FURTHER EXPERIMENTS WITH METHIOCARB ON BLUEBERRIES

P.T. HOLLAND, D.W. McFARLANE and G. LAWN

*Ruakura Soil and Plant Research Station, MAF, Hamilton
N.Z. Agricultural Engineering Institute, Hamilton*

SUMMARY

Application of methiocarb to high bush blueberries (*Vaccinium corymbosum*) at an initial rate of 112 g/100 litres followed by treatments at 7 day intervals of 75 g/100 litres using a hydraulic sprayer gave substantial protection of the ripening fruit from bird damage. Fruit yields from a 480 m² treated area were 24% less than those from an adjacent area enclosed in netting but this difference was not entirely attributed to bird damage. Methiocarb residues on the fruit at each harvest (7 day withholding period) were 4-15 mg/kg with a high residue after the initial spray which then declined but built up again over the next four harvests. Alternative formulations of methiocarb to the wettable powder were developed.

INTRODUCTION

Blueberry plantings are increasing rapidly in New Zealand, particularly in the Waikato region, encouraged by the ease of growth, and the high yields and prices being obtained from established plantings. The high capital cost of enclosures for prevention of bird damage and the continued maintenance cost of the plastic mesh are however disincentives to the industry. The protection of ripening fruit from the depredations of birds by the use of chemical repellents is an attractive alternative to netted enclosures. At present the only suitable chemical available commercially is methiocarb, which is registered internationally for grape and cherry protection and has generally been found to be effective against common problem birds (Guarina 1972; Crasse and De Haven 1976). The use of methiocarb on blueberries has not been greatly studied in New Zealand. A trial at Rukuhia (Holland *et al* 1980) showed that a high degree of control is obtained by sprays of 112 g/100 litres 10 days apart over ripening. This and associated trials also gave residue data showing a half life for methiocarb on the fruit of 5-10 days and residues in the range of 4-12 mg/kg at a series of picks made at 10 day withholding periods. The US Environmental Protection Agency has recently set maximum residue limit of 25 mg/kg for methiocarb opening the way for exports of treated fruit to the USA.

There are several areas of concern in relation to the use of methiocarb on blueberries. Firstly fruit for export needs to be harvested as soon as it is ripe and the industry has indicated a 7 day rather than 10 day waiting period would be desirable for optimum fruit condition during shipping and marketing. Secondly the Rukuhia trial (Holland *et al* 1980) did not use a netted control area and thus the absolute degree of protection could not be established. As blueberries are such a high value crop losses must be minimal for methiocarb spraying to be a viable alternative to netting in established plantings. Thirdly concern has been expressed that the methiocarb wettable powder formulation leaves visible deposits on the fruit due to the clay carrier. This could downgrade the premium grade fruit being produced. The following trials have been carried out to study these concerns.

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METHODS

An efficacy trial was conducted on the experimental planting at Lake Cameron, Rukuhia, previously used (Holland *et al* 1980). The area was split longitudinally into 2 plots each 80 x 6 m containing two rows of 4 year old plants of mixed variety. The first plot was enclosed in a timber framed, plastic netting covered enclosure. The second plot was treated with methiocarb at 7 day intervals from when the early cultivars began to ripen. This plot was surrounded with plastic flags (Holland *et al* 1980) to reinforce aversion. The volume rate for the first spray was 112 g/100 litres and subsequent sprays were 75 g/100 litres. A 75% wettable powder formulation was used with 10 ml/100 litre wetting agent. Application was to run-off with a hand gun (D4 nozzle with hollow cone swirler) operated at 15 kPa from a motorised pump. Ripe fruit was harvested from both plots immediately before each spray and subsamples retained for residue analysis. The harvest and spray schedule followed are listed in Table 1.

TABLE 1: Methiocarb application rates and residues on blueberries

Harvest/spray date	Dec.8	Dec.15	Dec.23	Dec.29	Jan.5	Jan.12	Jan.21	Jan.27
<i>Methiocarb residues</i>								
pre spray (mg/kg)	0	15.4	7.0	7.3	11.6	15.4	3.8	7.4
<i>Spray rate</i>								
g methiocarb/100 litres	112	75	75	75	75	75	75	-

A liquid formulation was prepared by dissolving methiocarb (7.5 g technical 99.7%) and non ionic wetting agent (2.0 g) in absolute ethanol (120 ml). A flowable formulation was prepared by mixing methiocarb (7.5 g), non ionic wetting agent (2.0 g) with water (25 ml) containing pH 7 phosphate buffer using a Polytron ultrasonic homogeniser. The dispersion properties were tested by mixing an aliquot of each formulation containing 9.75 g methiocarb in a beaker containing 1 litre of water. The storage properties were checked by storing the formulations in sealed containers in the dark for 3 months and analysing an aliquot by high performance liquid chromatography. The field properties of the formulations were compared to the standard wettable powder by spraying plots in a mature row of ripening blueberries (cv. Burlington) with each formulation at 75 g a.i./100 litres.

Methiocarb and methiocarb sulphoxide residue levels on fruit were analysed by gas-chromatography of their trifluoroacetyl derivations using flame photometric detection (S mode).

RESULTS AND DISCUSSION

The average of the area rates for the 7 x 75 g/100 litres sprays was 0.57 kg/ha. This relatively low rate results from the spot spraying method used on the small bushes in the trial. Blanket spraying of large bushes at full production would require 1-2 kg/ha. The yields of fruit from the treated and netted plots are given by variety in Table 2. The 104 kg overall yield from the sprayed area represents a 24% difference in yield relative to the enclosed area. The yield differences were greater for the early maturing varieties. Some

TABLE 2: Total blueberry yields by cultivar (kg fresh wt).

Cultivar <i>Maturing</i>	Blueray e	Stanley e	Ivanhoe m	Herbert m-l	Jersey m-l	Dixie l
netted	16.2	23.0	14.8	18.5	31.3	33.8
methiocarb	11.1	15.2	9.0	13.9	22.0	33.0
difference (%)	31.5	33.9	39.2	24.9	29.4	2.4

e early m middle l late

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pecked fruit was observed after the first spray, indicating birds were testing the crop. However this type of damage was not found after mid-December and bird activity was generally low. It is therefore unlikely that the yield reductions are solely due to birds. Some human depredation from a nearby housing area is possible. Also the plant quality was very variable because of varietal differences in establishment and mulch interactions inherent in the original trial planting. Some plants were badly affected by an early season herbicide application. The non-uniformity of the trial area was confirmed by examining in detail the yield data from the 1979-80 trial (Holland *et al* 1980) which divided the area across the rows rather than lengthwise. The yield data therefore only provide a demonstration that methiocarb sprays provide substantial protection against bird damage.

The total methiocarb residues on the fruit at each of the harvests are given in Table 1. As previously found 30-50% of this residue was in the form of the sulphoxide oxidation product (Greenhalgh *et al* 1977; Holland *et al* 1980). The high residue on December 15 is consistent with the residues found previously at 7 days following a 112 g/100 litres spray (Holland *et al* 1980). The reduced rate used for the later sprays resulted in lower residues for the next three picks with a build up to 15.4 mg/kg on January 12. The low residue on January 21 is due to rain falling within 3 hours of the January 12 spray application and to the 9 day interval to harvest.

The alternative formulations both formed suspensions suitable for spraying when mixed with water. The clear ethanol solution threw down a fine suspension of methiocarb which dispersed well. The white flowable concentrate also dispersed readily. The suspensions from both formulations settled rather more rapidly than that from the wettable powder but mild agitation was sufficient to restore uniformity and no problems were found in applying them with a motorised back-pack sprayer. The initial spray deposits and residue decay curves on blueberries were not significantly different from those of the standard wettable powder formulation with an initial deposit of 7.5 ± 1 mg/kg decaying with a half life of 6 ± 1.5 days. No phytotoxic effects were noted. Initial spray deposits from the alternative formulations could be observed on the fruit but after 7 days no difference from untreated fruit could be seen whereas clay deposits from the wettable powder were still visible.

The storage properties of the formulations were good with no detectable (less than 1%) degradation of the methiocarb over a 3 month period. This is of interest as liquid formulations of methyl carbamates are generally held to be unstable. Some settling of the flowable concentrate occurred but moderate stirring or shaking made the mixture homogenous again.

CONCLUSIONS

The economics of bird control using methiocarb relative to netting are quite sensitive to the degree of control achieved particularly with a high value crop such as blueberries. Quite small crop losses quickly negate the cost savings afforded by the repellent. The present trial has confirmed the previous finding that methiocarb is an effective repellent but has only established that yield losses are reduced to less than 25%. Large uniform plantings suitable for a properly replicated efficacy trial based on gross yields are not available. More accurate assessment of bird damage will have to rely on detailed studies on bird behaviour and of individual berry counts on treated bushes.

The residue data establishes that methiocarb used with an initial spray of 112 g/100 litres followed by 2-3 sprays of 75 g/100 litres can meet the USA tolerance of 25 mg/kg, provided a 7 day waiting period is observed. The fruit in this trial were smaller than export quality. This leads to higher residues (Holland and Watts 1980) so the levels measured will be 'worst case'. The above spray programme would be very suitable to cover the ripening period to a single varietal planting.

The alternative formulations of methiocarb appear effective and eliminate the clay carrier problem. Their further development is dependent on commercial interest both from blueberry growers and the chemical manufacturers.

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