

EXCLUSION AND ERADICATION OF DISEASE

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ABSTRACT

Virtually all economic plants in New Zealand, including principal pasture plants, are introduced. They are relatively disease free. Many diseases tend to be host specific and few endemic diseases have become problems. Only a small percentage of the pest weed and disease organisms recorded overseas on economic plants are here, but given opportunity these organisms could establish in New Zealand. It is desirable to exclude them because of costs (lowered production, poorer quality, preventive and control measures, restricted export opportunities). It is practical to attempt — organisms tend to be distributed with their hosts. Natural barriers plus legal restrictions limit entry of hosts to 15 supervised points. Hosts are classified according to disease risk and may be prohibited entry, quarantined, treated, subject to sample inspection or free movement.

Some organism by accident or design may pass this screen. Establishment need not necessarily follow if such organisms are located early.

Prompt reports of an organism, suspected new to New Zealand, must be made by diagnostic staff and concerned citizens to a central "clearing house" at Levin, there evaluated and the Deputy Director (Plant Health) informed. Interim decision follows on immediate action — treatment, initial survey, stay on movement of people and things, confirmatory diagnoses, advisory panel meetings — followed by decision to attempt eradication, contain locally or live with.

Eradication involves mobilisation of staff, treatment, equipment, accommodation, transport and communications under oversight of train regional co-ordinators.

Social, economic and political factors must be considered as well as technical advice on appropriate treatment measures. Action must be legal, cost of operations shared and the best possible public relations maintained.

TEXT

More than 80 per cent of New Zealand's export earnings are based on the plants, the produce of plants or the produce of animals feeding on plants. Our welfare is thus, in large measure, dependent on the future good health of these plants. They must flourish with the minimum of interference from pests, diseases and weeds.

Most of the "economic" plants including the principal pasture plants grown in New Zealand are introduced

ones. At present they tend to be relatively disease-free.

Many diseases tend to be host specific and pests too frequently have a restricted host range. This has particularly benefited New Zealand in that few endemic diseases and pests have become problems. Such weed contaminants in export produce that figure in overseas legislation are all plants that have been introduced to New Zealand.

To illustrate our relative freedom from disease, consider the following:

	Overseas	New Zealand
Recorded species of insect pests	> 10 000	200
Recorded species of fungal diseases	15 00	1 500
Recorded species of virus diseases	400	70
Recorded species of bacterial diseases	150	30
Recorded species of nematodes	300	30

Or, looking at specific export crops and their diseases:

	Overseas	New Zealand
Orchids	105	6
Chrysanthemums	51	14
Roses	72	18
Raspberry	85	26
Strawberry	91	19
Dwarf beans (21 seed-borne)	112	11
Onion	49	20
Maize (35 seed-borne)	113	10
Wheat (33 seedborne)	100	24

Diseases and pests cause more loss than most people care to admit.

1. Damage they cause — which may be anything from down-grading to complete loss.
2. Cost of preventive measures, and when these fail, add
3. Cost of control measures — orchard sprays > \$200/acre/year in Hawkes Bay.
4. Limitation on kinds and varieties of crops that can be grown — Pukekohe.
5. Substitution of low value for high value crops.
6. Reduced value, variety and volume of exports. Because of

Didymella — no tomatoes to Australia

Fire blight — no pip fruit to Australia

Smut — no Pukekohe or Canterbury onion to Australia

Virus — no roses nor blooms to USA

Codling moth — no apples to Japan

Red legged earth mite — no North Island vegetable hosts to USA unless fumigated.

With few exceptions (some rust diseases, Hemiptera and lepidoptera from Australia), New Zealand is not subject to invasion by pest and disease organisms other than those carried by man and on his goods and their conveyances. New Zealand is well served by its natural barrier. This is broken at 15 points — international airports, ports and customs parcel post — where the law permits entry of people and their goods. Some 100 Port Agriculture Officers supervise, inspect and examine according to instruction taking what action is necessary and legal (Refer Plants Act 1970, Introduction and Quarantine of Plants Regulations 1973, Agricultural and Vegetable Seeds Notice 1974, and International Plant Protection Convention 1951) to exclude disease.

Hosts are classified according to disease risk. Because pests or diseases carried by nursery stock are in contact with its host, such material provides one of the easiest ways for new organisms to establish. Thus many economic plants such as fruit trees, potatoes and conifers are normally prohibited entry except for nucleus quantities of new cultivars which may be introduced under very strict quarantine conditions. Other nursery stock is permitted entry by permit which specifies quantity, health certification requirements and initial growth in post entry quarantine.

Agricultural seed imported for sowing presents considerable risk as it can carry not only fungal bacterial viral organisms, nematodes and plant pests, but soil, noxious weeds, and organisms endangering animal health may also be associated.

So some seeds, e.g. sunflower, hop, tobacco, are normally prohibited entry except for nucleus quantities under strict conditions; others such as maize may come only from a few specified locations; others again may enter provided they have been treated with a fungicide limited in quantity and grown initially in quarantine. Least restriction is placed on seed of ornamental annual plants.

Health certification is of limited value unless endorsements for specific diseases are given, and even then, more reliance would be placed on some countries known and tried expertise than on others.

Vegetables and fruit intended for consumption tend to

present less risk and may be introduced providing the exporting country can satisfy the Ministry there is no disease risk. Usual practice is to permit entry from areas where diseases of concern to New Zealand do not occur and subject to treatment (fumigation or in transit cool storage) to eliminate pest risks.

Bulbs, tubers and rhizomes of ornamental plants may enter in the dormant state provided they are accompanied by a health certificate and show no evidence of infection on arrival.

Cut flowers that contain no propagative material, dried flowers and foliage excepting that of agricultural plants and weeds, may enter subject to inspection on arrival.

Stored products, including dried fruits, generally present little risk except for fresh introductions of new strains of storage pests with which fumigation will cope.

Packing materials, case timber and dunnage can all present some risk and may be subject to inspection and treatment.

Then there are the unpredictable hazards where organisms of concern to agriculture arrive by apparently innocuous carriers. Argentine ants in Australian cars, Japanese beetles in equipment for Deep Freeze operations based in Canterbury, carpet beetles in office equipment and disease organisms in trash with vehicles. Why do agriculturalists repeatedly import **uncleaned** second-hand agricultural machinery?

Though exclusion by quarantine of every individual insect or disease-producing organism from an area may not be achieved, this does not necessarily make the quarantine measures unjustifiable. It is not ordinarily a simple matter for an organism to become established in an area previously free from it. The large and repeated introductions under most favourable conditions of various biological control organisms before their successful establishment in New Zealand bears witness to this.

Usually a complicated set of conditions must exist before an introduction can result in the permanent establishment of a pest. These may include:

- (i) The organism arriving only at a certain period when foliage or fruit is present;
- (ii) Wounds or abrasions must sometimes exist before infection of the host plant can occur;
- (iii) Introductions must usually be in the immediate vicinity of the host;
- (iv) Species which require alternate hosts — some rust diseases — must be introduced into a locality where both host species occur.
- (v) With few exceptions, insects must be fertilised females, or both sexes must be admitted simultaneously;
- (vi) The organism must be introduced in sufficient numbers to ensure that at least a few will persist after unfavourable climatic conditions, host resistance and attack of enemies have taken the their toll.

The introductions so often fail to bring about the permanent establishment of pests in new habitats, is of fundamental importance to plant quarantine. It is manifestly impossible to prevent every introduction by legal restrictions, but if introductions happen frequently enough or on a sufficiently large scale, sooner or later the right combination of circumstances will occur and establishment will result. Plant quarantine can make these introductions so infrequent, so scattered and so

infinitely small that establishment will be either greatly deferred or prevented altogether.

The possibility of eradicating a pest or disease greatly increases the importance of the quarantine policy. The failure of a quarantine to prevent incipient establishment of a pest does not exclude the possibility of preventing permanent establishment since it may be followed up by a successful eradication campaign. It is not necessary to accomplish the destruction of the last individual of the pest organism (by artificial means) in order to bring about eradication. In some cases at least, the destruction of the major portion of such populations will result in the completion of the job by nature herself.

The early detection of pests and diseases new to New Zealand greatly enhances the prospects for successful eradication measures.

The Ministry has therefore sought the co-operation of everyone working in the relevant fields to assist. As well as alerting our own staff — Port Agriculture Officers, advisory officers, inspectors, scientists — the Ministry two years ago wrote to various divisions of DSIR, New Zealand Forest Service, Internal Affairs for the attention of the Dominion and other museums, the universities, entomological and microbiological societies, commercial firms and grower organisations, requesting anyone discovering a pest or disease which was thought may be new to New Zealand, to report it (as follows):

Such reports should be made immediately to the "clearing house", i.e. Plant Diagnostic Station, Ministry of Agriculture and Fisheries, P.O. Box 241, Levin, for checking whether it is in fact a new record.

Reports should contain as much of the following information as possible:

- (a) Suspected identity of organism
- (b) Host or habitat
- (c) Type of property, e.g. farm, nursery, glasshouse
- (d) Location, as precisely as possible
- (e) Finder
- (f) Date first found
- (g) Extent of infestation or infection
- (h) Any action being taken to confirm identification — preferably specimens being submitted to the clearing house.

Even if few details are available there should be no hesitation in sending in a report at the earliest possible moment; there is no need to wait until the identification is definite. Promptness of action can well decide whether eradication can be attempted with hope of success.

The central clearing house gives immediate attention to screening inward information, identifying specimens; seeking a confirmatory diagnosis and reporting an initial assessment to the Deputy Director (Plant Health).

The next step is to place the new organism in one of four categories. Namely:

1. **Total eradication**, e.g. circumstances which may involve the declaration of a disease emergency, where export markets may be closed unless specified disease eradication is carried out, or where eradication is feasible.

2. **Local eradication**; where eradication is desirable and feasible in a specified area.

3. **Containment** in specific area, e.g. the controlled restriction of a disease outbreak within certain defined geographical areas.

4. **Established disease** either

- (a) an important disease against which action is always taken when found; or
- (b) an ubiquitous disease which is generally not actioned except in an advisory capacity unless there is evidence of neglect causing spread.

The principle, feasibility and cost considerations which need to be taken into account prior to placing a new disease in one of the categories can be illustrated by looking at the considerations behind a decision for total eradication. This decision is the responsibility of the Ministry of Agriculture and Fisheries, but would normally be made after consultation with the Director of Plant Diseases or Entomology Division.

TOTAL ERADICATION

1. **Principles**

- (a) The disease must be one of important economic crops, including pasture, or if of a minor crop, eradication can be easily accomplished.
- (b) the disease must be judged capable of being eradicated.
- (c) The disease must be one which has a serious effect on the host, or, alternatively, a disease which while not having a devastating effect on the host in New Zealand, may have serious effects on export markets.

2. **Feasibility**

- (a) Is the disease capable of survival and spread from a widely distributed host or alternative host?
- (b) Is the disease capable of long term survival in the absence of the host, e.g., in the soil?
- (c) How long has the disease been established?
- (d) What is present geographical extent of the disease?
- (e) Will a survey establish the extent of the disease — including identification of source?
- (f) Is there sufficient knowledge of the epidemiology of the disease organism under the particular circumstances?
- (g) Are effective control methods available and can these be applied on a field scale with a good chance of eradication?
- (h) If the disease is not an important one but is limited to only a small area, is eradication desirable?
- (i) Is the nature and mobility of the disease and/or vectors known?

3. **Cost**

- (a) Is the cost of eradication justified?
- (b) Will the cost (finance and manpower particularly) be within the Ministry's capabilities?
- (c) Will the costs and effort involved be worthwhile in terms of benefits to New Zealand as a whole?

When a decision has been made to take action to control, contain or eradicate a plant, pest or disease, the Regional Advisory Officer is notified and he then has a responsibility to ensure that prescribed measures are efficiently carried out.

Eleven "disease co-ordinators" each concerned with a particular region of New Zealand together with a number of back up officers have attended courses held to familiarise them with divisional policy and type of action which may be required in a disease outbreak. Their function is to assist the Regional Advisory Officer in

co-ordinating and supervising the disease control measures, giving this first priority.

So that the Ministry may swing promptly into action, considerable prior planning has been undertaken by the co-ordinators. They must anticipate the disease appearing well away from Ministry offices and facilities and being faced with servicing a team of staff operating in unfamiliar surroundings. Thus for each region there are a series of resource cards covering such matters as:

- (i) **District headquarters**, i.e. the various buildings particularly halls, available in the region, their controlling officers and official and after hours address and phone numbers. In some cases, a hired caravan may be necessary.
- (ii) **Vehicles** — List of all Ministry cars, pickups, vans and trailers available at each office in the region, their registration, model and capacity, as well as sources of hire vehicles.
- (iii) **Contractors** who can provide fumigation, spraying and other services that may be required in an emergency.
- (iv) **Spray equipment** which is available at Ministry offices and other departments, as well as from growers' organisations.

Assessment Committees — being, for each class of crop in the region, informed Ministry and grower representatives who could assist in assessing value of any crops that might have to be destroyed in an emergency. **Equipment** must be immediately available for officers in an eradication emergency so that they may work in a hygienic manner and not inadvertently spread disease organisms from infested to clean areas. The co-ordinators therefore maintain a number of manpacks, field packs containing overalls, leggings, disposable overshoes and gloves, bactericides, containers, cleaning equipment, marking pegs and materials for collection and despatch of specimens.

Headquarters packs contain not only obvious materials such as stationery to growers and others may be made in the correct manner as required by the legislation under which staff operate.

Other bodies such as research stations, Forest Service, who may have staff who could assist in an emergency are noted.

Briefing sessions have been held with executive officers concerning that may be required:

- (i) Accommodation for staff — which may mean liaison with Army
- (ii) Transport
- (iii) Administration back up
- (iv) Map requirements — wall, field and sources (Ministry, Valuation, Lands & Survey, stationers, aerial contractors if necessary)
- (v) Communications — with Post Office for 'phone and teleprinter; with Civil Defence for field radios, and most essential, to provide a "recorder" or 'phone and teleprinter; with Civil Defence for field radios, and most essential, to provide a 'recorder' or scribe not only for efficiency at the time, but to maintain a clear account of operations to provide answers for the post mortems and Ombudsman's queries that arise.

By now it should be appreciated that there is a lot of unromantic homework to be done and updated. However, it will be incomplete.

Because of the wide range of crops grown and the great diversity of organisms which may arrive, there is no recipe for action which can be prepared. When action is

required, the first action will usually be a "preliminary" survey to determine the area and properties involved and from this the staff requirements (how many and who) and other resources determined. Field staff must be briefed; shown specimens, given background information; reminded of hygiene requirements that must be seen to be done; public relations and the need to act within the legislative requirements.

Good communications are vital to success. Publicity must be orderly controlled, consistent and informative. Within the Ministry it will originate from only two people — the Deputy Director (Plant Health) and one responsible man in the region who has sufficient time to devote to duties.

As well as news for the public, particular attention must be paid to affected growers, national organisations for the crop affected, and field staff on the eradication exercise.

There is more to eradication than technical feasibility, cost benefit and preplanning. There are political and social considerations as well. Eradication campaigns are or rather recent origin for political anecdote. Socially the technical approach must be tempered by such factors as particular ethnic or age groups. Where potato wart occurs in the domestic garden of a couple near retirement wishing to sell their one big asset and move north, can one use an eradication treatment that is effective against wart but will destroy all plants on the property and his neighbour's hedge?

The legal basis for eradication action is the Plants Act 1970 where in Section 11 "the occupier of any land or the owners or person in charge of any conveyance shall do whatever is directed by an inspector to be necessary in respect of land or conveyance to eradicate any serious disease or pest from or to control or prevent the spread of any disease or pest to or from any place whatsoever."

Compensation is not normally payable in cases where the Ministry requires occupiers to take action to eradicate pests or disease, although in some cases, particularly where crops are destroyed, the Government may agree to some cost sharing. Section 13(2) of the Plants Act 1970 provides that the Minister may pay compensation when plants or other things are destroyed. . . while the intention was that compensation would normally be payable in these circumstances, the option was included expressly at the wish of the Minister of Forests because of the large sums which could be involved if mandatory compensation was payable for destruction of forests.

New Zealand's continued relative freedom from disease is of considerable economic advantage. Few of the world's large range of pests and diseases are in New Zealand. As the habitat is further modified and as transport increases, so do the risks. Because complete embargoes are impracticable, quarantine by controlled entry is the compromise with risk. The possibility of eradication strengthens the quarantine. Early recognition of new disease is essential. The co-operation of all informed citizens is sought.

I wish to acknowledge the assistance of many colleagues in discussion, debate and suggestion.