1080 IN HONEY

FROM POSSUM BAITS

RAHOTU - TARANAKI

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ABSTRACT

Honey was sampled from beehives within the flight zone of a possum poisoning operation using 1080 with "jam bait" which is an attractive forage for bees. The methodology required some determination of bee activity and estimation of sample age so as to establish the link between the samples and the poisoning operation. The highest concentration of 1080 detected in the honey was 15 ppb and subsequent tests showed a gradual decay down to 3 ppb after 59 days. The honey source that the samples were taken from would have eventually gone on sale after 16 weeks, hence there would not have been any detectable level of 1080 in the sale product, although under different circumstances, this time could be considerably shorter. There is no risk of acute poisoning from such low levels of 1080 and with regard to sub lethal effects, there has been little research done. Aspects of risk management for Medical Officer of Health approvals, that include such factors for consideration as toxicity, decay, public perception and practical options for reducing levels of contamination are discussed.

DEFINITIONS

1080
Sodium Monofluoroacetate poison, used at a concentration of 0.08-0.15% in possum bait

"Jam" baits
The traditional method of luring possums to a poison, used in New Zealand, consisting of a fruit pulp with added sugar, similar to domestic table jam. The poison dosed baits are dyed green as required by the Pesticides (Vertebrate Pest Control Regulations), for the purpose of identification.

AIM

To determine whether contamination of honey *for human consumption* can occur as a result of 1080 poisoning operations using "jam" baits, that are attractive to bees, in the vicinity of beehives and discuss, that if so, whether there is a significant health risk as a result.

INTRODUCTION

The interest in this investigation was provoked by reports of green dye occurring in honey. Discussions with persons in other regulatory and research agencies, also suggested that bees do feed on "jam" bait and that some degree of contamination of honey with 1080 does occur.

In late 1993 the Ministry of Health began to draft a guideline for the use of Medical Officers of Health in setting conditions for the use of the controlled poison 1080, where special approval is required as per Regulation 12 of the Pesticides (Vertebrate Pest Control Regulations). A clause has since been adopted in the guidelines that restricts the usage of 1080 possum poison within 4 kilometres of any beehive. Meanwhile, some experimental work is being undertaken on alternative type baits that are either non attractive or repellent to bees.

Taranaki National Park (Mt Egmont) has had major possum control operations under way during 1993 and 1994, with 1080 being the predominant poison type used. The ground operation, under the control of Taranaki Regional Council has made use of "jam" baits, which is the standard method of attracting possums to the poison, in New Zealand, but is also recognised as being attractive to honey bees.

Phosphorus poison bait (Yellow phosphorus) is used as an alternative to 1080 and like 1080, the poison dosed baits are dyed green for identification, therefore honey that has been contaminated may be recognisable by the green stain carried from the bait (1080 or phosphorus).

A beekeeper was identified who had beehives in a suitable location for the purpose of a limited survey of honey from beehives. A beekeeper in Rahotu had made the decision not to remove his beehives from the area of the poisoning operation (1080 and Phosphorus) although all beekeepers in the area had been advised of the pending operation.

BEE ACTIVITY

Since the gathering of the honey is dependent on the activity of bees, it is necessary to consider the following aspects of bee activity during the "sample period ":
the flight zone, the influence of the weather.

Flight zone of bees

For the purpose of this report, the distance of 4 kilometres has been chosen as the radius of the flight zone for bees from the hive, as per the 1993 Ministry of Health guidelines.

Weather Conditions

The weather conditions, limit the bee activity and hence the amount of honey gathered and factors include: wind speed, temperature and rainfall.

Sources of available forage

Alternative natural sources influence the selection of the 1080 jam, by the bee for example native tree flower availability.

TOXICITY OF 1080

The toxicity of 1080 to animals is due to its conversion within mitochondria to fluorocitrate (Osweiler et al. 1985) which inhibits the enzyme aconitate dehydratase and blocks the Kreb's cycle (the major energy producing pathway), although other mechanisms which contribute to the overall toxicity of 1080 have been reported (Mead et al. 1985).

The 1080 lethal dose (LD50 oral rat) is 0.2 mg/kg and the dangerous dose to man is 0.5 -2.0 mg/kg (Sax).

SUBLETHAL AFFECTS 1080.

Nearly all research on 1080 toxicity relates to either the lethal doses or how long a species takes to eliminate 1080 after a sublethal dose (Clark 1993). For example in studies of the persistence of 1080 in mammals (Eason 1993) showed that rapid elimination occurs, with only traces detectable after 96 hours, following oral dosage with near lethal amounts. This is not surprising, since 1080 is highly water soluble and is readily excreted in urine or broken down in animal tissue to liberate free fluoride and non toxic metabolites. There is has been little research undertaken on the effects of sub lethal doses of 1080 (eg carcinogenic/teratogenic effects).

NEW ZEALAND FOOD REGULATIONS

The New Zealand Food Regulations 1984 do not provide a specific maximum permissible level for 1080, however there is a general requirement that "no food shall contain an incidental constituent that is a pesticide at a level that exceeds 0.1 ppm (reg 257)" however, this default provision may not be applicable to 1080.

1080 DECAY IN THE HONEY

There is a time period prior to the sale/consumption of honey, in which any 1080 present is undergoing decay. Eason (1993) demonstrated the decay of 1080 in various media and while the study did not include honey, a comparison between 1080 decay in distilled water (bacterial free) and honey (bacteriostatic) is relevant. In distilled water a reduction of only 16% had occurred after 7 days, whereas in biologically active aquaria, the amount of 1080 was reduced by 70% after 24 hours.

METHOD

1. Identify suitable target situation beehives, where 1080 poisoning with jam is taking place, within the flight zone of beehives.

2. Obtain data on timing/location of the poisoning operation.

   When taking honey samples, attempt as much as possible to determine the age of the honey so as to correlate with the timing of the poisoning operation.

3. *Make general observations such as, dye stained honey and* obtain weather records for the area. Information on sources of bee forage was not obtained

4 Carry out analysis of the honey samples for 1080, including a series of tests over a period of time, to determine the decay of 1080, if present over time.

   MAF Wallaceville, to carry out analysis of honey for 1080, and undertake these tests using Gas Chromatograph and Mass Spectrophotometer methods with the following limits of detection:

- Minimum proficiency level (MPL) = 10 ppb (5ppb from 19/5) *
- Lowest detection level (LDL) = 3 ppb (2ppb from 19/5) *

5. Determine the time period between the bee gathering and sale/consumption of the honey

* ***Minimum proficiency level (MPL)*** *The minimum amount that can be identified and quantified reliably*

* ***Lowest detection level (LDL)*** *The smallest amount that can be reliably observed or found in the sample.*

RESULTS

Taranaki Regional Council provided specific data on the location and dates that the poisoning ground operation had taken place, within the 4 km zone.

Map 1 and Photographs one and two show the location of the poisoning operations and beehives, see Map 1.

The NZMS map reference for the beehive sites are as follows:

Site 1 P20 920 102
Site 2 P20 909 105

Table 1
The time interval from when 1080 was laid until when the samples were collected

SAMPLE NO	SAMPLE SITE	DATE SAMPLES TAKEN	FINAL DATE, 1080 LAID IN 4KM ZONE FROM SAMPLE SITE	TIME INTERVAL FROM 1080 LAID UNTIL SAMPLING	"AGE" OF SAMPLE
53	1	24 March 1994	12 March 1994	12 days	Fresh
54	2	24 March 1994	12 March 1994	12 days	Semi-capped
55	1	24 March 1994	12 March 1994	12 days	Capped
56	2	24 March 1994	12 March 1994	12 days	Fresh
57	2	24 March 1994	12 March 1994	12 days	Capped

Information on the "age" of the honeycomb was able to be approximated by the opinion of the beekeeper, using such criteria as:

* the stage of "capping" of the honeycomb, where an "uncapped" cell is regarded as fresher (and most likely was less than 14 days old), while a "fully capped" cell is older *(Photo three and four show honeycomb in various stages of capping).*

* the position of the honey in the comb.

Table 2
Summary of weather records as recorded by the local NIWA agent on Upper Kahui Road.

	MONTH	
	FEB	MARCH
No of days with less than 0.1 mm of rain	13	9
No of days with wind velocity (Beaufort scale) estimated to be less than 5	26	14
Daily temperature	not available	not available

For results of the analysis of the samples for 1080, see Table 3.

Analysis of Samples 53, 54 & 56 showed traces of 1080 and sample 56 was tested sequentially over a 59 day period The sequential samples (sample 56) showed a decline in 1080 levels occurring over the test period and had decayed to 3ppb after 59 days from the date of the initial sampling.

This sample had its final processing and went on sale in mid July. Therefore the time from collection until consumption/sale was about 16 weeks and a minimum time period could be assumed to be about one week (between the hive and human consumption).

Table 3

HONEY SAMPLE, COLLECTED ON 24 MARCH 1994 (1080 levels are expressed as parts per billion)

SAMPLE NO	SAMPLE SITE	ANALYSIS DATES					
		28/3	5/4	19/4	19/5		COMMENT
53	1	10	0	0			
54	1	3	0	N/A			
55	1	0	N/A	0			
56	2	15	15	5	3		Green Dye Stained
57	2	0	N/A	N/A			

DISCUSSION

These beehives provided a suitable location, in a situation where it is possible for the bees to access 1080 baited jam. The four kilometre bee flight zone from the sample site beehives did include 1080 (and phosphorus) poisoning operations that occurred during the period in which bees could have been gathering the sample honey. Using the specified age criteria for the honey, the samples that contained 1080 did coincide with the date of the poison operation

The data on weather conditions showed that during the months of February and March, when the sample honey would have been being gathered, there were sufficient number of days suitable for bee activity.

Some samples showed traces of 1080, but no green dye was observed, but this could have been phosphorous poison (not tested for), which is also used with green-dyed jam.

Toxicity of 1080 at the Levels Found

At such low levels it would not be possible for a person to consume sufficient honey to receive an acute toxic dose and in the absence of information there is uncertainty as to the magnitude of hazard that is presented by sub-lethal doses.

With regard to the Food Regulations (Reg 257), (although this may not necessarily apply for 1080) all detected levels are well below the stated 0.1 ppm, ie 10 ppb is 10 times below 0.1 ppm.

1080 Decay in the Honey

Since a time period of 16 weeks; lapsed from when the honey was collected until the date for sale, this honey would not have had any detectable 1080 levels, when finally eaten (compare with sample 56). The time period between collection and sale can therefore be a determinant of the product residual level, depending on the extent of the initial contamination and variables in decay rate. The demonstrated decay rate of 1080 in honey is relatively slow, (more like that Eason reported of distilled water, than that of biologically active media).

CONCLUSION

Medical Officers of Health, in setting conditions for the use of 1080 should undertake a risk assessment of the situation that includes the potential for contamination of honey. This report provides some statistical information for use in this evaluation i.e.

1. Samples of honey from beehives in the proximity of 1080 operations with jam bait have demonstrated that contamination can occur.

2. The concentration of 1080 in the honey was found to be well below that for an acute toxic dose, however there is little known about sub-lethal effects.

3. 1080 does decay in honey, although at a slow rate.

Medical Officers of Health should request information on proximity of beehives, attractiveness of the bait type and liaison between the operator and beekeepers. Appropriate conditions should be applied in each circumstance, taking into consideration the options of exclusion of beehives from operation areas, or availability of alternative baits. The assessment will most likely also have to consider the perceived risk, where any detectable level of 1080 is likely to threaten the image of honey as a "pure" product.

High priority should be given to completion of research into effective alternative baits of non attractive or repellent type.

Further research on the effects of sub lethal doses of 1080 (eg carcinogenic/teratogenic effects)is required.

Further research into the possibility of honey contamination with the possum bait Phosphorus is also required.

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