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TERM MANAGEMENT PLANS FOR
BOVINE TB POSSUM CONTROL

Peter C. Nelson
Managing Director, Pest Management Services, Ltd.

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PETER C. NELSON, Managing Director, Pest Management Services, Ltd., Wellington, New Zealand

ABSTRACT: In parts of New Zealand the beef and dairy industry is being threatened by possums spreading bovine tuberculosis to cattle. As a result new strategies for the long term control of possum populations have been developed. For these strategies, management plans are prepared which detail the control programme for each area. New control strategies are being developed which include long term annual control to reduce infestation of treated areas. Research is being increased in an attempt to find long term answers with improved control techniques and more importantly the possibilities of biological control. Central and Local Government are providing long term funding for these management plans.

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INTRODUCTION

New Zealand's dairy and beef production is being affected by the brush tailed possum (*Trichosurus vulpecula*). In 18 geographical areas comprising approximately 25% of New Zealand the possum acts as the major feral/wild animal vector of tuberculosis (*Mycobacterium bovis*) for cattle and farmed deer. In these areas, TB is considered endemic (Livingstone 1988) and possum control has become a necessary component of the TB eradication scheme for cattle and deer.

Consequently it is necessary to implement a series of coordinated possum control operations across numerous areas of New Zealand. These operations are divided into an initial kill phase followed by annual maintenance operations to keep possum populations at low levels. For these control programmes to be effective requires long term financial commitment from both Central and Regional Government agencies and the Animal Health Board (A.H.B.) to develop control strategies. Initial control operations that utilise mainly sodium monofluoroacetate (1080) bait are funded mainly by the A.H.B who presently obtain 30% of their finance from Central government and the rest from a levy of \$5.70 from every cattle beast slaughtered in New Zealand.

The annual maintenance control operations which are aimed at further reducing possum numbers and restricting reinfestation may need to continue for up to 8 to 10 years after the initial operation. These are currently funded on a percentage basis from the A.H.B, Central and Regional Government.

Currently the expenditure on bovine TB possum control in New Zealand costs approximately NZ\$6 million per year with a further \$11 million associated with the TB control programme in cattle and farmed deer. Another \$4 to \$5 million is spent on short and long term research into facets of the TB problem including improved control for feral/wild animal vectors.

POSSUM PROBLEM

Since their initial introduction from Australia in 1837, brush tailed possums have spread to occupy more than 95% of New Zealand. It is estimated that the population now numbers 60 to 70 million, of which 40 million are in the farm associated scrub land. It is estimated that 66% of New Zealand's possum population is in the North Island and 34% in the South Island.

The average density in the North Island is equivalent to

4 possums per hectare, 2.7 times that in the South Island and is almost exactly the same as the distribution of livestock in both islands (Batcheler and Cowan 1988). Though 85% of the cattle and 55% of the fanned deer are in the North Island.

Possums are herbivorous, feeding on terminal buds of highly palatable trees and native shrubs, leading to large scale degradation of indigenous forests. As a result of this destruction there is a reduction in the numbers and the diversity of native birds who rely on flower and fruit produced by the native forest. Possum also cause severe damage to growing trees in exotic forest, damage horticultural crops and consume pasture affecting farm production.

BOVINE TUBERCULOSIS IN POSSUMS

Tuberculosis caused by *M.bovis* probably came to New Zealand with cattle when the country was first settled. In the late 1800s there are recorded cases of this disease in cattle.

A voluntary TB eradication scheme started for town supply dairy cattle in 1945. Compulsory testing of dairy cattle began in 1961 and in beef cattle in 1971 (Animal Health Div. MAF). Control of TB in cattle relied on the traditional testing and slaughter procedure, where cattle that reacted positively to the intradermal caudal fold tuberculin test were culled out of the herd as soon as identified. Good progress was made towards the eradication of TB in most dairying areas with the exception of the West Coast of the South Island and the lower East Coast of the North Island. In these areas, despite a very intensive test and slaughter program, TB persisted.

Tuberculosis was first reported in possums in 1967 on the West Coast of the South Island. It was some time however before the link between infected cattle herds and tuberculous possums was recognised and established. That lack of knowledge of the disease presented initial problems in attempts to control it.

By 1970 all herds in the West Coast region were being tested for TB with a significant number of herds remaining infected, or became infected in spite of a 3-monthly testing regime of all cattle.

The following example shows how the link was observed between infected cattle and TB possums. In 1970 it was recognised that all tuberculous reactors from a dairy herd had been grazing on a river flat to which possums had ready access. Possum in the vicinity of this river flat were poisoned with cyanide and 12% had TB. On the basis of this evidence a large scale possum control operation was undertaken. This included the aerial application of 1080 carrot on surrounding

bush and ground application of 1080 paste to the bush/pasture margin. Annual ground control operations were then undertaken over several years. Numbers of tubercular cattle and reactors dropped dramatically and remained low for a number of years.

Between 1969 and 1974 a number of areas in both Islands were identified from cattle testing information as having a TB possum related problem. As a result of the success achieved on the West Coast possum control operations were identified as the method required to manage the possum related TB cattle problem in other areas.

BOVINE TB TRANSMISSION.

It is believed that the spread of tuberculosis between possums and cattle is direct and achieved by possums exhaling TB bacteria in close proximity to cattle. Alternatively cattle may become infected by licking dead tuberculous possums found on pasture, or eating pasture or hay that has been contaminated from tuberculous pus from possums with open lesions.

It is known that:

1. Possums unlike cattle have an immune system that is unable to contain, localise and control *M. bovis* infection. Tuberculous lesions in possums are often full of pus, containing huge numbers of bacteria (5,000 million/gram of tissue) (Smith 1972).
2. Cattle are often grazed in bush for rough feed, or close to bush edges which is prime possum habitat. Possum populations are generally higher per hectare in these areas than open pasture or heavy bush.
3. Concentrated possum control carried out in areas where TB reactors have grazed, combined with TB testing of all stock in the vicinity results in reactor numbers being drastically reduced or eliminated.

CONTROL OPERATIONS IN THE 1970s

Early bovine TB possum control operations were of the "Blitzkrieg" type, aimed at drastically reducing possum populations over large areas. All inaccessible areas were treated by aerially sown 1080 bait, (carrot at 12 to 15 kg per hectare or cereal pellets at 5-10 kg/ha). Ground operations on adjacent pastoral land utilised paste (lured apple pulp) as a bait.

Sodium monofluoroacetate is the main poison incorporated into these baits at a toxic loading of 0.08% ww (800 grams per tonne of bait). These control operations drastically reduced possum populations by upwards of 80% and as a result cattle reactors remained low for a period of 5-7 years. These initial operations included buffer zones 1-2 km deep in the bush bordering farmland aimed at restricting possum movement into the treated area. This delayed reinestation of the bush/pasture margin for 1-2 years. After this period of time, the possum population had returned to its pre control level and numbers of TB possums had increased with consequent upsurge in tuberculous reactor cattle, requiring further control operations.

Over time it was also noticed that the outer edges of endemic areas were expanding. Expansion occurred mainly down watercourses, possums move readily along these areas due to favourable habitat and food. The bovine TB problem gradually increased, almost entirely due to the expanding TB feral animal problem, of which possums are the major disease

vector to cattle and farmed deer.

Because of the 7-10 year cycle of large scale expensive operations it was decided in the mid 1980's that the possum control strategies had to change.

In 1987, a computer simulation model of tuberculosis in possum populations was developed. The findings of that model suggest that TB can be eradicated from possum populations if they are maintained at less than half their carrying capacity for up to ten years and tuberculosis does not migrate into the area (Barlow 1991). As a result of that computer modelling in conjunction with results from some operations that had had annual maintenance control operations carried out, it was decided to introduce a requirement for continued possum control on an annual basis until the problem had been eradicated. Since then every initial control operation has had a maintenance control undertaken to ensure the possum population remain at a low level.

CONTROL STRATEGIES IN THE 1980s

In order to manage the TB scheme NZ was categorised into either TB Free Areas, or Special TB Control Areas, where TB was endemic. In the TB free area (65% NZ) where TB is not established in feral/wild animals, incidence of TB in cattle is kept below 0.02% by regular TB testing

In Special TB Control areas cost-effective disease management plans were developed.

The problem areas were also classified into various categories:

1. Eradication—Currently there are ten areas in New Zealand where the aim is to eradicate TB from the possum population by extensive control work and annual maintenance. In some cases, the areas are newly identified and are therefore small in size, in other cases their geography is such that reinestation is reduced. In a number of areas that have been proceeding for several years it appears the objective of eradication has been achieved.
2. Containment—Endemic areas where it is currently not feasible because of financial or technical reasons to eradicate the disease from feral animals at this time. It is in these areas that buffers are used to contain the problem.
3. Roll-back—Used where containment has been successful. Buffers are progressively widened on the TB possum side of the buffer.
4. Reactor Reduction—This type of operation is carried out within endemic areas where it is impossible to eradicate infection from the possums population. Localised possum control is undertaken on specific areas where TB reactors have increased to such an extent that it is cost effective to carry out control.
5. Preventative Control—If an unexplained reactor in a cattle or deer herd in a TB Free Area occurs, urgent control is carried out on that property to reduce possum numbers and another TB area developing.

Possum control methods changed, low density buffer zones were placed outside known TB areas, with the aim of restricting the outward migration of TB possums into adjacent clean economically important primary productive areas (areas without TB). This reinestation is very dependant on the availability of vacant nest sites, although often the move-

merit into bush/pasture margins is quicker than for large tracts of forest, as the feeding opportunities are more diverse.

Where possible, boundaries of these buffer zones were selected to utilize natural buffers i.e. major rivers, lakes and fast flowing streams or open expanses of intensively farmed pasture. The open pasture allows easy access for control, little cover and can be shot at night with ease. Once the boundaries of buffers zones which were up to 5 km wide have been defined, the area had concentrated possum control carried out, aimed at a 75% minimum reduction in possum numbers. This was followed by annual control operations aimed at keeping the possum population at low levels.

PEST CONTROL AGENCIES

Like many other pest control organisations world wide, New Zealand over the past three years has gone through a major reorganisation on the way pest control is being carried out. The large number of Pest Destruction Boards were abolished in late 1989 and in their place 14 Regional Councils (Local Government) were established covering the whole of New Zealand. These regional authorities are charged with the responsibility of pest and weed control amongst a multitude of other tasks. The members of Regional Councils are elected every three years and predominantly come from urban areas. This was a major change from the past when the Pest Destruction Boards were managed by predominantly rural people. The other main change is that each Regional Council is charged with deciding their own future, for example identifying their pest problems, then deciding how they can control that problem and how that work will be funded. The payment for pest control work is usually raised by a general rate on all ratepayers or by specific work rates set on areas of the region.

Built in to the legislation is the requirement that each Regional Council must produce an annual plan and allow the general public time to read the plan and to put in submissions. Regional Councils also need to produce their budgets in late January or early February for the following July.

The requirement to produce an annual plan has forced people in the decision making area, to look more carefully at an integrated pest plan. This forces them to be far more accountable and justify the proposed expenditure and subsequent results. Many Regional Councils are producing issues and option papers available to the general public and other interested parties for comment and submissions. Once the submissions are considered then the annual plan is published.

MANAGEMENT PLANS

Long term possum control programmes developed for TB endemic areas have necessitated a joint commitment from both Central and Regional Government. The Animal Health Board in conjunction with the Ministry of Agriculture and Fisheries instigate the preparation of detailed management plans which cover specific areas ranging in size from 4,000 hectares to over 250,000 hectares.

Currently there are 9 plans completed and the long term objective is to cover all TB endemic areas in New Zealand.

PREPARATION OF A MANAGEMENT PLAN

Management plans are implemented on a priority basis, in areas where long term control is needed to either eradicate or contain a major TB problem. The initial preparation of a management plan requires a number of meetings between the

Animal Health Board technical consultant, the Regional Council senior Pest Management staff and the Ministry of Agricultural and Fisheries (MAF) veterinarian from the district where the plan is proposed. Initially the proposed area is inspected, after consulting detailed maps. Ground inspections are necessary to identify the outer boundaries, having regard for the need to prevent reinestation of possums back into the area being treated. The toxin chosen and the method of application depends on the geographical nature of the country and the farming practice. The MAF veterinarians epidemiological report which details the disease dynamics in the affected herds in the area is used to define the possum problem and acts as the focus for the investigation.

A cost/benefit analysis is carried out to assess the cost effectiveness of the proposed plan. Most control strategies require a minimum of 75% of the possum population to be killed initially and then the possum numbers kept at low levels by annual maintenance. There have been a number of large scale operations that have reduced possum populations by over of 90% during initial operations.

CONTENT OF MANAGEMENT PLANS

1. Description of area involved: This includes maps of the area, properties involved, topography, vegetation types and current land use.
2. Feral animals involved: Possums are the main target animal although in some areas feral deer and pigs are infected with TB and need to be considered in the plan.
3. The aim of the plan: Either eradication, containment, roll back or reactor reduction depending upon the size of the area, geographical boundaries, benefit/cost analysis, likelihood of succeeding.
4. The objectives: This lists the objectives of the various agencies for example—administration of present and future testing policies of all stock, enforcing movement control restriction on infected herds, promoting self-help possum control by ratepayers etc.
5. Disease profile: This covers the background history of the disease, and future predicted trends.
6. Options: This covers the various options of control and discusses the reason these options have been selected.
7. History of possums: The history of liberation, spread, current populations and past methods of control.
8. Recommended methods of control: This covers the following:
 - a. If aerial poisoning is required, the type of aircraft, bait type, application rate of bait and the recommended lure to be used.
 - b. With aerial poisoning, whether rhodamine bait acceptance trials are required and at what level of acceptance the operation may proceed.
 - c. With ground application of bait, the method of application to be used and the specification of that application, such as size of baits, placement of bait, use of bait stations and distance they should be placed apart.
 - d. Specific problem areas, such as possum control

- around houses, crops, high use public areas where various methods of control, bait types and even toxin selection are discussed.
- e. The use of traps to include kill traps, night shooting and commercial operators are discussed and various methods recommended.
 - f. Monitoring procedures: There are specific requirements listed which include monitoring bait production, bait application, acceptance, preference and the monitoring of the results achieved. A number of different assessment methods are used including spotlight counts, bait disappearance and interference, the results of which are supplied to all parties involved in the management plan.
 - g. Maintenance operations: This covers specifications of annual control operations used to keep possum populations reduced to the required level. It also allows, with agreement of all parties to transfer an area onto biannual operations if required.
 9. Quality assurance: This specifies what is required similar to monitoring but allows the Animal Health Board to independently monitor operations as they wish. All data is supplied to the Control Agency. At present \$250,000 is spent on this work.
 10. Public relations: This covers a number of points
 - a. That only designated personnel are allowed to make public statements on the disease status of the herds in the area, or to make comments on the actual field operations.
 - b. Precautions to be taken in regard to the general public. Dog protection such as the control of dogs, the hiring of muzzles and biting chains and emetic pills, recommended hand-outs on the use of 1080 and other poisons to ratepayers and neighbouring property owners.
 11. Administration: Estimates of cost per annum over the predicted life of the plan which would usually be 10 years. Some large schemes may take 6 to 8 years to complete initial operations, then the costing could cover a period of up to 18 years. It also includes documentation relating to funding, division of costs and payment of accounts.
 12. Role of the agencies involved: This usually specifies the setting up of a coordinating committee which includes representatives of all agencies and farmer groups in the area, to ensure the smooth running of the plan. This committee meets as required and especially if there are major changes considered for the plan. The authors of the plan review the scheme annually and if new technology is developed (such as the recent use of permanent bait stations) then it can be introduced. The farmer members are also useful to pressure a farmer in a control area who does not want, say 1080 poison used on his property. In most cases they can convince him to change his ideas.

Once a plan has been completed, it is circulated to the farming community involved and public meetings are held to discuss it in detail. At these meetings the assistance of the farming community is actively sought to play a part in the

plan e.g. by feeding bait stations, destroying possums by trapping and shooting.

Once the consultation process is completed the plan is then put to the Animal Health Board and the Regional Council concerned to ensure the long term finance is available. If finance is approved, the management plan is proceeded with.

Currently the Animal Health Board, in conjunction with Regional Councils and MAF, are producing a detailed protocol on bovine TB possum control. This document will list all procedural matters, operational strategies, documentation, safety precautions and copies of all monitoring methods and other allied material available to use in the scheme. This will greatly assist in the production of management plans and will ensure that all operations will be up to acceptable standards.

Today, with the steady move to user pays and allowing the people to decide what they want, it has become necessary to openly declare your animal management plans early and defend the scheme. Many of the management plans when first circulated draw quite a lot of criticism, often from people not directly affected. At public meetings it is important to have speakers who can defend the use of toxins and have present farmers who are directly affected so they can assist in selling the plan. If involved in a court case to stop the use of a toxin, then it is essential that expert witnesses know their subject. In the last 8 to 10 years we have had very few court cases re farmers who will not allow the use of 1080 poison. Only one case was lost, because expert witnesses were not available to assist.

SUMMARY

I believe, that in the future all animal control programmes of any size or of extended duration will require the production of management plans. These plans will look at the options available, the immediate costs, the benefits to the people involved, the benefits for possibly the nation as a whole, but more importantly will ensure that finance is available for the duration of the scheme.

From the ratepayers point of view, they will be assured that they get value for money and the control agencies will need to consider all possible options before deciding on the method of control they will utilise.

For long term plans it is necessary to get the cooperation of landowners and to be cost effective, their assistance should be sought in helping with parts of the operation. The benefits outweigh the problems and with their assistance pest numbers are reduced and they feel they are part of the plan.

The careful development of management plans forces you to take a more professional approach to the control programme proposed, and reduces criticism from the general public. For this reason I believe most vertebrate pest control staff in the future will become involved in developing these plans.

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