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Education for the Profession of Plant Pathology

There are three key words in the title; education, profession, plant pathology, and each must be discussed.

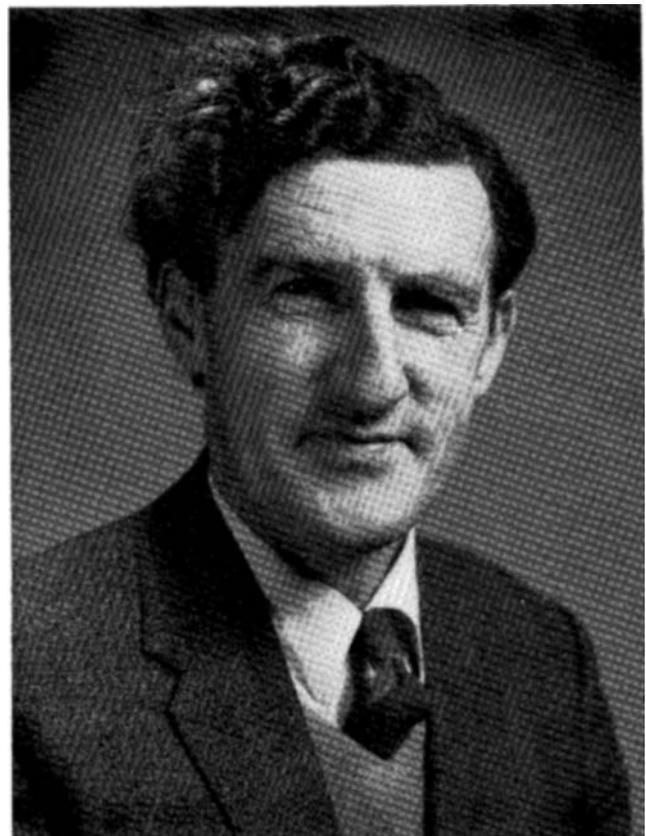
The Concept of Plant Pathology

First of all, what is plant pathology? How are we to teach this subject unless we know what it is all about? I find that even among plant pathologists there is much muddled thinking. They may have been working in the field for many years and without a clear idea of all that is involved. Some would suggest that it is easier to say what plant pathology is not. Plant pathologists should not be enthusiastic about disease, though I am sure it is natural for us to feel delighted when the results of our inoculation experiments are successful and the plants develop good symptoms or die in the appropriate manner. On the other hand, our enthusiasm and concern should be for healthy plants, because our basic aim must be to ensure that plants remain healthy from their "cradle" to their "grave".

However, these comments do not answer the question "What is plant pathology?" At this point some might mention the disease triangle but that has been replaced. The triangle has now become a square with man involved in the process. And even the square has further given way to the pyramid with the important parameter of time added. But plant pathology involves more than the five parts — host, environment, pathogen, man and time. Plant pathology draws on many disciplines and therefore can be regarded as a field that has a conceptual boundary, with inputs from, and outputs to, relevant disciplines. This is illustrated in Fig. 1.

For the purpose of this discussion we can divide plant pathology into three parts: causes, the diseased plant, and plant protection. Each of these are large areas in themselves and require separate discussion.

In the area of causes, we can easily see that there are a number of living and non-living causes of plant diseases. And so plant pathology is not mycology or even applied mycology. It is regrettable that the first International Congress of Plant Pathology was not held until 1968, and that it was not till 1970 that the Review of Applied Mycology at last became the Review of Plant Pathology. In other



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words, although the study of plant pathology is very old indeed, it has been immersed in the disciplines of botany and mycology, and only now is emerging as a fully recognised entity. Also, the disciplines of bacteriology, virology, nematology and entomology have only a part to contribute to plant pathology.

The second area of interest is the diseased plants or "patients". Here an important aspect is our study of the healthy plant, its morphology, anatomy, physiology, and biochemistry, for only by understanding the healthy plant can we recognize the changes that take place after infection. A good knowledge of crop agronomy, ecology, plant nutrition and plant breeding is also essential to understand the epidemiology of disease.

The third part of plant pathology is plant protection, or control by biological or chemical methods. The latter involves physics and chemistry of chemicals and their use, toxicology, engineering and the essential cost-benefit analyses, not only of control methods but perhaps also of our experiments.

This division into three areas is artificial, and they should not be seen as separate sections but as a whole concept. Note that the conceptual boundary, the rectangle in Figure 1 remains, and we recognize the importance of inputs from other subjects, and their importance to plant pathology. Thus plant pathologists must integrate and use information from many fields, and because of this plant pathology is both an art and a science.

At the same time we generate knowledge of our own as an output to supporting disciplines. This concept is similar to that proposed by Grossman (2).

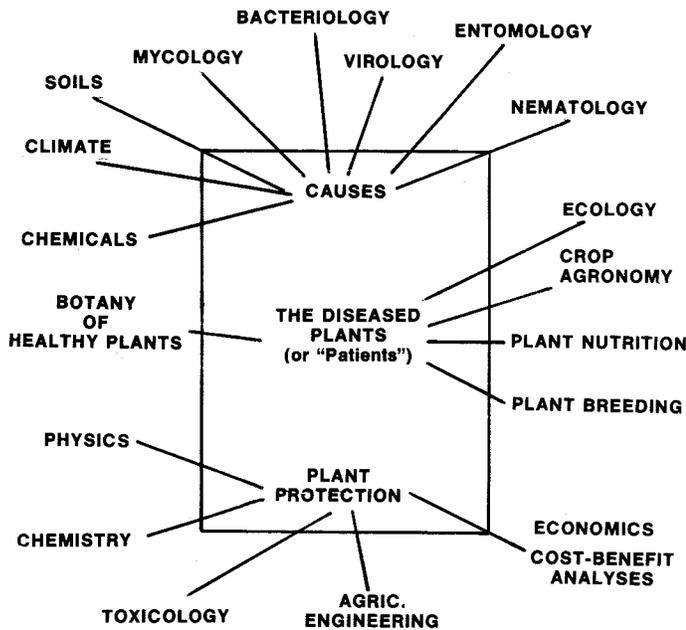


Figure 1. The concept of plant pathology (the rectangle being the conceptual boundary), with inputs from and outputs to supporting subject areas.

The Profession of Plant Pathology

Plant pathology is a profession in exactly the same way as human medicine and veterinary medicine are regarded as professions. Plant pathology is of equal importance, but, if we recognize the fact that "all meat is grass" then perhaps we should regard ourselves as being of prime importance. Healthy plants means abundant food for animals and human beings, and if mycotoxins are involved then unhealthy plants means unhealthy animals.

Plant medicine is important, and when compared with human medicine you can see many similarities and differences. Human medicine is based on an extensive system of general practitioners but very often plant pathology is not. There are certainly many plant pathologists who are general practitioners, in our context, referred to as crop pathologists and often they are less highly regarded than the specialists. In the field of veterinary medicine, we can also recognize general practitioners, those veterinarians who deal only with horses, or with cattle, or sheep, or small animals.

In my opinion our profession is suffering from a surfeit of specialists, and this may be as a result of an education process which culminates in a Ph.D. degree. It appears that the criteria for Ph.D. topics and examinations should be considered again in the light of present day needs, so that multi-disciplinary or problem-solving topics can not only be permitted but should be actively encouraged. The development at the Waite Institute of synoptic studies on wheat and lucerne may be a step in the right direction.

I thus make a plea for more general practitioners in plant pathology who will require better training and will need better job opportunities and career prospects. In human medicine, there have been formed General Practitioners Societies to meet the needs and interests of the group. This may well happen in plant pathology, and in the long term we could see the development of plant medical centres and registration of those qualified to practice. The Australian Society of Microbiology is, at present, going through the process of registration of its members. In New Zealand we have the registration of farm management consultants.

Like human medicine, there will be a need for specialists in plant medicine. These should not be in the front line dealing with growers or advisory officers but should be available on a referral basis. At present most of our specialists are discipline-oriented, e.g. mycology, virology, nematology. We have not yet become organ or tissue-oriented like human medicine. A brief study of their literature will reveal a number of human pathologists, who deal with all the disorders of a particular organ or tissue. Thus there are specialists dealing with eyes, teeth, kidneys, heart, vascular system, ear, nose and throat, nerves, reproductive systems, skin. The nearest that plant pathology comes to this idea is in seed pathology and in some areas of root pathology. Is there not more scope in this area? How about vascular pathologists either xylem or phloem-oriented, leaf pathologists, flower pathologists, and so on. There could even be appropriate post-graduate qualifications; say Member of the Royal College of Seed Pathologists (MRCSP (Denmark)) for those who qualify in seed pathology.

In comparing human medicine and plant pathology I have ignored the fact that they are dealing with only one animal species, whereas we are dealing with a large number of plant species. Thus the problems of our profession are much more complex but I feel we can usefully

compare our present approaches with many of the ideas generated within human and veterinary medicine. We should be able to learn from these sources, to adopt their good ideas and avoid their obvious errors. However, the profession of plant medicine should be able to develop into a strong and viable organization in its own right. Let us not underestimate our value to the community and give more thought to strengthening our endeavours in the field of public relations as emphasized by Professor Stubbs (3) in his Presidential address in 1975.

A short quote from Professor Stubbs is appropriate. "I realize that there will be some who will say that our field of endeavour should be adequately publicized by our scientific achievements. Unfortunately, in present day society, that is not the order of things.

"If we don't push our barrow no-one will ever push it for us, and I think the time has arrived that we should start to push it harder than we have done in the past."

My own views are similar; the public and politicians must be made aware of the benefits that come from our research and advisory work. The benefits will be in terms of losses that have been prevented, not only in tonnes per hectare but also in dollars per hectare on a local and national scale. Crop-loss assessment has been neglected and we are rapidly trying to correct this position. How are thinking men to evaluate our worth, if we do not provide the necessary data?

The Education of Plant Pathologists

It is true that education is a life-long process and this applies just as much to plant pathology as to other fields. It would be interesting to know how much plant medicine is taught in our primary and secondary schools. I would venture to suggest that there is very little indeed and that what there is consists of outmoded ideas and of diseases of little or no economic importance. This is probably our fault. A fresh approach is needed in the school system if the community in general is to be better informed of plant diseases and their control. The value of this is outlined by Anderson (1).

Now to consider the university system of education in plant pathology. First of all let us accept the concept of plant pathology as I outlined earlier to you, and the fact that we are a profession. Therefore, we need a professional degree. Here again we can learn from the other professions, which have a fixed course structure.

At present most plant pathologists enter the field via introductory courses in botany or agricultural degrees. They may then move into Masterate programmes which are good because they generally involve additional course work. Those going direct to a Ph.D. will be in training for specialist fields.

There is an urgent need to examine carefully the training of plant pathologists; to consider this without any preconceived ideas, and to base the course on an agreed concept of plant pathology. As far as I can tell there is not yet at any English-speaking university a degree course in plant pathology or plant medicine. We may well ask why. Why not work towards establishing such a degree: a Doctorate of Plant Medicine (DPM) and a degree in chemotherapy — a Doctorate of Plant Chemotherapy (DPCh)? The latter is particularly appropriate as more and more chemicals for plant protection are becoming available and we need to be well informed of their various properties, methods of application, etc.

If you think about the present situation I think you must agree that we have allowed "education in plant medicine" to develop without any well-considered outline of the priorities and essentials for the course.

So let us establish a few Schools of Plant Medicine, whose staff would include some people who spend much of their time as practicing plant pathologists. The use of such part-time staff is well accepted in human and veterinary medicine. This is a desirable development that ensures that the experience available from our colleagues in associated institutes can benefit those in training.

What would constitute a good course in plant medicine? Obviously we must start with an intermediate year on the basic sciences, followed by a further two years on a detailed study of healthy plants, including training in crop agronomy, ecology, genetics, plant breeding, economics, statistics, computer methods, extension and communications, psychology, and so on. During these three years (pre-clinical) it would be appropriate to have some clinical experience to maintain the students' interest in plant medicine. At the end of this period there could be, if required, a degree in Plant Biology. Entry to the professional part of the course also could be through an initial degree in agriculture.

Then would come the professional training required for the qualification. This would also be a three year course. During that time, there would be at least a one year intern period or periods in plant pathology diagnostic or research laboratories. The intern periods are most important for plant pathology students, for although still linked to a university course, practical experience of great value can be obtained in plant pathology institutes, the "hospitals" of plant medicine. It is not possible to go into all the details but the course at university would include training in clinical and diagnostic procedures, recognition, identification and control of the main diseases, all aspects of chemicals in plant protection, organ and tissue pathology (seeds, xylem, phloem, etc), pathology of important crops, selected subjects, and a short research project. At the end of this six year course, students would qualify for the DPM and DPCh. This would train our general practitioners who would work in the advisory-extension field, diagnostics, field research, crop protection, crop pathology and plant breeding. The next stage in training could be one of the following options: (1) after a certain period of post-graduate experience working alongside registered plant doctors, graduates could register for entry into a professional society and so be qualified for independent practice. (2) A Ph.D. programme designed to train people for research and/or as a specialist in certain areas.

This whole proposal might be regarded as a very formidable course but of course we are dealing with a large and complex field, and, like the courses in human medicine, requires a long period of detailed study and clinical experience. Similar ideas have been proposed by Tammen and Wood (4).

In the Australasian region the only possibility for a course of this nature would be to graft some of these more detailed courses on to existing facilities. For example, it would appear that the Waite Agricultural Research Institute has the staff and facilities to cope with a post-graduate three year course leading to a DPM, and they could attract graduates, with basic training, from other universities. It will be apparent that, like human medicine, specialized courses in plant medicine would only be available at certain universities. Likewise intern periods would be allowed only at approved institutes and for specified periods.

However, education is a continuing process and so we must make provisions for refresher courses in many aspects of plant pathology, not only for short-term workshops as have been arranged by our Society, but for courses of longer duration. Human medicine organizes regular refresher courses, and has established various scholarships and foundations to facilitate this continuing education.

As part of the education scheme for plant medicine, we will have to consider the training of para-medical staff, i.e. the "nurse" equivalents, other technical staff, spray contractors, and so on. For this, a degree course in plant health technology has been proposed (4). This would be organized by qualified plant pathologists, but the course would include studies on weed and pest control, as well as on the control of plant diseases. The emphasis in this three year course would be on plant protection especially on applied aspects. However, there would also be a need for similar courses of a shorter duration. Other courses would be required for training of staff in diagnosis, and in the conduct of laboratory, glasshouse and field experiments.

Those of us in the universities have a great responsibility to see that there are acceptable yet progressive developments in the training of professional plant pathologists and their para-medical staff.

I do hope I have stimulated you to think about and discuss all the aspects that I have mentioned. We do need to have vision and to work towards change for the better, before change is forced on us from other directions. It is very important that we established a well-qualified profession, not only to gain the recognition that we deserve, but also to ensure that all plant diseases are controlled for the benefit of mankind.

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Ron Close

DANIEL McALPINE MEMORIAL LECTURE

Looking Ahead

Mr. President, fellow members of the Australian Plant Pathology Society, ladies and gentlemen, may I first thank you for the honour of inviting me to deliver the second Daniel McAlpine Memorial Lecture. In accepting your invitation, I did not at first realize the problem I had set myself in selecting a topic on which to speak to you. As time went by, and I had still made no decision, there came to my mind

in desperation the advice sometimes given to novice speakers that all you need for a speech is a beginning and ending — few listen to the middle and with luck some might even drop off to sleep. My wife is of the opinion that this advice is firmly based after observing me in church Sunday by Sunday. After a rousing hymn from the new Australian Hymn Book, I sit down straight-backed and alert to listen to the sermon. Now it so happens that my church is blessed with a very good minister and his sermons demand real concentration. I find it easier to give this with my eyes closed. I may even nod my head in agreement with some subtle theological point well made. It is, Mr. President, on the basis of the false interpretation of such observations that the belief has arisen that the middle of lectures are of no account.

Where was I? — Ah, yes, searching for a topic. I turned to the letter of invitation for guidance. It read, "There are no guidelines for the address. It does not have to be an historical appraisal." Not much help there, except that it was not necessary to try and emulate the masterly summary of the development of knowledge of the diseases linked with the name of Daniel McAlpine, as given by the first Memorial Lecturer.

Eventually, two options remained. The first was to speak on my own research field, the role of physical factors in the ecology of soil microorganisms and in soil-borne diseases. This I rejected because I have reviewed the topic at fairly frequent intervals and there seemed no justification to do so again to this audience, most members of which are already amongst the converted, so to speak.

The second option was to base my remarks on some thoughts that have come to me with increasing emphasis over the last few years and this I have decided to do. My aim is not to make an authoritative statement but to share with you an area of concern.

My remarks relate to science, rather than to the particular issue of plant pathology, and especially to the interaction of science with the world of people. Let me lead into this through our own discipline.

My knowledge of Australian plant pathology dates back only to 1955, when I arrived in this country but the change in less than twenty-five years has been extraordinary. I shall note only a few widely differing instances. New institutions have been created or old ones reformed and reinvigorated. In this latter class, the Biological and Chemical Research Institute of the New South Wales Department of Agriculture provides a good example, now drawing visiting research workers of distinction from Britain and America.

Phytoalexins are no longer the off-beat idea of Muller but are firmly established in the plant pathological vocabulary, largely by the early work of Cruickshank and his associates.

Although the terms (thankfully) originated elsewhere, Australian plant pathologists have not been lacking in the investigation of the concepts of vertical and horizontal resistance, as is demonstrated in some of the poster exhibits for this conference.

In my own research area, the barrier between soil microbiology and plant pathology has been breached, to the mutual benefit of both. Our appreciation of the interweaving of the biological, chemical and physical within the soil system is far richer and more accurate than even fifteen years ago.

Our discipline, like the rest of science, would therefore seem to be flourishing. Yet the media frequently suggest that something is amiss. To give but one example, the ABC program "Four Corners" last week showed a film concerning the possible deleterious effects flowing from the use