

Plant pathology in New Zealand

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Introduction

The early history of plant pathology in New Zealand has been fully explained (Chamberlain 1969). There is no doubt that the late G.H. Cunningham was instrumental in developing secure foundations for the disciplines of mycology and plant pathology in New Zealand. His foresight led to the creation in 1936 of the Plant Diseases Division (PDD) of the Department of Scientific and Industrial Research (DSIR) and its location at Mount Albert in Auckland. By 1950 PDD had been established for 14 years and had developed a good relationship and reputation with the horticultural and agricultural industries. The Director, Dr Cunningham, had been able to recruit persons able to further expand and advance their disciplines. In mycology, Ray Brien and Joan Dingley were active in plant disease diagnosis, making records of plant diseases and developing the herbarium. Bill Reid was joined by Doug Dye and they increased the knowledge of bacterial plant diseases, and *Rhizobium* root-nodule bacteria. Ted Chamberlain was joined by Dick Matthews and Peter Fry, to increase the work on virus diseases. An important decision was to establish three PDD substations. These were to have a regional focus as well as to assist plant breeders. Lincoln was established in 1938 to investigate field crop diseases, Riwaka in 1958 to study tobacco diseases, and Palmerston North in 1961 to study grass and clover diseases. Riwaka was closed after about 20 years, but the others performed good regional research until they were incorporated into one of the Crown Research Institutes (CRI).

Plant disease identification/diagnosis

The Plant Diseases Division was primarily responsible for this work, and published a series of papers on new records, initially by R.M. Brien and then by Brien and Dingley. This culminated in the book 'Records of Plant Diseases in New Zealand' (Dingley 1969) which recorded 892 diseases on 1070 host plants. There were 724 fungal pathogens, 28 bacteria, 69 viruses, 19 nematodes and 52 physiological disorders. One value of the book was that it included notes on the occurrence and importance of each disease.

From 1952 the Department of Agriculture started to become involved in plant disease identification, particularly in examining imported plant samples received from officers of the Plant Quarantine Service. This work expanded and by the mid-60s the Agriculture Department offered to take over the diagnostic work of PDD. This was accepted somewhat reluctantly as plant disease identification had been considered a good training for the younger plant pathologists, in particular to gain experience in the range of plant pathogens involved, and to become familiar with diseases of many crops. By the late 60s this transfer of responsibility had been completed. Diagnostic plant pathologists were located at Lincoln, Auckland, and at Levin, their Head Office. Subsequently, the Levin group was moved to Auckland. With the completion of new laboratories and glasshouses at Lynfield in Auckland, diagnostic work is currently carried out at two centres. One is located at the Plant Protection Centre, Lynfield, Auckland, with 19 full-time staff and receives specimens from throughout the North Island. The other is at the Plant Protection Centre, Lincoln, with six full-time staff and receives specimens from the South Island.

Each centre is equipped to diagnose the range of problems likely to be encountered on crops and individual plants, as well as those on exported or imported plant material. In addition, from time to time, the centres survey specific crops for problems, work that is requested and contracted by other groups within the Ministry of Agriculture. Often assistance and verification of diagnoses are sought from other pathologists within New Zealand. They also have a role in extension of plant disease control advice.

Diagnostic work was still continued by PDD and a major effort in Oceania was co-ordinated by them, and funded by a United Nations grant (Dingley *et al.* 1981). A data base on records of plant diseases in New Zealand was continued. Thus by 1989 a new book of three volumes was published (Pennycook 1989). This listed 1102 fungal pathogens, 7 algal, 70 bacterial, and 169 virus (or virus-like) pathogens affecting 1856 host species. Physiological disorders and nematodes (in Dingley 1969) were omitted. Volume 1 contains a list of the host plants and associated pathogens, Volume 2 lists fungal pathogens, while Volume 3 lists algal, bacterial and virus pathogens.

Plant Protection Division, 1 October 1990

This was formed by amalgamating the Plant Diseases Division and the Entomology Division of the DSIR, with John Longworth as Director. For some time this grouping had been considered to be desirable, even though there had been close co-operation between scientists in each division. However, Ministry of Agriculture scientists in plant protection were not included. During the period 1990 to 1992 a review of science administration was undertaken. A group of plant protection scientists submitted through a common group – the New Zealand Weed and Pest Control Society (now the New Zealand Plant Protection Society) that a plant protection institute was required. But they were not successful, and new commodity-based institutes were established on 1 July 1992.

Crown Research Institutes (CRIs)

There are ten of these institutes and they began on 1 July 1992. Finance for the CRIs comes from the Foundation for Research, Science and Technology (FoRST). This has to be applied for, generally on an annual basis, unless two or three year funding has been granted. There are 40 output classes, and these and research priorities are set by the Ministry of Research, Science and Technology (MoRST). A proportion of the total FoRST budget is set aside for non-specific output funding, allowing CRIs to support projects that may not have been approved in the FoRST peer review process. A further sum has been established to support basic science, but also is available only on a competitive basis.

The competitive tendering process is open to scientists from the CRIs, to University scientists, and to private companies. In fact, some scientists made redundant during the restructuring are now competing successfully for funds for projects similar to their previous work. Because each CRI is a limited company it is also expected to attract a proportion of its funds from outside sources other than FoRST, and to make a profit. In addition, independence for CRIs has meant that staff numbers and location of staff has been assessed by the Board of each, and in some cases staff have been obliged to move, or be made redundant. Fortunately this has not affected plant pathology. However, some plant pathologists with diverse interests have had to choose (or have decided for them) the CRI for their major research effort. Another unsettling element is that salaries are part of tendering, so if the contract is an annual one then money for salary is part of the process of gaining funds. At present, contract bids have to be in by November of each year. They are assessed by persons outside the CRIs and selected by FoRST. The peer reviewers are not paid and this does not encourage persons to undertake this task. The success or otherwise of bids is notified to applicants by April–May of the following year, with funds allocated for the year 1 July to 30 June.

The CRIs employing plant pathologists and scientists in related fields (like mycology) are as follows:

The New Zealand Crop and Food Research Institute This has its headquarters at Lincoln,

Canterbury, with 12 regional stations. The emphasis is on arable and vegetable crops. There are 17 plant pathologists and technical support persons.

The Forest Research Institute, Rotorua This was not greatly affected by the restructuring and retains nine plant pathologists and technical support staff, including two persons who work on wood decay organisms.

The Horticulture and Food Research Institute of New Zealand Ltd The Head Office is at Palmerston North, but there are staff at 16 other locations, some of which are research orchards. The main research is on fruit crops. There are 32 plant pathologists and technical support staff.

Manaaki Whenua Landcare Research The Head Office is at Lincoln, Canterbury. The plant pathology staff are in Auckland, working on identification of fungi and bacteria and maintaining a mycological herbarium and culture collections. There are nine scientists and technical support staff.

New Zealand Pastoral Agriculture Research Limited Its aim is to provide innovative sustainable production technologies for pastoral agriculture. It does research on the diseases of grasses and pasture legumes as well as on bio-control of weeds in pastures. There are 15 plant pathologists and technical support staff.

Of the ten initial CRIs, one, with 18 staff, was forced to close in October 1994, basically because it failed to make a profit. This is an indication of the business-based nature of these enterprises.

Plant quarantine

For an island nation like New Zealand, plant quarantine is essential to prevent the introduction of new diseases. In fact, it is remarkable that this country has remained free of many serious pathogens that occur overseas. It can be said that the basis of quarantine is a sound knowledge of the diseases that occur here. This illustrates the importance of the books by Dingley (1969) and Pennycook (1989) on diseases recorded in New

Zealand. The key word is 'recorded', as a number of diseases have been found recently and it is clear from the evidence that they have been present for many years and were not detected. The classic cases are potato cyst nematode and bacterial wilt of lucerne. The other aspect is the problems that arrive in New Zealand by wind-dispersal generally from Australia. There is enough evidence (Close *et al.* 1978) to show that once a rust disease is detected in Australia, the same disease is soon found in New Zealand e.g. poplar leaf rusts and stripe rust of wheat in 1980. In addition, some diseases have been recorded with a limited distribution in New Zealand. Efforts have been made to eradicate them with some apparent successes (citrus canker).

Nevertheless, plant quarantine is of value as it attempts to prevent or delay the introduction of serious plant pathogens, insect pests, mites, nematodes and weeds.

The modern era of plant quarantine could be said to have begun in New Zealand in 1952 with a small group of scientists supporting and directing the plant quarantine service. The work was strengthened with the passing of Plant Quarantine Regulations in 1957 which gave rules and penalties, and clear reasons for plants that were prohibited or where conditions were placed on their importation. Because New Zealand was an early signatory of the International Plant Protection Convention, it was necessary to implement procedures to fulfil all the conditions relating to the export of plants. In 1957, there were three groups involved in quarantine, those interested in plants, those with animals, and the forestry interests (trees and timbers). These were soon amalgamated into a port agricultural service, which then became known as border services. The present name is MAF Quality Management Quarantine Services, who implement the policy set by the National Agriculture Security Service of MAF Regulatory Authority. The Biosecurity Act and associated regulations, to be introduced, appear to regard all plant introductions as dangerous, unless proved to be safe. This is a different approach from previously, when certain plants were prohibited for specific reasons, but many were allowed, provided they had been either inspected prior to export in the country of origin and/or inspected on arrival. The full impact of the Biosecurity Act has yet to be evaluated.

Education and training

Identification and control of plant disease forms an important part of many horticulture courses at Polytechnics and private training providers. For this purpose a book on this topic was prepared (Lucas 1994) with good colour photographs. Similarly, in the undergraduate diploma courses at Lincoln and Massey Universities, there are subjects covering pest and disease control, as well as pesticide technology. To encourage the safe use of pesticides, the New Zealand Agrichemical Education Trust was formed to promote one- or three-day Growsafe courses. These were designed to make growers more aware of safe practices, and become competent in the use of pesticides.

Six of the New Zealand Universities, but not specifically Waikato, teach plant pathology at the degree level. Some tuition is provided at the undergraduate level, but more in the Masters programs, and finally in a Ph.D. on a specialised area of plant pathology. Often it is followed by a post-doctoral position to gain further experience. University staff and research students have completed much research in plant pathology of value to the agricultural and horticultural industries, especially over the last 30 years.

Other organisations with an interest in plant pathology

Seed Testing Station of MAF Quality Management There have always been one or two plant pathologists at this station in Palmerston North doing research on seedborne diseases and seed treatment. Massey University also has a seed technology centre active in research, as well as education and training on seed.

Plant Protection Research Unit This is based at Lincoln University, and completes a range of contract work for chemical companies, private companies, and growers.

Agro-research Enterprises Ltd This is based in the Hawkes Bay at Havelock North and completes research work under contract. It also publishes the 'Agrichemical Directory and Hazard Response Handbook', now in its 1994 seventh edition.

Plant Doctor Ltd This enterprise began recently and does contract research mainly on cereals, but also on other crops. It is based in Carterton.

Chemical company research Most of the major companies have staff engaged in field trials.

Wattie Industries (now part of Heinz) This is doing research and actively promoting organic vegetable production, especially of peas and carrots for the Japan market. Disease control is an important part of their work.

Extension in plant pathology

Most advisers with MAF are now part of Agriculture New Zealand, a consultancy company that operates as a business. Advice on plant diseases and their control can be obtained from them, as well as several private consultants. There is a fruitgrowers' organisation that has technical advisers. The CRIs also engage in extension activities, as well as the Universities, and the MAF Plant Protection Centres.

Conclusion

In retrospect, it is indeed fortunate for New Zealand that Dr Cunningham was able to establish the Plant Diseases Division in 1936 and for it to remain intact for over 50 years. It is also important to note that the initial staff of the division were able to develop skills and knowledge in mycology, bacteriology, virology, and physiological disorders, and so lay the foundations for excellent future research. The change to Crown Research Institutes in 1992 has moved the team of plant pathologists into five commodity areas and only time will show the value of this approach. As a generalisation, there could well be less co-operation and more competition between them. As a consequence, conferences of APPS and the NZ Plant Protection Society will play an even more important role in bringing plant pathologists together to exchange ideas and share knowledge.

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