PROCEDURES FOR FRUIT FLY (TEPHRITIDAE) ERADICATION IN NEW ZEALAND

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SUMMARY

If a fruit fly outbreak was detected in New Zealand, an eradication programme would be implemented immediately by the Ministry of Agriculture and Fisheries under the Plants Act 1970. Procedures that are in place now to cope with an outbreak are outlined. These include: initial reporting, definition of quarantine areas, establishment of emergency centres and headquarters to coordinate activities, survey, monitoring, ground application of protein — insecticide baits applied as 100 ml spots to trees at a rate 100 spots per hectare, collection of infested fruits and vegetables, and restrictions on movement of produce. These procedures have recently been reviewed, and the development and refinement of them is continuing, including evaluation of alternative methods of eradicating fruit fly populations.

INTRODUCTION

MAFQual, the regulatory division of New Zealand Ministry of Agriculture and Fisheries, has statutory responsibilities for pest and disease regulation under the Plants Act 1970. This paper outlines the contingency plans that MAFQual has ready to implement in the event of an outbreak of any of the exotic, economically damaging species of Tephritidae referred to as fruit fly (Cowley and Frampton 1989). Measures being taken to improve these plans are also outlined.

Consequences of fruit fly establishment in New Zealand have been summarised by Cowley and Frampton (1989). Eradication programmes are operated almost routinely against isolated occurrences of several fruit fly species in California and in South Australia (Somerfield 1984; R. Rosander pers. comm. 1988; P. Mobbs pers. comm. 1988; P.R. Birks pers. comm. to J. Burton and P. Alexander 1988). For example, California has conducted an average of at least five eradications per year for the last 5 years, with the frequency showing a strong trend to increase (R. Rosander pers. comm. 1988). Species involved have included Mediterranean fruit fly (*Ceratitis capitata*), Mexican fruit fly (*Anastrepha ludens*), Oriental fruit fly (*Dacus dorsalis*), and melon fly (*Dacus cucurbitae*). In South Australia, eradications have been conducted against Mediterranean fruit fly and Queensland fruit fly (*Dacus tryoni*). These programmes are implemented on detection of the pest.

Similarly, detection of a fruit fly population in New Zealand will automatically result in implementation of an eradication programme under the administration of MAFQual's Emergency Response Procedures (ERP). Early detection combined with fast and efficient mobilisation of resources to implement a programme will increase the prospects of rapid eradication and an early return to full access to overseas markets for our horticultural products.

Operation of a fruit fly eradication programme involving placement of surveillance traps, application of pesticides and restrictions on movement of produce would entail regulation of people and property, and entry to property. Special powers, currently available under the Plants Act 1970 after declaration of an emergency by the Chief Plants Officer, MAFQual, are required to enable this. The Chief Plants Officer will have overall responsibility for the eradication programme.

Eradication procedures are based on environmentally acceptable methods described by Bateman (1982). Procedures for application of bait and insecticide have been adapted from systems used by the South Australian Department of Agriculture

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(Department of Agriculture, South Australia, undated). Other components have been developed from procedures used in South Australia and also in the USA (USDA 1982; Brown 1985).

OVERVIEW OF PROCEDURES

Fruit fly detection and initial responses

A formal reporting system has been put in place to initiate action if fruit fly is detected, either as maggots in New Zealand grown fruit or as adults in surveillance traps (Cowley and Frampton 1989). The Initial Response System is focussed on the Plant Protection Centres located at Lynfield in the North Island and Lincoln in the South Island. The entomologists at these laboratories are responsible for identifications and providing authoritative preliminary information about the outbreak.

Initial actions involve notifying the Chief Plants Officer, MAFQual, who is responsible for official declaration of an emergency. The declaration will result in establishment of: (i) quarantine areas, (ii) an emergency headquarters to manage eradication within the quarantine areas, (iii) a national emergency centre in MAF Head Office to manage national and international communications and (iv) regional emergency centres at the Plant Protection Centres to coordinate operations outside the quarantine areas, e.g. increasing the levels of surveillance trapping or organising tracing of fruit consignments.

Other organisations will also be notified, either to ask for their services or else to request them to stop moving horticultural produce out of quarantine areas. Early notification will be given to industry, Police, Ministry of Transport, Telecom Corporation, media, transporters, local authorities and other government departments such as Valuation, Survey and Land Information, DSIR, Meteorological Service, Department of Health, Works Corporation and Department of Labour.

Quarantine areas

Declaration of a fruit fly emergency will result in the legal definition of quarantine zones centred on the initial find. This in turn will set the boundaries for different eradication activities. Three zones will be defined: an outbreak zone, a primary quarantine zone and a secondary quarantine zone. Boundaries will follow roads, local authority boundaries, railways and or other prominent legally definable features such as rivers. Specifications are as follows: (i) the outbreak zone boundaries are not less than 200 m in radius from any known infestations, (ii) the primary quarantine zone boundaries are not less than 1.5 km in radius from any known infestations and (iii) the secondary quarantine zone boundaries are not less than 80 km in radius from any known infestations.

The outbreak and primary quarantine zones follow the specifications of the South Australian Department of Agriculture (Department of Agriculture, South Australia, undated); the boundaries for the secondary quarantine zone have been set according to internationally recognised specifications for demonstration of area freedom from fruit flies.

Duration

Duration of eradication treatments is dependent on the need to have convincing evidence of programme success and also to fulfill the requirements of overseas markets. The minimum duration of eradication activities adopted in the USA is the equivalent of two lifecycles of the pest after detection of the last fruit fly (either larva or adult) (USDA 1982), and in South Australia 10-12 weeks afterwards (Department of Agriculture, South Australia, undated). These represent minimum limits for New Zealand.

Eradication components

At present, there are four essential components to the eradication procedures:

1. Application of a bait and insecticide mixture in both the outbreak and primary quarantine zones to contain and eradicate adult flies;
2. Trapping in all three zones, to detect new infestations and monitor the progress of the eradication in the outbreak zone;
3. Fruit collection and disposal in the outbreak zone, to detect larval infestations, and to remove infested host material and destroy it;

4. Control of the movement of produce in all zones, to prevent spread of the pest, and to permit the area freedom concept to be applied when negotiating with overseas trading countries for market access.

Location of outbreaks

Fruit fly outbreaks in South Australia and California have largely occurred in urban and suburban locations. It is assumed that this is associated with domestic consumption of infested fruit brought in unofficially from infested areas (P.R. Birks pers. comm. to J. Burton and P. Alexander 1988; R. Rosander pers. comm. 1988). Consequently eradication procedures in these countries (and New Zealand) have been developed on the assumption that the most likely place of occurrence will be in a town or city.

ERADICATION ACTIVITIES

Application of bait and insecticide

The method is based on spot application of a mixture of protein bait and maldison insecticide to trees and shrubs at the rate of one hundred 100 ml bait spots per hectare (Department of Agriculture, South Australia undated). In terms of typical urban localities, this equates to 5-10 bait spots per property. Bait spots are applied to trees and shrubs with foliage at about 1-1.5 m height.

Rega¹ applicators will be used to deliver the bait. These are comprised of a 16 litre plastic knapsack tank with a manually operated pump which delivers a jet of liquid composed of large droplets. Each pump cycle delivers 50 ml of bait. Consequently, application of bait to one tree involves two pump cycles with the bait directed accurately into the foliage in the centres of the trees to be baited.

Selection of a time scale for operation has been based on the need to apply eradication treatments as rapidly as possible. The treatment schedule for the outbreak zone is designed to achieve complete treatment of the whole area within 1 day, and of the primary quarantine zone within 4 days. Applications will be repeated at 7 to 10 day intervals or following rainfall, as specified in the South Australian Department of Agriculture procedures.

Resource requirements needed to do this are based on the assumption that in an urban/suburban location, there will be 150 properties to treat in the outbreak zone and 8000 in the primary quarantine zone, and that these will be treated using blobs of bait applied by Rega applicators. These assumptions have been stated on the basis that appropriate scaling can be applied to the specific location to be treated. Assuming 5 minutes to treat each property, resource requirements have been calculated to be 12 bait spraying teams, each team consisting of two bait applicators. Each team will have support from a vehicle and driver, which will also pull a 300-400 litre tank of mixed bait plus insecticide in constant agitation.

Survey and trapping

During the outbreak the normal surveillance intensity of traps of 400 m intervals in high risk areas (Cowley pers. comm.) will be supplemented and the frequency of inspection increased. Traps used will consist predominantly of the Lynfield type (Cowley and Frampton 1989). In the outbreak zone, all properties will be trapped with one trap per property, as long as suitable trees and shrubs with foliage are available. In the primary quarantine zone, trap densities will be maintained at 400 m centres, and likewise traps will be placed at similar densities in the secondary quarantine zone where there are urban and suburban localities, villages and presence of horticulture. Inspection frequencies will increase from at least once a fortnight during surveillance trapping to once every 3 days in the outbreak zone and once a week in the primary quarantine zone. In the outbreak zone, Lynfield traps will be supplemented by bait traps (Cowley and Frampton 1989) with the objective of collecting female flies in order to monitor their reproductive status.

Fruit collection and insecticide spraying

Eradication procedures in both South Australia and the USA include methods to pinpoint infestations of larvae in host fruits. Once these infestations have been identified, additional eradication treatments are applied specifically to these areas.

¹ REGA Pty, Ltd. P.O. Box 217, Banksdown NSW, 2140, Australia.

These include fruit stripping (USA and Australia), application of fenthion insecticide as a cover spray to infested trees to control both adults and larvae (South Australia), application (from the ground) of bait and maldison mixture as a cover spray to infested trees to control adults (USA), and ground application of insecticide to control larvae and pupae in the soil (USA and Australia). Fruit cutting is used to detect maggots in infested hosts (USA and Australia).

In New Zealand, a fruit collection and insecticide spraying group will be responsible for application of such treatments to infested properties. The activities of this group will be confined to the outbreak zone. At this stage details of the treatments depend on the registration status of insecticides for cover spraying trees, as fenthion is not registered for use on fruit trees in New Zealand. All windfall fruit will be collected from all properties in the outbreak zone, and samples will be selected for cutting based on detection of external symptoms of infestation by maggots. These examinations will take place in an insect proof building within the primary quarantine zone, under the supervision of an entomologist. Detection of maggots in this fruit will result in the identification of additional infested properties. All windfall fruit will then be disposed of by deep burial with coverage at minimum of 1 m of soil. This process will also physically remove a proportion of the infestation of larvae and destroy it. Repeat visits will be made to properties throughout the eradication period to continue collection of windfall fruit for destruction. Diazinon at 4 kg ai/ha will be applied under the drip zone of host trees to control larvae and pupae in the soil on all outbreak zone properties. Three applications will be made at 10 day intervals. Where specific infestations are identified on properties as a result of examinations of windfalls, all fruit will be stripped from these trees and destroyed. A cover spray of bait and maldison applied to these trees is also an option for control of adult flies.

Movement control

Road blocks are not used as a routine measure to police quarantine zones in either South Australia or the USA (P. Mobbs pers. comm. to P. Alexander and J. Burton 1988; F. Meyers pers. comm. 1988). Regular operation of road blocks on the quarantine boundaries in cities, towns and on major roads in New Zealand would likewise cause extreme problems. This is a result of the large volumes of traffic that would have to be regulated and the detailed checks that would be required to ensure security. Consequently an alternative policy has been formulated based on the need to obtain public cooperation and encourage voluntary adherence to quarantine requirements, and negotiation of compliance agreements with commercial operators. Public cooperation will be sought through: (i) distribution of pamphlets (describing procedures that should be followed) to all householders in the outbreak and primary quarantine zones, (ii) publicity via newspapers, radio and television and (iii) ensuring that eradication teams have a respectful attitude while conducting their tasks. Road blocks will, however, be used on a random basis to provide positive reinforcement and to evaluate the level of compliance by members of the public.

Regarding commercial operators, the concept of negotiated compliance agreements forms the basis of movement control procedures in the USA. In view of the need to demonstrate area freedom for exports, similar procedures are currently being developed for New Zealand. An outline of operation is as follows. Compliance agreements are drawn up after negotiation. Movement control officers visit commercial operators and discuss the range of options available to them for safe marketing or disposal of their produce. Lists of commercial operators (growers, wholesalers, exporters, sellers, transporters) are maintained by MAFQual. The movement control officer can only sanction options that have been officially approved by the Chief Plants Officer. On agreement the specific details of the procedures that must be followed will be recorded on the compliance agreement which both parties sign. The level of commercial activity that is allowed will depend on (i) position of the property in either the primary or secondary quarantine zones, (ii) availability of markets within the quarantine zones, (iii) availability of processing facilities, (iv) availability of scientifically proven commodity treatments, e.g. fumigation, cold treatment, heat treatment etc., (v) availability of scientifically proven insecticide controls for incorporation into spray schedules and (vi)

use of insect proof barriers to prevent fruit flies ovipositing in harvested produce.

Once compliance agreements have been negotiated with all commercial operators, the movement control group will enter a policing phase to monitor and enforce compliance. Specific details of this are still being developed. However, policing will include regular unannounced check visits to commercial operators by movement control officers and beginning and end point checks of permits for consignments of hosts being moved.

FUTURE DEVELOPMENTS

Apart from refining current procedures, particularly those for movement control, alternative eradication methods and their feasibility for potential use in New Zealand are currently being evaluated. Such methods are the male annihilation technique (Bateman 1982), aerial application of bait and insecticide (USDA 1982; Brown 1985) and use of the sterile insect technique (Hooper 1982).

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REFERENCES

- Baker, R.T., 1986. (Ed.) Fruit Fly Manual. Ministry of Agriculture and Fisheries. 32 pp.
- Bateman, M.A., 1982. Chemical methods for suppression or eradication of fruit fly populations. *In*: Drew, R.A.I., Hooper, G.H.S. and Bateman, M.A. (eds). Economic Fruit Flies of the South Pacific Region. Brisbane: Queensland Department of Primary Industries. 139 pp.
- Brown, V., 1985. Action Plan for Mediterranean fruit fly *Ceratitis capitata* (Weidemann). California Department of Food and Agriculture, Division of Plant Industry, Pest Detection/Emergency Projects Branch. 45 pp.
- Cowley, J.M. and Frampton, E.R., 1989. Significance of and monitoring for alien fruit flies (Tephritidae). *Proc. 42nd NZ Weed and Pest Control Conf.* (in press).
- Department of Agriculture, South Australia. Undated. Fruit Fly Manual. Pest Eradication Unit. 39 pp. plus appendices.
- Hooper, G.M.S., 1982. The sterile insect release method for suppression or eradication of fruit fly populations. *In*: Drew, R.A.I., Hooper, G.H.S. and Bateman, M.A. (eds). Economic Fruit Flies of the South Pacific Region. Brisbane: Queensland Department of Primary Industries. 139 pp.
- Somerfield, K.G., 1984. Report on a visit to Australia to investigate the biology and control of fruit flies of potential importance to New Zealand 1983/1984. Internal Ministry of Agriculture and Fisheries Report. 33 pp. plus appendices.
- USDA, 1982. Action Plan. Mediterranean fruit fly. *Ceratitis capitata* (Weidemann). United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Emergency Programs. 39 pp.