

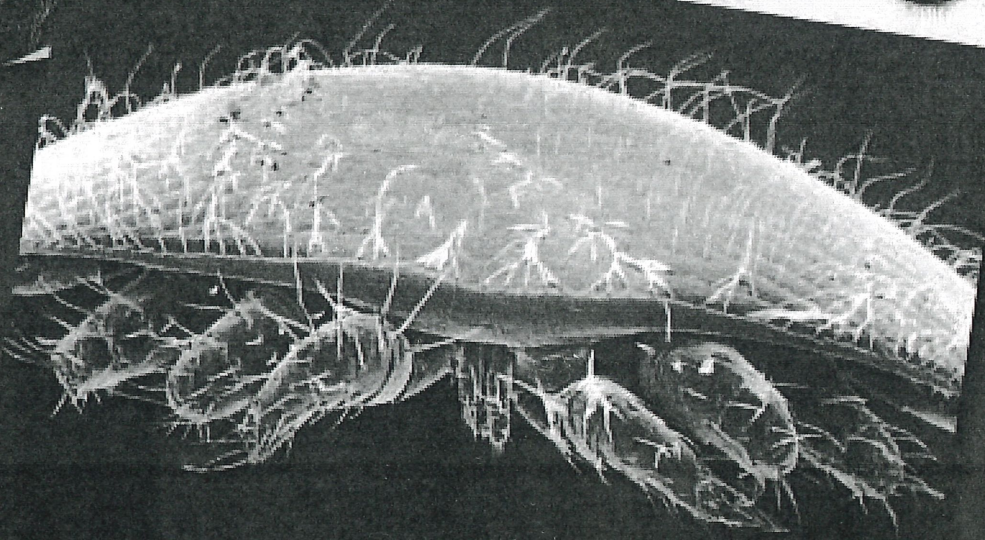
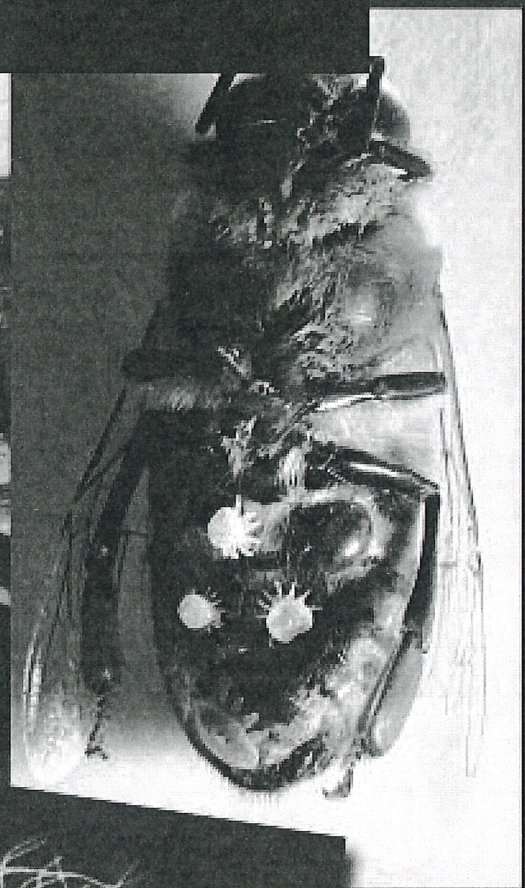
2000

OAG, 2002

Case Study 4

Response to the Incursion of the Varroa Bee Mite

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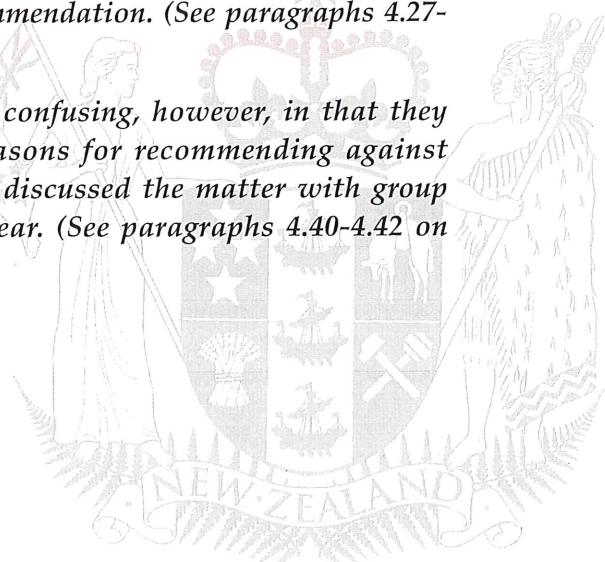
CASE STUDY 4 – RESPONSE TO THE INCURSION OF THE VARROA BEE MITE

Why Did We Select This Case Study?

- 4.1 The incursion of the varroa bee mite raised questions about the effectiveness of the surveillance programme for this pest. The decision not to eradicate the varroa bee mite was controversial. We selected this case study to examine:
- the process by which the decision was reached, including the work of the technical advisory group and the consultation undertaken by MAF; and
 - an incursion response that involves large-scale pest control measures as opposed to measures to eradicate a pest.
- 4.2 This case study also enabled us to examine the work of the Animals Biosecurity Group within MAF Biosecurity.

Key Findings

- 4.3 *The varroa bee mite is thought to have been present in New Zealand for up to five years before detection. The varroa surveillance programme did not identify the presence of varroa until it was too late to eradicate it – the incursion shows how crucial surveillance is to effective biosecurity risk management. (See paragraphs 4.14-4.15 on page 81, and paragraphs 4.44-4.57 on pages 88-90.)*
- 4.4 *Minutes of the Technical Advisory Group (TAG) meetings were exhaustive, and the TAG was well briefed on the issues relevant to making its recommendation not to eradicate the varroa bee mite. Moreover, the minutes set out clearly the TAG's recommendation. (See paragraphs 4.27-4.39 on pages 84-87.)*
- 4.5 *The minutes of the TAG meeting were confusing, however, in that they did not clearly set out the precise reasons for recommending against eradication. It was not until after we discussed the matter with group members that these reasons became clear. (See paragraphs 4.40-4.42 on page 88.)*





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- 4.6 *MAF acted quickly to apply its standard procedures to set up a pest response. MAF had to “reprioritise” its work programme to fund the response. The criteria and implications of such reprioritisation are unclear, but it undoubtedly put pressure on MAF’s core operational funding. We believe that, if MAF had to respond to more than one significant incursion at any one time, it would have difficulty in simultaneously funding the multiple responses by reprioritising its funding without compromising other important work. (See paragraphs 4.58-4.77 on pages 90-93.)*

Recommendations

- 4.7 *MAF should detail the aims of each surveillance programme, and produce performance standards that specify the expectations and coverage of the programme. (See paragraph 4.57 on page 90.)*
- 4.8 *MAF and the Treasury should agree on a process for applying for incursion response funding. This process should include a clear timetable, and be documented, pre-agreed and well communicated. (See paragraph 4.77 on page 93.)*
- 4.9 *TAG minutes should reflect the actual TAG decision-making process. (See paragraphs 4.40-4.42 on page 88.)*

Introduction

- 4.10 The varroa bee mite (*Varroa jacobsoni*) is an external parasite of honey bees that attacks adult bees and their developing larvae, or young. It weakens bee colonies and kills them.
- 4.11 *Varroa was discovered in New Zealand on 11 April 2000 in South Auckland and has since spread throughout much of the North Island. Varroa is believed not to be present in the South Island.*

How Did the Varroa Bee Mite Enter New Zealand?

- 4.12 New Zealand has prohibited the import of live bees for the last 40 years to protect its bee health status. Before 2000, New Zealand was considered to be free from varroa.



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- 4.13 Although it is not possible to determine exactly how the mite entered the country, the Minister for Biosecurity has said *the most likely route was through the illegal importation of queen bees by a New Zealand beekeeper, either by post or as personal luggage*. However, it has also been suggested that it might have arrived by the sea container pathway.

How Was the Varroa Bee Mite Detected?

The varroa bee mite is thought to have been present for up to five years before detection.

- 4.14 The incursion of the varroa bee mite was detected on 11 April 2000 in two different ways. The original detection was made after a hobbyist beekeeper had a collapsed hive investigated by a bee disease expert and notified the event through MAF's 0800 telephone hotline. MAF also detected varroa on the same day as part of its ongoing random testing of samples of bees from export consignments.
- 4.15 MAF believes that the evidence suggests that varroa may have been present and undetected for up to five years.

What Are the Financial Implications of the Varroa Bee Mite?

Varroa is estimated as being likely to cost the country at best around \$400 million and at worst around \$900 million.

- 4.16 The varroa bee mite affects agriculture and horticulture in two ways:
- directly, on the beekeeping sector; and
 - indirectly, on sectors that benefit from honey bee pollination.
- 4.17 MAF prepared an economic impact assessment of varroa on agriculture. That assessment suggested that, with no direct Government involvement, varroa was likely to cost the country at best around \$400 million and at worst around \$900 million (in present value terms) over the next 35 years.
- 4.18 It is therefore understandable that the Minister for Biosecurity described the breach in May 2000 as *probably the most serious breach of our biosecurity in recent times*.

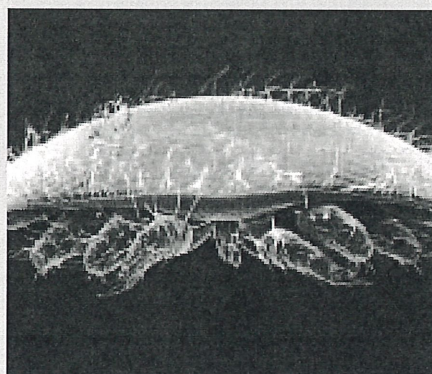
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- 4.19 The Government decided *not* to try and eradicate the varroa bee mite but, rather, adopted a three-tier strategy involving an immediate, interim, and long-term management plan.

Figure 4.1
The Varroa Bee Mite

The varroa bee mite is an oval-shaped, bronze-coloured mite 1-2mm long, which is found on the outside of adult honey bees. It can be seen with the naked eye if bees are examined carefully. It also appears on honey bee pupae. The mite does not affect humans, and has no known host other than the honey bee.

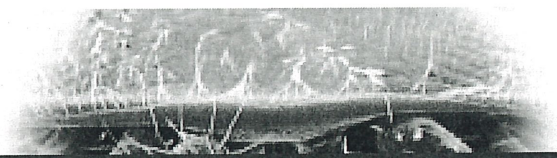
The mite lives by feeding on bee pupae. Infected pupae fail to survive, or may be born with deformed wings. Eventually, the mite population increases to a point where all the bees in the beehive die. This can take up to three years.



The mite spreads naturally from hive to hive by bee contact. However, the rapid spread of the mite world-wide is due mainly to human activities. Modern beekeepers shift their hives long distances to pollinate crops, or gather honey. This has enabled the mite to spread over the whole North American continent within 5 years of it being introduced. Another means of spread is the international trade in live bees. Queen bees are shipped world-wide, and are believed to be responsible for the spread of the mite from Europe to both North and South America.

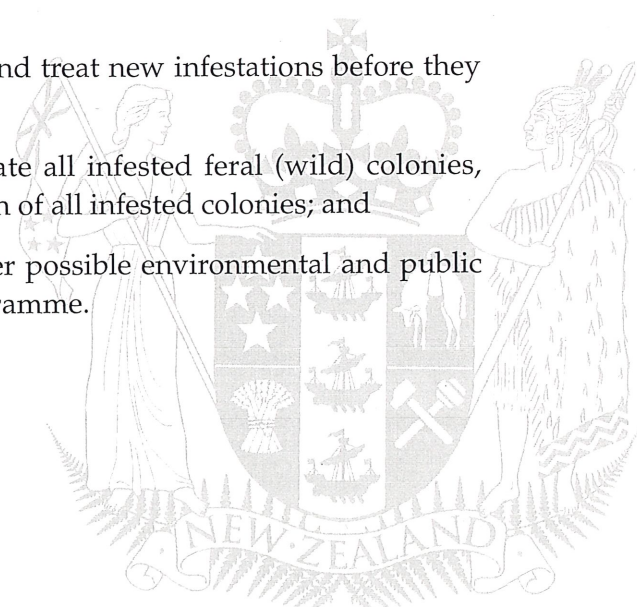
Why Did the Government Decide to Control Rather Than Attempt to Eradicate the Varroa Bee Mite?

At the time of detection, the chances of achieving eradication were minimal. The varroa surveillance programme did not identify the presence of varroa until it was too late to eradicate it.



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- 4.20 On 12 July 2000, the Government announced that no attempt would be made to eradicate the varroa bee mite. This was on the basis that the chances of achieving eradication were minimal. It was a controversial decision that was criticised by both industry and non-industry groups.
- 4.21 The decision meant that New Zealand beekeepers and the horticultural sector had to learn to live with the varroa bee mite.
- 4.22 MAF estimated that the costs of an attempted eradication would have been \$55-70 million. Given the assessed economic impact (see paragraph 4.17), eradication would therefore have been worthwhile from an economic perspective if it were technically feasible.
- 4.23 The decision not to eradicate was essentially an irreversible one. That is, once the decision was made, the opportunity (if there was one) to eradicate was lost. This is because varroa would continue to spread by natural means and beekeeper movements, leading to the decreased likelihood of a successful eradication.
- 4.24 The decision not to eradicate was therefore a critical decision. In reaching that decision, the Government considered the views of the beekeeping and other primary sector industries, and also the independent Technical Advisory Group (TAG) established by MAF to provide advice on technical aspects relating to eradication. In the end, the Government accepted that the probability of fully eradicating the varroa bee mite was minimal.
- 4.25 The four identified primary technical impediments to attempted eradication were that:
- varroa might be more widespread than previously known and the likelihood of unidentified infestations reduced the feasibility of eradication;
 - it might not be possible to detect and treat new infestations before they spread to other locations;
 - it might not be possible to eradicate all infested feral (wild) colonies, and eradication requires elimination of all infested colonies; and
 - there might be public concerns over possible environmental and public health impacts of a poisoning programme.





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4.26 In addition:

- a failed eradication attempt would weaken beekeeping and pollination-dependent industries and jeopardise long-term management of the bee mite; and
- eliminating a substantial proportion of the North Island's bees posed a significant risk to industries that rely on bees for pollination services.

How Was the Decision Not to Attempt to Eradicate Reached?

Minutes of the Technical Advisory Group (TAG) meetings were exhaustive, and the TAG was well briefed on the issues relevant to making its recommendation not to eradicate the varroa bee mite. Moreover, the minutes set out clearly the TAG's recommendation.

However, the minutes of the TAG meeting were confusing, in that they did not clearly set out the precise reasons for recommending against eradication. It was not until after we discussed the matter with TAG members that these reasons became clear.

4.27 For other case studies, we have been concerned with the decision-making process of the TAGs. See, for example, the painted apple moth case study on pages 57-76. Because of the importance placed by the Government on the varroa TAG's conclusions in reaching a decision, we decided to review the decision-making processes of the TAG.

4.28 In early-May 2000, MAF contracted AgriQuality New Zealand Limited (AgriQuality) to develop a draft operational plan, so that issues of technical feasibility could then be fully considered. The plan envisaged depopulating managed hives immediately after a decision had been taken to pursue eradication. Feral bees would be eradicated over the spring and summer of 2000-01 through the deployment of poison stations throughout the eradication area.

4.29 On 31 May 2000, MAF convened a TAG meeting to consider the feasibility of the draft operational plan for eradication. This TAG included scientific expertise across a range of disciplines and from a variety of science institutions, as well as representatives from the beekeeping and horticultural industries. It operated to agreed terms of reference, and was independently chaired by the Chief Executive of Institute of Environmental



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Science and Research Limited. Officials from interested Government agencies were invited to observe the deliberations and provide input where appropriate.

4.30 The meeting of 31 May 2000 was crucial because, based on the discussions at this meeting, the TAG later recommended –

... against proceeding with the proposed eradication operational plan because the unresolved associated technical/biological risks mean that the probability of success is unacceptably low.

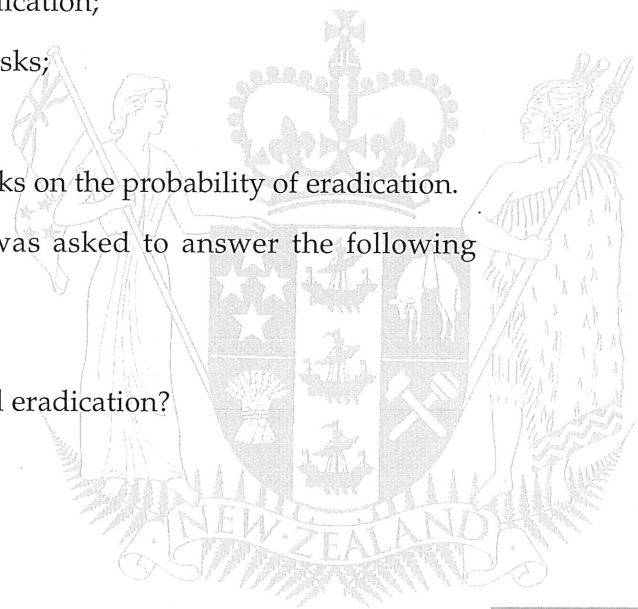
4.31 The meeting of 31 May had a clear purpose and clearly defined terms of reference that had been circulated prior to the meeting. These included evaluating the technical feasibility of the eradication plan and the probability of success, and preparing a report on a preferred response strategy. The TAG's final report (recommending against eradication) was dated 30 June 2000.

4.32 Our examination showed that minutes of the TAG meetings were exhaustive and that the TAG was well briefed on the issues relevant to making its recommendation not to eradicate varroa. The attendees at the 31 May meeting:

- received a presentation and discussed the methodology and results from MAF's delimiting survey;
- received a paper and discussed overseas experience of varroa eradication and control efforts;
- received a presentation and discussed the operational plan for eradicating varroa proposed by AgriQuality;
- identified risks associated with eradication;
- determined the relevance of these risks;
- excluded irrelevant risks; and
- assessed the impact of identified risks on the probability of eradication.

4.33 Initially, each member of the TAG was asked to answer the following three questions:

- Is eradication technically feasible?
- What is the probability of successful eradication?
- What are the major risk factors?



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- 4.34 The opinions of the members fell into four categories, as set out in Figure 4.2 below.
- 4.35 Figure 4.2 shows that, based on the eradication plan as presented to the group, a majority of the TAG, when polled individually at the beginning of the meeting, thought that eradication was technically possible.

*Figure 4.2
Initial Poll of TAG Members*

| Eradication technically possible? | Number of Members | Probability of success | Risks for successful eradication |
|---|-------------------|------------------------|--|
| Unreserved "Yes" | 3 | 80-90% | None |
| "Yes" – but only if identified risks overcome | 10 | 70-80% | <ul style="list-style-type: none"> • survival of feral bees; • non-compliance of beekeepers; and • non-detection of movement of unregistered hives. |
| Unsure as to the technical feasibility | 4 | 50% | <ul style="list-style-type: none"> • survival of feral bees; • non-compliance of beekeepers; • non-detection of movement of unregistered hives; • lack of knowledge about varroa; and • under-estimation of inter-apiary spreading. |
| Eradication technically not feasible | 5 | 20-50% | N/A |



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- 4.36 There was then a group discussion that focused on identifying the technical risks to an eradication attempt being successful. The primary risks identified were:
- the infested area might not be accurately delimited;
 - the available surveillance tests might not be sufficiently sensitive to enable new infestations to be detected and treated before they spread further;
 - it might not be possible to eradicate all infected feral colonies;
 - there was potential for delays arising from public concerns over possible environmental and public health impacts of a poisoning programme; and
 - there might be non-compliance by some beekeepers.
- 4.37 After discussing these major risks, the TAG concluded that the proposed operational plan for varroa had serious risks attached to it. In particular, the TAG assessed that, taking these risks into account, the probability of a successful eradication was approximately 17%. This was done on the basis of the TAG identifying mutually exclusive events (risks) that would lead to eradication failure if they occurred and assessing their probability of occurrence.
- 4.38 In summary, the TAG concluded that the technical and non-technical risks associated with varroa raised sufficient doubts in the minds of the TAG to prevent it from recommending the eradication of varroa.
- 4.39 The TAG minutes set out clearly the TAG recommendation. The *Final Report for the Varroa Technical Advisory Group Meeting on Feasibility of Eradication* stated that a majority of members believed that the technical/biological risks associated with varroa meant that the probability of success for eradication was seriously constrained. Accordingly, the TAG could not recommend proceeding on a course of eradication. Specifically, the TAG recommended:
- against proceeding with the proposed eradication, because the unresolved associated technical/biological risks meant that the probability of success was unacceptably low; and
 - urgency in completing an operational plan for the control of varroa.



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- 4.40 However, the confirmed TAG minutes were somewhat confusing in explaining the decision-making process. In particular, the minutes record the conclusion that there was a low probability of a successful eradication, whereas members, when polled individually, had assessed the probability of a successful eradication as much higher.
- 4.41 The minutes did not explain that the poll of members was taken **before** the risks associated with eradication were fully considered. It was only when this was explained to us that we were able to understand the logic behind the decision not to recommend eradication.
- 4.42 It is important that TAG minutes accurately reflect its decision-making process.
- 4.43 On 12 July 2000, the Government announced that it had ruled out attempting to eradicate varroa, opting instead for a management programme. The Government said that, in making this decision, it had considered carefully the views of the beekeeping and other primary sector industries and also of the independent TAG. However, the Government accepted that the chance of successfully eradicating varroa was minimal. Moreover, a failed eradication attempt would weaken beekeeping and pollination-dependent industries and jeopardise long-term management options of the bee mite.

What Surveillance Was Under Way for the Varroa Bee Mite?

The varroa incursion shows how crucial surveillance is to effective biosecurity risk management.

- 4.44 At the time the varroa bee mite was found in New Zealand in April 2000, MAF (in association with the beekeeping industry) was already funding a programme for surveillance of exotic diseases of honey bees. Broadly, the surveillance programme had (and still has) two objectives:
- to meet the reporting requirements of New Zealand's trading partners to facilitate trade in bees, honey, and bee products; and
 - to assist in the detection of any new or exotic diseases of honey bees.
- 4.45 As noted in paragraph 4.15 on page 81, the varroa bee mite is not thought to have been discovered by MAF surveillance until up to five years after it entered the country.



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- 4.46 Until November 1998, surveillance of bees was conducted on the following basis:
- Each year, MAF targeted 500 apiaries in high-risk areas for entry of bee diseases. These risk areas were around rubbish dumps, seaports and airports, high-volume tourist areas, suburbs from which a large number of people travel overseas, military establishments, and hospitals. All colonies were visually inspected, and a sample of bees from 500 apiaries was taken to test for exotic internal and external bee mites.
 - In addition, samples from a further 500 apiaries of live bee exporters were tested for internal and external mites.
- 4.47 Essentially, this was a targeted surveillance programme based on risk, and the annual cost was approximately \$180,000.
- 4.48 From November 1998, a change was made in the way bee surveillance was conducted. Because the exotic bee disease incursion risk was concluded to be randomly distributed through the country, the new sampling regime was:
- 600 bee samples tested for internal and external mites;
 - these samples to come from bee samples submitted as part of the bee industry's American Foulbrood Pest Management Strategy and from bees sent directly to laboratories from exporting beekeepers; and
 - “approved beekeepers” used to undertake inspection for exotic diseases (as part of their inspections for American Foulbrood) and to send in an annual return certifying that their apiaries are free from exotic diseases.
- 4.49 A number of reasons caused the change in approach.
- 4.50 First, the new surveillance programme assumed that the risk of bee disease getting into New Zealand was random throughout the country.
- 4.51 Secondly, the re-organisation of MAF – under which MAF Quality Management was established as a State-owned Enterprise (AgriQuality) – ultimately led to the funds available for bee surveillance being reduced to \$100,000 a year.
- 4.52 Thirdly, the new surveillance programme reflected a move towards the industry becoming more responsible for surveillance. Any surveillance programme relies on the people working with the bees recognising a change in the bee population and then reporting it, so that the relevant authority can investigate.



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- 4.53 There is no evidence that the earlier surveillance programme would have detected the varroa bee mite any sooner.
- 4.54 However, the varroa incursion shows how crucial surveillance is to effective biosecurity risk management. In particular, it demonstrates that a higher level of surveillance is needed to detect some pests in time to mount an eradication response that has a reasonable chance of success.
- 4.55 In some respects, the varroa surveillance programme can be regarded as a “failed” programme. One of the aims of the programme was to assist in the detection of new or exotic diseases of honey bees. Ultimately the programme did do this, but at a stage where it was not considered worth attempting to eradicate varroa.
- 4.56 Although it is not clearly stated, we believe that the aim of detecting new or exotic diseases (such as varroa) is to detect them in time to allow eradication. That aim was not achieved in this case.
- 4.57 Accordingly, in our view MAF should set out in some detail for each surveillance programme:
- the aims of the programme; and
 - performance standards setting out the expectations and coverage of the programme.

How Did MAF Respond to the Incursion?

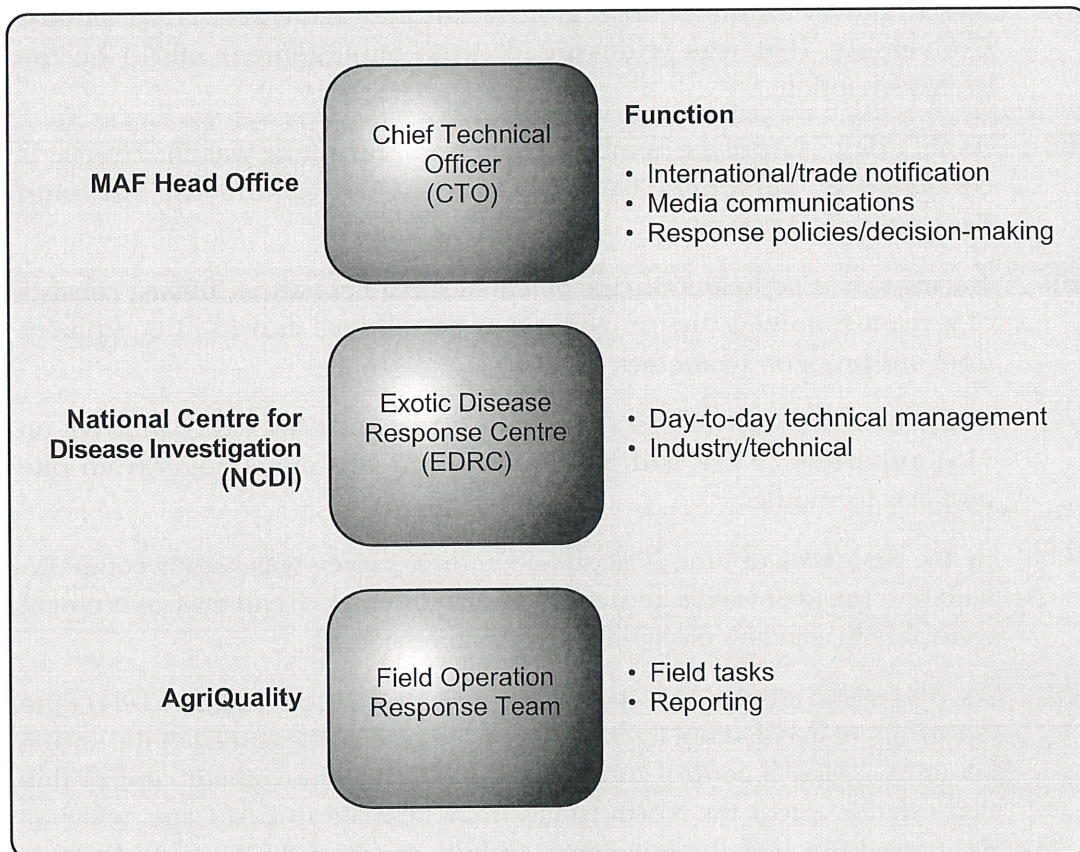
MAF acted quickly to apply its standard procedures to set up a pest response.

- 4.58 The contingency plans for dealing with an incursion of varroa bee mite are specified in MAF’s *Biosecurity Authority 153 series of Standards: Exotic Disease Programmes of Animals (including honey bees and fish)* (the standards).
- 4.59 The standards set out MAF’s policy and procedures relating to the period of notification of a suspected exotic disease through to the response phase (if required).
- 4.60 The standards total 152 pages, and set out the standard response procedures as well as roles and responsibilities for each organisation involved in a response. Specifically, the standards set out the:
- National Control Centre (NCC) operating procedures;

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- role and responsibility of the Exotic Disease Response Centre;
 - establishment of procedures relating to the Field Operations Response Team; and
 - specific procedures for an exotic incursion relating to a honey bee exotic disease.
- 4.61 The standards also set out the general requirements for all contractors contracted by MAF to assist in a response – such as capability, service, technical and delivery requirements, and training requirements.
- 4.62 The structure established by the standards is outlined in Figure 4.3 below.

*Figure 4.3
MAF Honey Bee Exotic Disease and Pest
Response Structure*





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- 4.63 The Field Operations Response Team function is contracted to AgriQuality.
- 4.64 The varroa bee mite was discovered in four small South Auckland apiaries on Tuesday, 11 April 2000. The laboratory identification of the mite was reported at 4.15pm on that day.
- 4.65 An emergency pest response was initiated, and a Field Operations Response Team was established in Auckland on 11 April.
- 4.66 A “controlled area” was defined and declared by public notification in newspapers on Friday, 14 April. Broadly, a controlled area means that the movement of bees (live and dead), beehives, beekeeping equipment and appliances are prohibited within the area, or from the area to other areas.
- 4.67 From Wednesday, 12 April teams of apiarists and MAF personnel visited and inspected beehives within the controlled area. The aim of the inspections was to “delimit” or determine the extent of the incursion. After this had been done, the Government could then make informed decisions on an appropriate response. For example, if the varroa bee mite was found in a limited area, eradication may have been a possibility. Conversely, if it was widespread, then management might be the preferred option.
- 4.68 As at Friday, 14 April the number of field teams operating was 15. The teams consisted of personnel from MAF, AgriQuality, and the National Beekeepers Association.
- 4.69 Tracing was used to identify the potential spread of varroa. Tracing consists of a team following the movement of bees, hives and used equipment from one property to another.
- 4.70 In the first week of the response, field teams had checked 3356 hives on 318 properties. They had also tracked 777 bee movements from one property to another.
- 4.71 By the first week of June 2000, the delimiting survey was largely complete, with the spread of varroa known. From that time, MAF and the Government were able to consider possible longer-term responses.
- 4.72 As discussed above (see paragraphs 4.19-4.26 on pages 82-84), the Government decided not to eradicate but to control the spread of the varroa bee mite. MAF’s control programme includes a movement control line that extends across the North Island from Taranaki to East Cape, which is designed to restrict the movement of bees south of the line. Earlier this year, varroa was found north of Wellington in a hollow log in a load of transported timber. MAF has reported that, as of 23 September 2002, two varroa-infested apiaries had been identified in the area and numerous other hives had tested free of varroa.



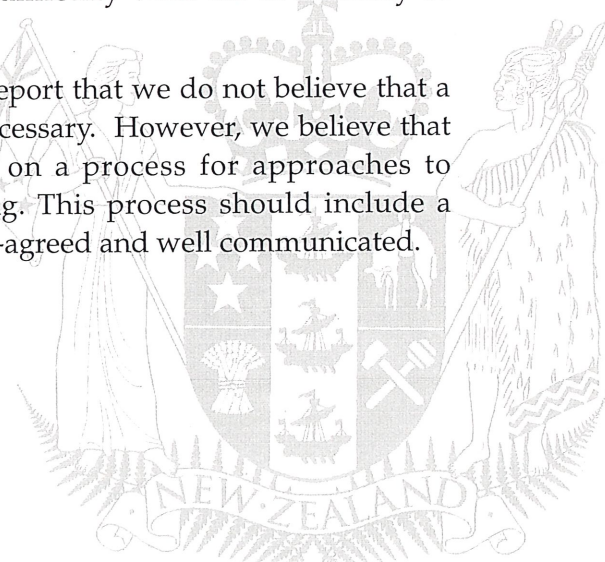
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How Did MAF Fund and Resource the Response?

MAF had to “reprioritise” its work programme to fund the response. The criteria and implications of such reprioritisation are unclear, but it undoubtedly put pressure on MAF’s core operational funding.

We believe that, if MAF had to respond to more than one significant incursion at any one time, it would have difficulty in simultaneously funding the multiple responses by reprioritising its funding without compromising other important work.

- 4.73 Managing a response is very expensive. For example, from 11 to 27 April 2000, MAF spent approximately \$850,000 on the response. This money was funded by MAF re-prioritising its work programme.
- 4.74 Cabinet later approved \$1.35 million extra funding for MAF that enabled it to complete the delimiting survey.
- 4.75 We do not believe that the response was compromised by MAF not having funds readily available to respond to an incursion. However, the current funding arrangements do raise issues for MAF. For example, MAF must “reprioritise” its work programme to fund any incursion response. The criteria and implications of such reprioritisation are not clear.
- 4.76 The funding requirements undoubtedly put pressure on MAF’s core operational funding. MAF has not had to respond to more than one significant incursion at any one time. We believe that, if MAF was required to do so, it would find difficulty in simultaneously funding the response to two significant incursions by reprioritising its funding without compromising other important work. Depending on the nature of the incursions, there could also be difficulty with the availability of sufficient trained and specialist staff.
- 4.77 We have said in Part Four of the main report that we do not believe that a dedicated incursion response fund is necessary. However, we believe that MAF and the Treasury should agree on a process for approaches to Cabinet for incursion response funding. This process should include a clear timetable, and be documented, pre-agreed and well communicated.





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Information technology was not well suited to the response against varroa, and made co-ordination difficult.

- 4.78 The ability to eradicate exotic pests requires co-ordination of an appropriate level of resources at specified locations at the correct time. Information collected from the field must be supplied to the headquarters in a form that enables analysis and interpretation, such that informed policy and operational decisions can be made. These decisions can then be fed back to field operations.
- 4.79 MAF's information technology system is currently not capable of enabling both the response headquarters and the field operations to share a common set of data. Telephone, fax, e-mail, and post are relied upon for communication between headquarters and the field.
- 4.80 The problem lies with MAF's IT security system, which does not allow data collected in the field to be entered directly into the response software. Consequently, version problems occur, with different data sets maintained at each site. MAF has convened an IT project team to resolve the problems.
- 4.81 The current IT system was designed for fast-moving infectious disease of livestock, and could not be adapted for a varroa response in the event of an incursion in the South Island. The IT project team is also looking at options for developing a new incursions database, more suited for a response such as varroa.

As the response is largely undertaken by contractors, MAF carries out periodic audits to ensure compliance.

- 4.82 Finally, the model for launching a response is largely contractual, with MAF having standard contracts with suppliers for relevant services.
- 4.83 For example, for the purposes of the varroa response, MAF had a contract with AgriQuality to manage and undertake the functions of the Field Operations Response Team. This is a crucial part of any response, and the capacity (or otherwise) of the supplier to undertake its contractual obligations is largely out of MAF's hands.
- 4.84 MAF therefore audits these contracts periodically to ensure compliance. For example, in July-September 2001 MAF audited Asure New Zealand's performance under a contract for the supply of Meat Industry Exotic Disease planning.

Introduction

Management of Biosecurity Risks: Case Studies.

This report contains seven case studies that highlight how departments have managed specific biosecurity risks. These case studies illustrate how departments have worked together, and how the policies and procedures of the Biosecurity Programme¹ have been applied in relation to specific biosecurity risks.

We follow the same structure in each of the case studies:

- the reasons for selecting the case study are explained;
- our key findings and recommendations are summarised; and
- a detailed discussion of issues relating to the particular case study is provided.

An explanation of key terms is given in paragraphs 1.27-1.38 (<https://oag.parliament.nz/2002/biosecurity/part1.htm#terms>) of the main report, and a glossary of technical terms is provided as Appendix 1 (<https://oag.parliament.nz/2002/biosecurity/appendix1.htm>) to the main report.

Links to the case studies

- [1: Importation of Table Grapes from California \(PDF 220kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part1.pdf)
- [2: Response to the Incursion of the Southern Saltmarsh Mosquito \(PDF 205kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part2.pdf)
- [3: Response to the Incursion of the Painted Apple Moth \(PDF 244kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part3.pdf)
- [4: Response to the Incursion of the Varroa Bee Mite \(PDF 220kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part4.pdf)
- [5: Response to the Incursion of the Red Imported Fire Ant \(PDF 313kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part5.pdf)
- [6: Management of Risks Associated with Sea Containers \(PDF 172kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part6.pdf)
- [7: Preparedness for an Outbreak of Foot and Mouth Disease \(PDF 242kB\)](https://oag.parliament.nz/2002/biosecurity-case-studies/docs/part7.pdf)

1: "The Biosecurity Programme" is the expression used in this report to refer to the Government's Biosecurity Programme. It is co-ordinated by MAF Biosecurity, which is the lead agency for managing risks to New Zealand's biosecurity.

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