAPES

R.W. PRINCE AND P.W. FISHER

Bayer New Zealand Limited, Auckland and Hastings

SUMMARY

Prothiofos, an insecticide of low mammalian toxicity and good persistence was evaluated for the control of mealybug (*Pseudococcus calceolariae*) in grapes (*Vitis vinifera*). The insecticide proved to be very effective in giving season long control from a single application applied pre-bud-burst, a time which coincides with the vulnerable stage of the insect's population development.

INTRODUCTION

Mealybug is an important insect pest in vineyards. High population numbers can debilitate the vines while low levels of infestation may reduce the value of the grapes as the honeydew secreted by the mealybug is an ideal growth medium for sooty mould fungi.

As mealybugs avoid bright light they are concealed feeders usually found under the bark of the vines, on the underside of leaves and in the middle of bunches. This tendency to hide within the crop means that the standard methods of controlling mealybug in vineyards, symptomatic insecticide sprays, are not completely successful as penetration and coverage are difficult to achieve.

Recent work on the life cycle of mealybug species has shown that the insect overwinters under bark or in other protected parts of the plant, and the insects move onto new growth in the spring. The low numbers of insects present in spring can build up to very high levels during the season (Charles 1981; Charles and Walkers 1981).

It has been reported that season long control of mealybug can be achieved in table grapes by a single pre-blossom application of prothiofos (Swart and Barnes 1979, 1980). Similar results have been shown in apples with prothiofos plus oil applied at green tip (Charles and Walker 1981).

Prothiofos is a broad spectrum, organophosphorous insecticide of low mammalian toxicity. It was developed by Nihon Tokushu Noyaku and was formerly coded NTN 8629. It has a long residual life under neutral to acidic conditions with a half life of 160 days at pH 2 and 40°C. The oral LD₅₀ for rats is in the range of 920 - 1800 mg/kg and dermal LD₅₀ for rats is greater than 4000 mg/kg (Kadamatsu 1976).

This paper covers the evaluation of prothiofos for the control of mealybug in New Zealand vineyards.

METHODS

Three detailed trials were carried out on commercial vineyards during the 1979/1981 seasons, in the Poverty Bay area. At all trial sites mealybug had been a problem the previous season and over-wintering insects and frass were readily found under the bark.

Trial A: Treatments were applied to Palomino vines prior to bud burst on 30.9.79. The trial was randomised block design with six replicates, each plot consisting of three vines. Application was made by handgun to the trunk and crown using 0.5 litres per vine. Assessment was made at harvest on 8.4.80 by inspecting 25 bunches per plot.

Trial B: The trial was of randomised complete block design with each treatment replicated four times. Each plot consisted of four Baco 22A vines which were at the late dormant - early bud movement stage when treatments were applied on 16.9.80. Treatment was made using a handgun timed to deliver 1000 litres/ha. Assessment was made at harvest on 31.3.81 by recording the incidence of mealybug in 25 bunches per plot.

Proc. 35th N.Z. Weed and Pest Control Conf.

Trial C: The trial was of split plot design with the main plots consisting of eight vines and sub plots consisting of four vines of the variety Baco 22A. Prothiofos was applied to the main plot on 16.9.80 while vines were in the early bud movement stage. Omethoate was applied to the sub plots on 16.12.80 while grapes were at the pre bunch closure stage. Treatments were applied as an overall spray using a handgun, timed to deliver the equivalent of 1000 litres/ha. Assessment was made at harvest on 30.3.81 by recording the incidence of mealybug in 25 bunches per plot.

In assessing the trials the bunches selected at random were rated according to the following scale:

0 = No live mealybug/bunch, 1 = 1-2, 2 = 3-6, 3 = 7-10, 4 = > 10.

No differentiation of insect stage was made and mealybug was the only pest present.

From these figures the degree of infestation according to Townsend and Heuberger (1943) was calculated. The percent effectiveness according to Abbott (1925) was calculated and analysed using the standard analysis of variance. Means were separated using Duncan's new multiple range test.

RESULTS AND DISCUSSION

The results of the assessments are presented in Tables 1 and 2. They show that a single pre-bud burst application of prothiofos to the trunk, crown and canes of grape vines gives excellent control of mealybug at harvest.

In trials A and B prothiofos at 50 g/100 litres gave significantly better ($p < 0.05$) control than the standard early season application of parathion methyl plus oil.

In Trial A the addition of Mobil 663 spraying oil at 1% of spray mix significantly improved the control achieved by prothiofos at the 30 g/100 litres. In both trials the addition of oil to the 30 g/100 litres rate of prothiofos resulted in mealybug control equivalent to 50 g/100 litres. The increased effectiveness achieved by the addition of oil is probably due to greater penetration into the bark assisting coverage.

In Trial B the level of mealybug control by prothiofos at 30 g/100 litres plus 1% oil applied overall was lower than that achieved by a similar treatment applied either to the crown and canes only or as a drench. The trial variation was such that these differences failed to reach significance.

The results from Trial C (Table 2) show that under very high mealybug pressure treatments with prothiofos plus oil during dormancy, omethoate at bunch closure or a programme of both treatments resulted in significant ($p < 0.01$) mealybug control.

TABLE 1: Mealybug control at Harvest

Treatment	Rate g/100 litres	Application** method	% Control of mealybug	
			Trial A	Trial B
parathion methyl*	45.6	Overall	69.8 b	28.6 bB
prothiofos	30.0	Overall	71.7 b	-
prothiofos*	30.0	Overall	91.9 a	81.2 aA
prothiofos	50.0	Overall	92.9 a	83.7 aA
prothiofos*	30.0	Cane and Crown	-	93.1 aA
prothiofos**	30.0	Drench	-	95.5 aA
untreated***			0 (84%)	0 (62%)
CV%			16.5	20.6

* Mobil 663 spray oil added to treatments at rate of 1% of mix.

** Overall as in machine spray; cane and crown excludes trunk; drench is complete soaking of the whole vine.

*** Figure in brackets represents degree of infestation.

TABLE 2: Mealybug control from dormant and mid season insecticide applications.

Treatment	Rate g/100 litres	% Infestation	% Control (After Abbott)
prothiofos*	30	21.75 B	75.9
prothiofos*	30	13.00 B	85.6
+ omethoate	87		
omethoate	87	25.75 B	71.4
untreated	-	90.25 A	0.0

* Mobil 663 spray oil added to mix at 1% of water rate.

Unpublished trial reports suggest that a higher level of effectiveness could have been expected with the pre-bunch closure application of omethoate. Considering that a high level of mealybug existed under the bark of canes and trunks and was protected by a dense canopy of foliage at treatment the results are satisfactory.

In the trials as reported and numerous commercial applications of prothiofos plus oil there has been no evidence of damage resulting from applications to vines at the early bud movement stage or with up to 100 mm of new growth.

We have observed that if prothiofos is applied to vines which have recently been sprayed with bordeaux mixture or lime sulphur there is a marked reduction in activity. It is recommended that these products should not be used if prothiofos is to be used for mealybug control.

CONCLUSION

The concept of timing insecticides to coincide with the most vulnerable stage of an insects development underlies most pest control programmes. Prothiofos applied pre-bud-burst at 30 g/100 litres in combination with 1% spray oil fulfils this ideal in the control of mealybug in vineyards.

In most situations a single spray would provide season long control. However, under extremely high pressure the early application of prothiofos can be followed by a pre-bunch-closure omethoate spray. This programme is effective and a change from the traditional insecticide programmes in vineyards.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the assistance and cooperation given by growers on whose properties the trials were conducted.

REFERENCES

- Abbott, W.S., 1925. A method of computing the effectiveness of an insecticide. *J. Econ. Entomol.*; 18: 265-267.
- Charles, J.G., 1981. Distribution and life history of the longtailed mealybug, *Pseudococcus longispinus* (Homoptera:Pseudococcidae) in Auckland Vineyards. *N.Z. J. Zool.*; 8: 285-293.
- Charles, J.G. and Walker, J.T.S., 1981. Mealybug control in apples. *The Orchardist of New Zealand*; 54: 252-253.
- Kadamatsu, A., 1976. Tokuthion, a new organophosphorous insecticide with low mammalian toxicity. *Japan Pesticide Information No.* 26. 14-17.
- Swart, P.L. and Barnes, B.N., 1979. Mealybug on table grapes: the most effective use of prothiofos for its control. *Deciduous Fruit Grower* 29: 222-226.
- Swart, P.L. and Barnes, B.N., 1980. Mealybug on table grapes: Newer insecticides for control. *Deciduous Fruit Grower* 30: 258-264.
- Townsend, G.R. and Heuberger, J.W., 1943. Methods of estimating losses caused by diseases in fungicide experiments. *Plant Disease Reporter* 27, No 17: 340-343.