METHIOCARB AS A BIRD REPELLANT IN BLUEBERRIES

P.T. HOLLAND, D.W. McFARLANE and P.M. BATES

Ruakura Soil and Plant Research Station, MAF, Hamilton

Summary

Methiocarb applied to high bush blueberries (*Vaccinium corymbosum*) in five sprays of 112 g/100 litres each 10 days apart over the ripening period greatly reduced bird damage. A treated 3 year old planting of 450 m² area gave a fruit yield of 93 kg while a similar sized untreated area yielded 0.9 kg. Birds were observed to have an almost complete aversion to feeding on the treated area. Residue measurements showed that berries picked 8-10 days after the previous spray had carbamate levels of 4-11 mg/kg. The oxidation product, methiocarb sulphoxide, was the predominant residue. Separate single spray persistence trials at three sites showed the half life on the berries of the total carbamate residues to be 5-10 days.

INTRODUCTION

Birds are the major pest affecting blueberry production. In Europe and North America high losses of fruit to birds are consistently found in both wild lowbush blueberries (*V. augustifolium*) and commercial highbush cultivars (*V. corymbosum*). Protection from depredation has proved very difficult and extensive plantings are used to minimise the effect of losses. Plantings in New Zealand are as yet small and netting is the only effective method of preventing the bushes being stripped of ripe berries. The cost of permanent netting is a major factor limiting establishment of larger plantings.

The carbamate methiocarb was originally developed as an insecticide but has also been found to be an effective bird repellent. Its use for seed, seedling and fruit protection in a variety of crops has been reviewed (Guarino 1972; Grasse and De Haven 1976). In Michigan, Stone *et al* (1974) demonstrated that a single application of methiocarb at 1.4 kg/ha reduced damage to highbush blueberries by starlings (*Sturnus vulgaris*) and robins (*Turdus migratorius*) to 16.7% as compared to 44.2% on untreated areas. Wood and Pearce (1977) applied 2 sprays at 2.2 kg/ha with an interval of 8 days to lowbush blueberries in New Brunswick. After 7 days the treated bushes retained 95% of the fruit compared to 42% on untreated bushes. At 28 days the figures were 47% and 9% respectively which underestimated the degree of control as many ripe berries from treated bushes had dropped to the ground. Greenhalgh *et al* (1977) found methiocarb to have a half life of 5-7 days on lowbush blueberries with substantial conversion to its oxidation products.

In New Zealand methiocarb has been successfully tested for pea establishment (Porter 1977). It is registered as a seed dressing and as a spray for grape and cherry protection. In trials at Auckland, Porter and Purchas (pers comm) reduced bird damage to two grape varieties from 100% to 28-38% by using three sprays of 1.1 kg/ha 11 and 21 days apart. Preliminary small plot trials at Rukuhia had led to inconclusive results in protecting blueberries (G.C. Atkinson, unpublished data). The trials reported here were instituted to clarify the possible role of methiocarb in blueberry production under N.Z. conditions and to provide data on residues and chemical persistence.

METHOD

An efficacy trial was carried out on an area of highbush blueberries at Lake Cameron, Rukuhia. The area was originally set out to test cultivar, mulch and mycorrhizal interactions and was 3 years old from planting. It consisted of 24 sub plots

Proc. 33rd N.Z. Weed and Pest Control Conf.

Fruit Crops

each containing 14 plants (two each of seven cultivars) arranged in four rows each 80 metres long. Behavioural studies have shown that birds require large, clearly identifiable blocks if they are to remember where the previous aversion took place (Guarino 1972). The whole area was, therefore, simply divided in half, providing treatment and control areas each 40 x 12 metres. To further assist birds to identify the treated area it was surrounded by a wire 1.5 m high on which were hung strips of black polythene film 1 m apart. The nearest substantial trees or hedges were 150 m distant.

The treatment was sprayed 5 times over the fruit ripening period. Spray dates were 10.12.79, 20.12.79, 30.12.79, 10.1.80 and 19.1.80. Methiocarb 75% was applied to drip point at 112 g/100 litres using a motorised knapsack sprayer. The overall application rate was 0.7 kg/ha. Wetting agent was added at 25 ml/100 litres. Trial assessment was by comparison of the ripe fruit yield from the treated and untreated areas. Picks were generally made immediately prior to the next spray. Subsamples were kept for residue analysis. Observations of bird activity were made from a hide on the morning of 14.1.80 and the evening of 24.10.80.

Residue decay trials were carried out at three sites. At Awakiri, Bay of Plenty a netted row of 3 year old bushes (mixed seedlings) was used (spray date 18.12.79). At Lake Cameron, Rukuhia a caged row of mature bushes (Dixi) was used (spray date 2.1.80). At West Road, Moanatuatua netted rows of mature bushes (Burlington and Dixi) were used (spray date 4.1.80). Treatment areas of 4-6 bushes were selected in each row. The treatments consisted of 112 g/100 litres of methiocarb 75% WP applied with wetting agent using a pressurised precision knapsack sprayer. A double rate treatment was also made at the Moanatuatua site. Samples of 50-100 berries/treatment were picked from representative positions on the bushes immediately the spray dried (day 0) and at 1, 3, 7, 14 and 28 days following. All samples were stored at -20 °C prior to residue analysis.

Residues of methiocarb and its oxidation products on the fruit were determined by a modification of the method of Greenhalgh *et al* (1977) using solvent extraction and gas chromatography of the trifluoroacetyl derivatives with flame photometric detection (S mode).

RESULTS AND DISCUSSION

Efficacy:

The weights of fruit picked from the treated and control areas are given in Table 1. The untreated area was essentially stripped of fruit while the methiocarb treatment allowed a fruit harvest of 93.4 kg. As there was no suitable netted control area it is difficult to establish the absolute degree of protection. However, the following factors indicate that it was very high. There was a great deal of variation in the fruit yield from individual treated bushes due to the various cultivars and mulches used in the original planting. Under the best mulch treatments Dixi gave mean fruit weights of 2.2 kg per bush which are excellent yields for a 3 year old planting. Except for the first pick, there was very little evidence of bird damage to the treated area with less than 1% of the fruit being split or pecked. Direct bird observations also supported an almost complete aversion to feeding on treated fruit.

TABLE 1: Efficacy Trial. Fruit yields and carbamate residues from blueberry bushes treated with methiocarb (5 sprays of 0.7 kg/ha)

Harvest date	20.12.79	30.12.79	4.1.80	9.1.80	18.1.80	26.1.80	11.2.80	Total
Yield kg (untreated)	0	0	0.7	0	0	0.2	0.9	
Yield kg (treated)	2.1	25.9	8.0	19.1	22.3	12.7	3.3	93.4
Residues (mg/kg)	4.2	8.0	12.4	6.7	9.0	11.3	3.4	-
Days from last spray	10	10	5	10	9	8	16	-

Fruit Crops

General bird activity was greatest in the 2 hours after first light and at dusk. Birds in some cases landed on the treated area but always moved quickly to the control area before feeding. The species observed feeding were, in order of dominance, blackbirds (*Turdus merula*), Mynahs (*Acridotheres tristis*) and thrushes (*Turdus philomelos*). Native waxeyes (*Zosterops lateralis*) and starlings were not present although they have been reported by local growers as serious pests in previous years. No dead or affected birds were found in the vicinity of the trial area.

To check for any effect of the spray on the flavour and acceptability of the fruit, samples were taken 4 days following the 4th spraying and chilled overnight. An experienced taster was unable to distinguish treated and untreated berries from unmarked containers, both having the characteristic flavour of the cultivar (Dixi).

Residues:

The persistence measurements for the 3 trial areas are listed in Table 2. The calculated area rates of application were 1.9 to 3.5 kg/ha for the 112 g/100 litres sprays. The substantial variation mainly reflects the different size and layout of bushes. Initial deposition on the berries is better indicated by the volume rate as the spray was applied to run off point. The half life for methiocarb and its oxidation products was 5-10 days. At 14 days the residues were 6-10 mg/kg with 60-70% in the form of the oxidation product methiocarb sulphoxide. No methiocarb sulphone was present (detection limit 0.2 mg/kg). The higher residues at Awakiri may reflect the smaller fruit and sheltered site. Precipitation at Moanatuatua and Rukuhia amounted to about 150 mm between days 14 and 21 but this does not seem to have greatly affected the decay patterns.

TABLE 2: Persistence of methiocarb on highbush blueberries following a single spray

Cultivar/site	Rate g/100 litres	Total carbamate residue (mg/kg)						
		Day						
		0	1	3	7	14	21	28
Mixed seedlings (Awakiri)	112	30	23	25	21	10	4.8	4.3
Burlington (Moanatuatua)	112	22	20	17	14	6.0	4.2	3.1
Dixi (Moanatuatua)	112	22	19	18	10	6.5	4.1	3.5
Dixi (Rukuhia)	112	24	21	13	14	7.0	2.5	1.9
Dixi (Rukuhia)	224	35	34	25	25	20	4.5	2.9

The residues found on fruit harvested from the efficacy trial are given in Table 1. There is a trend of increasing residues at the 8-10 day pick interval as the number of sprays increased. The residues were mainly in the form of the sulphoxide. For example at 26.1.80 over 90% of the residue was in this form with the remainder the parent methiocarb. The methiocarb levels are somewhat lower than might have been expected from the persistence results. This may be due to faster breakdown on the more exposed, spindly, young bushes in the efficacy trial.

CONCLUSIONS

The high apparent degree of bird control achieved in the efficacy trial show that methiocarb sprays could be a valuable tool in commercial blueberry production. The problem of residues at harvest is the main factor preventing its commercial use. It is not likely to be registered for blueberry use in N.Z. until the U.S.A. sets a residue tolerance as this is the prime export market. The pattern of residues observed in these trials

Fruit Crops

indicates that a tolerance of 25 mg/kg (proposal before the EPA) can readily be met. However, other spray schedules and rates warrant investigation to reduce the relatively high residue levels found. Possible spray schedules are limited by the uneven ripening characteristic of most blueberry cultivars which necessitates several harvests at 7-10 day intervals. A fourteen day spray interval, as used with grapes, would have the disadvantages of high residues at the first of two picks 7 days apart or fruit loss through dropping with a single pick at 14 days. The efficacies of stretched spray intervals or reduced rates are also uncertain. Commercial plantings of cultivars with similar ripening dates should need only three sprays at 10 day intervals for protection. The visible clay deposits resulting from the wettable powder formulation also affect the acceptability of treated fruit. Alternative formulations may be able to overcome this problem.

ACKNOWLEDGEMENTS

T.K. McGhie for assistance with laboratory analyses. Henry H. York and Co. Ltd for analytical standards. T. Fermin, Dr C.L.I. Powell and T.K. James for the use of their trial areas.

REFERENCES

- Grasse, F.T. and De Haven, R.W., 1976. Methiocarb, its current status as a bird repellent. *Proc. 7th Vertebrate Pest Conf.*, Monterey, Calif. 46-50.
- Greenhalgh, R., Wood, G.W. and Pearce, P.A., 1977. A rapid GC method of monitoring methiocarb and its metabolites and their persistence in lowbush blueberries. *J. Environ. Sci. Health B12*, 229-44.
- Guarino, J.L., 1972. Methiocarb, a chemical bird repellent: a review of its effectiveness on crops. *Proc. 5th Vertebrates Pest Conf.*, Fresno, Calif. 108-11.
- Porter, R.E.R., 1977. Methiocarb protects sprouting peas from small birds. *N.Z. Exp. Agric.* 5, 335-8.
- Stone, C.P., Shake, W.F., and Langowski, D.J., 1974. Reducing damage to highbush blueberries with a Carbamate repellent. *Wild Life Soc. Bull.* 2, 135-9.
- Wood, G.W. and Pearce, P.A., 1977. Reducing damage to lowbush blueberries with carbamate repellent. *Acta Hort.* 61, 201-4.