CHEMICAL PROTECTION OF BLUEBERRIES FROM BIRDS

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SUMMARY

Two seasons trials on highbush blueberries (*Vaccinium corymbosum*) on a site with a high bird population gave near complete loss of fruit from unprotected bushes. Recovery of tagged fruit from methiocarb treated bushes was 73% in 1982-83. This dropped to 24-52% in 1983-84 which was attributed to rain reducing deterrence and a larger bird population. Two applications of bendiocarb gave comparable protection to that of methiocarb. Monitoring of two grower properties showed a large difference in bird population and damage. It is considered that the present high value of blueberries justifies netting plantings older than 3 years where bird population is high.

INTRODUCTION

Currently growers mainly rely on permanent netted enclosures to protect blueberries from birds. These are expensive and in the early years of production the use of methiocarb sprays as a chemical repellent is an attractive alternative. However the high value of the crop means the cost advantages of spraying over netting are quickly negated if the methiocarb treatments do not have a relatively high degree of effectiveness. It has been calculated that, depending on the value of the fruit, the cost benefit from spraying could be lost after the third year of fruit production if the spraying was only 90% effective (Sorenson and Holland 1981).

Previous trial work (Holland *et al* 1980, 1981) established suitable spray programmes for methiocarb in blueberries that were reasonably effective and that gave acceptable residues on harvested fruit. However the gross yield assessment technique used did not give a very accurate measure of the degree of protection provided. This paper covers three further seasons work at a number of trial sites in the Waikato, using a berry counting technique to assess the fruit losses due to birds more accurately in controlled trials using methiocarb and on grower properties. A preliminary investigation of the repellent properties of another N-methyl carbamate, bendiocarb, was also made.

MATERIALS AND METHODS

Trial areas

All experiments were carried out on established plantings of highbush blueberries.

In 1981 a trial was laid down at the Rukuhia site described by Holland *et al* (1981), using the same design to compare a methiocarb sprayed area with an adjacent netted area. Within each area 12 bushes, cv Blueray (early), cv Jersey (mid season) and cv Dixi (late) were selected for assessment.

In 1982 and 1983 similar trials were laid down on a 10 year old planting on the Moanatuatua swamp, Ohaupo. A row of 42 Burlington cv bushes was divided into three plots: untreated, netted (covered with plastic netting), and methiocarb sprayed. An adjacent row of Dixi cv was similarly treated. In 1982-83 an additional Dixi cv plot sprayed with bendiocarb was included to compare the effect of this carbamate with methiocarb.

Trial treatments

The treatments to the methiocarb plots were begun when fruit first began to ripen. The first application was made at 112 g/100 litres and the subsequent 5-6 sprays were applied at 7 day intervals using 75 g/100 litres (Mesurol 75 WP). The bendiocarb

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treatment was applied twice at 7 day intervals using 75 g/100 litres (Ficam 80 WP) beginning 15.1.83 to an area that had been under netting until that time. Applications were made to run-off with a motorised knapsack mist blower and included wetting agent (Citowett, 10 ml/100 litres). Mean area rates per application were 0.6 kg/ha at Rukuhia and 1.2 kg/ha on the larger plants at Moanatuatua.

Grower monitoring

In 1981-83 two grower properties were monitored for bird damage to young unnetted blueberry plantings. Grower 1 was on the Moanatuatua swamp at Kaipaki. Grower 2 was on the Rukuhia swamp at Rukuhia. Both growers had expressed their intention to use methiocarb but in the event elected only to apply a single early season spray (around mid December) and then only for the first season. Grower 2 at Rukuhia observed severe depredations by grey ducks (*Anas superciliosa*) and obtained a permit to eliminate the problem by shooting.

Assessment

On trial sites and grower properties a berry counting technique was used to assess losses of fruit. In early December when fruit was fully formed but still green, bunches of fruit containing 25-50 berries were each tagged with a band of tape around the stalk. A count was then made of the number of fully formed berries in each bunch. Any immature or deformed berries were removed. A total of 48 bunches per variety were tagged in each plot with a random selection of locations over the bushes. As the fruit ripened weekly harvests were made and a record kept of the number of ripe berries collected from each tagged bunch. On trial sites the harvests were immediately prior to the next methiocarb spray. The cumulative count, expressed as a percentage of the original green count, then gave the berry recovery. Bird observations were made several times at each site using hides at dawn.

RESULTS AND DISCUSSION

The berry recoveries for the 1981-82 trial at Rukuhia and the 1982-84 trials at Moanatuatua are given in Tables 1 and 2 respectively. The results are expressed as the mean and standard deviation of the percentage berry recovery for the 48 bunches assessed for each variety. The netted treatments were expected to yield greater than 90% berry recovery as pre-trial thinning of substandard fruit and weekly picking should minimise berry drop. The 49-78% recoveries from the netted treatment at Rukuhia indicate that this trial site was again affected by unauthorised entry. The Moanatuatua site afforded better security and the berry recovery from the netted areas were high as expected. During 1982-83 some birds penetrated the netting and this probably accounts for the slightly lower recovery than in 1983-84 (Table 2).

Due to the problems with security, the degree of protection by methiocarb during the 1981-82 season is uncertain. The 63-67% recovery over the three varieties indicates that the upper limit to bird damage was about 35%. The previous 1980-81 trial (Holland *et al* 1981) put the upper limit at 25% for that season. Observations at this site indicated that a colony of mynahs (*Acridotheres tristis*) had established itself in the area and that these birds were persistent feeders on the treated crop, relatively undeterred by methiocarb. This observation has also been made on methiocarb treated cherries (Porter 1982). Poisoning or shooting campaigns may be necessary where mynahs are causing significant damage in commercial plantings.

The Moanatuatua site on a high moor peat bog supported high populations of blackbirds (*Turdus merula*) and thrushes (*Turdus philomelos*). The bird pressure was confirmed by the low recoveries of unprotected berries in the two seasons studied (Table 2). This site therefore presented a good test for the effectiveness of methiocarb against these species, which are the most common pests of blueberries. In 1982-83 the weekly spraying of methiocarb resulted in 73% of the fruit being harvested but in 1983-84 this dropped to 24-51%, with the late ripening Dixi cv being most affected (Table 2).

TABLE 1: Rukuhia trial 1981-82: ripe blueberry recovery (%).

Treatment	Blueray	Cultivar Jersey	Dixi
methiocarb	66 ± 26	63 ± 23	67 ± 24
netted	78 ± 16	49 ± 29	69 ± 16

TABLE 2: Moanatuatua trials 1982-84: ripe blueberry recovery (%).

Treatment	Burlington		Cultivar	
	1982-83	1983-84	1982-83	Dixi 1983-84
None	7 ± 0		4 ± 5	0
methiocarb	73 ± 19	52 ± 22	73 ± 24	24 ± 13
netted	86 ± 21	92 ± 12	84 ± 20	91 ± 20

TABLE 3: Monitoring of blueberry growers 1981-83: ripe berry recovery %.

		Early selection	A9	Cultivar Atlantic	Jersey	Dixi
Grower 1	1981-82	n.a.	n.a.	n.a.	35 ± 14	18 ± 17
(Moanatuatua)						
Grower 2	1981-82	n.a.	n.a.	n.a.	73 ± 22	46 ± 26
(Rukuhia)						
Grower 2	1982-83	66 ± 20	86 ± 14	98 ± 12	n.a.	n.a.

n.a. data not analysed due to incomplete harvest counts.

Due to the limited areas of uniform plants available for experimental trials it was not possible to achieve adequate plot replication. Therefore the quantitative significance of the trials is low. The uniformity of the trial sites was high and no reasons for spatial preference by birds other than the treatments were obvious. This was supported by a combined analysis of transformed data for the 2 years trials at Moanatuatua which showed no interactions, but significantly lower recovery from untreated ($P < 0.01$), or methiocarb sprayed ($P < 0.05$) than from netted areas.

Factors in the reduced yields in the second year were a higher bird population including some mynahs and a wetter season. Rainfall figures showed that greater than 1 cm of rain fell on 2 days during the 1982-83 harvest period (Jan-Feb) versus 7 days in 1983-84. Heavy rain reduces methiocarb deposits (Holland *et al*; Porter 1982) and this combined with chemical breakdown can leave fruit with non-repellent levels only a few days after spraying. Caged experiments with methiocarb treated cherries showed starlings (*Sturnus vulgaris*) did not memorise the repellent effect after 1 day (Hoyoux and Zenon-Roland 1982). Rather than conditioned aversion, the alarm generated by a few birds being affected after testing treated fruit may be the main repellent mechanism (Wright 1980).

The results of monitoring grower plants for bird damage are presented in Table 3. The high moor bog site of grower 1 was observed to support a large bird population. The low recoveries of his unprotected fruit are therefore not unexpected. The single early spray of methiocarb some weeks before main harvest was unlikely to have had any significant effect.

The results for grower 2 are more interesting, although the data are incomplete due to some trial bushes being harvested by commercial pickers. Some moderate to excellent recoveries were obtained (Table 3). Observations confirmed that this site had an unusually low population of pest birds. The early season shooting operations against ducks may have scared off other birds, although such an effect is usually very temporary. The order of berry recovery versus variety may be explained as follows. The very early special selection bushes were attacked by ducks, the early to mid season cultivars A9, Atlantic and Jersey were not badly affected following control operations, and the late Dixi variety were attacked by returning blackbirds.

Another factor on this property was a pair of magpies (*Gymnorhina hypoleuca*). This species, a relative newcomer to the Waikato district, is very territorial and drives away other birds. This pair was not observed to damage the blueberry crop.

The mean berry recovery for the bendiocarb treatment at Moanatuatua was $60 \pm 21\%$. The two sprays over the main harvest period thus provided a useful degree of protection, similar to that of methiocarb at this site. The mammalian acute toxicity of bendiocarb is 179 mg/kg (LD 50 rat) versus 130 mg/kg for methiocarb. The avian toxicity of methiocarb is in the range 3-13 mg/kg (Schafer 1972) and this high ratio of avian/mammalian toxicity is a major component of methiocarb's usefulness as a bird control agent. Bendiocarb also has a high avian toxicity (personal communication D.M. Foulkes, FBC Ltd, UK) and thus may be an acceptable alternative to methiocarb. No dead or seriously affected birds were observed from the methiocarb or bendiocarb treatments.

CONCLUSIONS

The results of a number of trials show that methiocarb used in a regular spray programme does provide a degree of protection from birds. However under high bird pressure and adverse climatic conditions the protection may be inadequate to prevent serious losses of fruit. Methiocarb spraying is suitable for protection of the first crops from young plantings and its effectiveness can probably be enhanced and extended when combined with more drastic measures such as shooting or poisoning. Some bird species such as ducks or mynahs appear not to be greatly affected by methiocarb. As bird populations vary widely, each grower should carry out observations, preferably at dawn, of bird behaviour in the crop. This should be coupled with tagged berry counts to rationalise the control measures required.

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