Presidential Address

RESEARCH IN AGRICULTURE

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A FEW YEARS AGO, agriculture took a back seat in New Zealand while the development of secondary industry was being vigorously pushed. A number of voices were raised against this, but with apparently little effect at the time. Many of our most prominent personalities in agricultural research departed to far "greener" fields overseas and few have returned. There has in the past been much discontent over scientific and university salaries and the organization of research in New Zealand, and the fact that the majority of Government research organizations come under the control of the State Services Commission. At various stages, the research scientist has been promised enquiries into scientific organization in New Zealand similar to the Hughes-Parry Commission on the universities, but these promises have not been fulfilled.

The continuing fate of the New Zealand scientist could be well illustrated by an analogy used by Eugene Rabinowitch in his book *The Dawn of a New Age*. According to Greek legend, the titan Sisyphus was condemned by the gods to eternal frustration for crimes forgotten by most who remember his cruel punishment. He had to roll a heavy rock up a steep mountain; whenever the top was in sight, the rock slipped down the slope and the weary titan had to start from the bottom again. The task of getting those in control of this country's affairs to understand the position of science in national affairs, let alone agriculture, has proved to be as frustrating as the labours of Sisyphus.

In the larger industrial countries, the scientific Sisyphuses have reached the top with their rock, or almost so, because it is plain that they are an essential part of the national defence and development effort. Their achievements can be measured in terms of the amount of ironmongery in orbit around the earth and the multitude of new products we depend on scientists in other countries to develop. In New Zealand, the top of the mountain has been hidden in fog with only occasional glimpses obtained when we were heartened by promises which failed to materialize. However, I feel that there has been a tremendous advance up the mountain as a result of a number of recent events, and

it is up to us to see that the rock does not slip back but rather that the impetus is maintained.

The events I refer to are four in number: first, the Agricultural Development Conference; secondly, the formation of the National Research Advisory Council; thirdly, the granting of full university status to Massey; and fourthly, the changes in the *Rules* of the Royal Society of New Zealand.

THE AGRICULTURAL DEVELOPMENT CONFERENCE

This Conference has been criticized as achieving very little. However, it did focus attention on the fact that New Zealand's greatest undeveloped resource is her agricultural potential and it has become Government policy to develop this potential in order to help solve our precarious balance of payments situation. It was rather noticeable that there were no research representatives on any of the conference committees. This signifies that those organizing the Conference felt that research personnel had little to contribute to New Zealand's first attempt at indicative planning on a national scale. I hope this state of affairs will be rectified by scientists themselves in the future.

THE NATIONAL RESEARCH ADVISORY COUNCIL

The National Research Advisory Council was established in 1963 to advise the Minister of Science on matters related to scientific research in New Zealand. The Act provides for six members including the Chairman to be appointed by the Governor-General, and three *ex-officio* members, the Director-General of Agriculture, the Director-General of the D.S.I.R., and the Secretary to the Treasury. There is no provision for representation from practising research scientists or scientific bodies as such, though some of the Government appointees from industry and the universities have had a science training. This would perhaps again indicate a lack of confidence in the advice of the practising scientist.

One of the first acts of the N.R.A.C. was to set up sixteen working parties to review and report on research and service in various fields of scientific work. I think it is fair to say that most of us were sceptical about the return from the very considerable time and effort expended by working-party members in the preparation of the reports. However, even though the first N.R.A.C. report was published only in April, 1965, the Government went a long way in that year's

budget towards meeting the N.R.A.C. recommendations that out of a total increase of some half-a-million pounds for research, some £320,000 should go to agricultural research, and, what is more, that research in this area should be increased cumulatively by £320,000 per year.

I feel that neither the Agricultural Development Conference nor the National Research Advisory Council reports have been received with the acclaim that history will bestow on them. There has been considerable criticism in matters of detail while the much larger issues involved have been overlooked.

FULL UNIVERSITY STATUS TO MASSEY

When our forefathers left Great Britain to settle in New Zealand, they set up institutions along similar lines to those they had known in their homelands. The universities were no exception, and they preserved the English tradition by preparing young men for careers in law, medicine and the ministry. Time-honoured subjects were taught for the purpose of mental discipline and not for their practical application. If a student learned how to think, it was taken for granted that he knew what to think. This attitude has taken a long time to change. It seems strange that the young student is always the rebel against the established order while there is no one more conservative than the long-entrenched university professor.

A similar situation existed in the establishment of universities in the United States where Harvard, Yale and Princeton were modelled on the old European universities. However, a most important revolution in higher education was initiated when Abraham Lincoln in 1862 signed an act "to donate public lands to the several states and territories which may provide colleges for the benefit of agriculture and the mechanical arts". The grants of federal lands resulted in the founding or further development of 32 state universities whose object was "without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanical arts". Many of these have become universities with world-wide reputations in many fields of science and letters as well as agriculture. The largest of the land-grant institutions, the University of California, expects an enrolment of about 120,000 by 1975, while Wisconsin, Minnesota, Rutgers, Purdue and Iowa are just a few of those that have achieved both high standing and large size as universities. As far as agriculture is concerned, they have

played a major role in the application of science to soils, to plants and to animals, which has made it possible for one American to produce enough food for himself and some twenty-five others and to have an over-abundance at that.

We in New Zealand have done very well with Massey and Lincoln Agricultural Colleges but they have certainly not been considered in the same light by the rest of the New Zealand university system as the better United States land-grant institutions have been regarded by their United States counterparts. The other university colleges have, in general, taken the cream of school-leavers, and only a few of the best science graduates have been attracted into agricultural research. With the granting of full university status to Massey, some 100 years after the universities with an agricultural bias were set up in the U.S.A., it is hoped that a better balance will be achieved. No doubt there will be conflicts within the one institution between the so-called "pure" and "applied" faculties. However, there is more opportunity to resolve this conflict within one university than within a number when they are miles apart.

More and more original ideas and creative thinking are going to be needed in agricultural research in the future. The best long-term way to provide these is to resolve the age-old division between the philosophies of the theorist and the applied scientist. The pure scientist must come down from his ivory tower, and the technologist must get alongside him because the tools of pure science today become those of applied research tomorrow. For example, the electronic computers built for the theoretical mathematicians and physicists have rapidly become essential to the geneticist and animal breeder. One of the most outstanding examples of the skilful melting together of the ivory-tower pure scientists and the tolerant technologists was in the development of the atomic bomb. Out of this harnessing together of the "thinkers" and the "doers" came the most amazing synergism.

Our future science graduates should be conditioned to understand that applied science is a good professional framework for some, but may be unacceptable to others. From undergraduate training upward, students of the sciences should be made to appreciate that some men are driven by a deep desire to add to our store of knowledge, and that the challenge of discovery is rewarding in itself whether it has immediate practical value or not. Others are satisfied only when they can apply the fundamental findings and obtain practical results. Both types of people are

necessary, and I hope that, at the new Massey University, whatever path the science student chooses he will be taught to make his choice a personal preference with the firm conviction that neither pure or applied science is a superior calling. People in agricultural research with the right attitude are our most precious commodity.

CHANGES IN THE NEW ZEALAND ROYAL SOCIETY RULES

It has already been mentioned that the Government did not seek scientists' advice in planning future agricultural development and research. Presumably, scientists have failed in the past to demonstrate their ability to contribute to policy-making decisions. The independent scientific body to which the New Zealand Government turns for advice is the Royal Society. This has, in the past, hardly been truly representative of New Zealand science. The new *Rules* under which the Society is now operating should gradually make it a much more representative body which I trust will raise the status of scientists by being recognized as a source of independent, responsible and reliable opinions on all phases of New Zealand science.

I believe, for reasons outlined earlier, that the climate has changed for the agricultural scientist. I believe that he now has the top of the mountain in sight, and can reach it if he makes use of his opportunities — if he shows himself to be a reliable and responsible user of the funds allotted and of the new graduates that will come from the universities.

There are many smoke screens behind which scientists have sought refuge in the past. The universities have overworked and misused the term "academic freedom". Such quotations as "Let us recognise at once that one cannot 'organise' research but one can create conditions under which fundamental research will flourish", or, as Lord Hailsham has stated, " . . . the relationship between Government and pure science is essentially the same as that between an enlightened Government and the artist — that is, the relationship of an enlightened patron and not that of an employer", are acceptable in their correct context, but I am sure do not impress the politician and taxpayer in New Zealand when quoted in isolation. Moreover, are we not sometimes fooling ourselves in accepting such quotations without giving them the critical appraisal we would be expected to focus on a scientific problem?

I feel that research has to be more organized in the future than it has been in the past. More attention has to be paid to selecting the right projects. This has not been thought wise in the past, as one could not foretell where advances would be made and in which projects there was likelihood of a stone wall being reached. However, because both fundamental science and technology have added so vastly to the ability to solve problems, and are continuing to do so at an ever-increasing rate, it is now more than ever likely that if a problem is nominated for solution it will be solved. It is merely a matter of the amount of effort put in. Results — perhaps not instant or even economic — can be achieved almost every time. This is not an arrogant attitude, but rather one of humility in face of the massive achievements of man in the realms of natural sciences and technology. Humility is needed when one realizes that the waste caused by posing the wrong problem, or by postulating the wrong objectives, can be avoided. Planning is likely to be more important in scientific research in the future because:

(1) Most of the "easy" problems have already been solved, and therefore research results are harder to obtain. Gone are the days when isolated individuals made most of the far-reaching discoveries with simple apparatus. Though new ideas generally originate within a single outstanding mind, teams of people with expensive apparatus and supporting service personnel are needed to bring them to fruition.

(2) The greater background knowledge now available has greatly increased the chances of solving the more difficult problems, but often the total background knowledge required is not contained in the mind of one individual, making collaborative efforts essential.

This means that research administrators have a more important function to perform than they had even a few years ago. It was considered that, as long as good scientists were recruited and provided with equipment, they could best function by being left to come up with ideas. Today, the fields of research are so enormous and diverse that it is becoming more and more necessary to see that the ideas are sought in desired fields, and, above all, to choose the fields correctly.

Having chosen the fields to work in, there still remains the problem of how much effort should be put into basic relative to applied research? It would be risky in the extreme to believe that any universal ratio can be found.

This ratio varies widely from one field to another according to the effort and success that has been achieved in the past. If too much effort is put in to basic research and too little into applied, the result will be the discovery of a large number of facts, but the application of only a small fraction of those discovered. If too large an effort is put into applied research and too little into basic, there will not be enough basic knowledge on which the applied can be based.

With the changes in climate that have taken place over the last two years, we have the responsibilities of spending our increased money wisely and of encouraging universities to train scientists in certain desirable fields. We must first choose the fields, and then ensure that proper balance of effort is maintained with the selected fields. I believe our methods of research administration are not geared to cope with this situation and that new ones must be devised. The scientists themselves must accept this very real challenge which is with us now, and, if they do not, they cannot complain if they cannot at best maintain the position they have attained with the top of the mountain in sight.