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The Future of Animal Research

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I UNDERSTAND that the reason for an address on the future of animal research is that, having persuaded several venturesome souls to take a prophetic role in respect to animal production in general, and to land development, dairy, meat and wool production, and plant research in particular, it seemed necessary to get someone equally foolhardy to forecast the way in which future needs of our animal industry will be serviced by research.

Since no one would provide me with advance information on the prophecies of our previous speakers as to the precise nature of future requirements, and since an advance copy of my own contribution was demanded by the leader of the discussion to follow, I am apparently credited with possessing second sight. However unusual my many qualities, I have too little Scottish and too much Irish in my ancestry to lay claim to being reliably "fey."

With no knowledge of future problems and with no desire to join the ranks of the soothsayers and perhaps guess a completely different story, I am left with but one alternative—that of stating my personal views on the kind of research organisation which I personally, would like to see develop in the foreseeable future to handle its unforeseeable problems.

Realistic appraisal of future organisational requirements should take some account of the past. One's views of the future are inevitably coloured by one's experience of the past and the present. "Where we have come from" and "where we have got to" cannot help but be of importance in deciding "where we might go."

Organised animal research on a national scale in New Zealand is of quite recent origin, dating from 1939, with the formation of the Animal Research Division of the Department of Agriculture. Prior to this, odd individuals—and the adjective is used in at least two senses—working largely on their own and in their own time in various Government Departments or the Agricultural Colleges, had made quite notable contributions in many specialised fields. The names and work of Gilruth, Hopkirk, Cunningham, Scott and Leslie, to mention but a few, are sufficiently familiar to emphasise this. Each of these men had other major responsibilities; but to them research was of necessity a sideline to be prosecuted under difficulties and often active discouragement. In no small measure their achievements were responsible for gradual recognition by the political, farming and scientific leaders of their time, that New Zealand had passed the pioneer stage of mere land development and entered the era where efficient utilisation by livestock of the products of land was of paramount importance. This recognition became official in 1936 with the invitation to John Hammond of Cambridge to visit New Zealand to report on the organisation of Animal Research.

In retrospect, his report (1) which covered problems, organisation, staffing and future prospects, was significant and important mainly because of its recommendations on the organisational side, and their outcome. Hammond strongly recommended the immediate formation of an animal research organisation, financed by the State, and charged with the responsibility of servicing the animal industry. This concept received universal approbation. However, his suggestions for implementing this by the establishment of an Animal Research Bureau, under the control of the Department of Scientific and Industrial Research, was not so fortunate. Even though Hammond—with the

Englishman's love of compromise—made a valiant effort to reconcile the conflicting interests of the many organisations concerned, by advocating a Bureau of 21 members representing every conceivable official farming body in New Zealand under the Chairmanship of the Director-General of Agriculture, it quickly became clear that the Department of Agriculture would not agree to the D.S.I.R. obtaining control of animal research as it had already largely done of plant research.

Traditionally, the Department of Agriculture had always provided the necessary research services to farming. Excellent arguments were advanced as to why it should continue to do so. Unfortunately, shortly before, the rapidly growing team in its Plant Research Station at Palmerston North had become so disgruntled with the difficulties of persuading a dominantly administrative and servicing Department to appreciate the peculiar, sensitive and special needs of scientists, that the botany, grassland, agronomy and plant pathology sections of that young and extremely promising station were transferred to the D.S.I.R. In the process these inter-related units were separated and scattered to the four winds. If I may be permitted to express an opinion on something not my business, a great deal was lost thereby.

In the official discussions that followed receipt of the Hammond report by the Government, the past performance of the Department of Agriculture was freely used as an argument against centring major research activities in a dominantly administrative organisation and for accepting the recommendation that animal work should be placed under the control of a specialised research department, of which D.S.I.R. was the only choice. Agriculture's counter that it was unsound to separate agricultural research of any type from extension work and that its existing field organisation could be of incalculable value to specialist animal workers was so firmly believed by its administration that swift action, whereby the Department of Agriculture created a special Animal Research Division, brought an overnight solution to the dilemma facing everyone concerned. This solution, however, cut directly across Hammond's third major recommendation that three centres of research should be established; one at each of the Agricultural Colleges to deal with the animal production problems of each island and the third at the Wallaceville Diagnostic Laboratory to handle animal disease. The new division took over Wallaceville for disease work but in lieu of direct co-operation with and at the colleges, assumed control of the Ruakura Farm of Instruction as a new and major centre for animal production. The colleges were thus left out of the new organisation.

Appreciating the overriding importance of leadership, the Department of Agriculture was fortunate in securing the services of Dr. J. F. Filmer who brought to the task of developing our first animal research organisation, not only marked scientific ability and experience, but that dogged, fighting spirit and outstanding critical faculty which have enabled him to build a team of which I hope he is justly proud. His Animal Research Division to-day comprises some 60 graduates of which a high proportion carry degrees at honours and doctorate levels; it spends over a quarter-of-a-million pounds a year; its two main stations have been staffed and equipped to handle the main problems considered to exist in animal production and health; it has organised, where required, local sub-stations to handle special problems which must be attacked on the spot; despite its youth its achievements have already been real, and not the least of these is the success with which it has created that scientific atmosphere of freedom of thought and action so indispensable to sound research.

While the Animal Research Division has thus become the dominant factor, a few other bodies engage in restricted activities. Thus the two Agricultural Colleges receive limited financial support for specific projects from the D.S.I.R. to supplement their own relatively meagre

resources; the D.S.I.R. and the appropriate industries jointly support specialised animal work within dairy, leather and wool research institutes; the dairy industry supports the field survey and dairy cattle breeding research of its Herd Recording Department; the Veterinary Services Council supports small-scale work on special problems of sheep reproduction at the Gisborne Veterinary Club and at Lincoln College; and latterly, the pig industry through its National Council, has launched into limited research into special problems of pig improvement in association with Massey and Ruakura.

From this cursory survey of the past and the present, six major points emerge:

1. Organised Animal Research has existed for less than fifteen years and is practically completely dependent upon State finance.
2. Plant Research is largely controlled by the D.S.I.R.
3. Animal Research is largely controlled by the Department of Agriculture.
4. The Agricultural Colleges receive restricted support, and this from D.S.I.R., which is not officially responsible for animal work.
5. On the research side, organisation has concentrated on carefully picked teams at two main centres capable of handling many of the major problems confronting the industry.
6. Direct industry participation in control and finance has been of minor importance.

While all must agree that definite progress has been made and that an organisation reflecting credit on all concerned undoubtedly exists, it would be unusual if not unhealthy if "everything in the garden were lovely." What are the main disadvantages and weaknesses of the present set-up?

First, dependence on State finance involves unavoidable obligations, controls and difficulties. The man who pays the piper has a right to call the tune. So long as he is working for the State, the scientist has a loyalty to his employer which transcends any obligations which he may feel toward any particular industry, section of the community or political or social philosophy. On occasion, this loyalty can conflict with concepts of right and wrong, with scientific honesty, and with freedom of expression, especially in respect to the interpretations and policies arising from specific additions to knowledge. As one previously accustomed to the relative freedom of expression in the University in such matters, it will not come as news that I have had a certain amount of trouble from this cause. The problem is a difficult one. On the one hand the modern, educated community—quite reasonably—is critical of scientists who make a contribution, leave it to the laymen to implement the new idea, and accept no responsibility for the consequences. On the other, the State—equally quite reasonably—asserts that policy making and policy issues are no concern of the scientist; that his only responsibility is to report his addition to knowledge with accuracy.

Of even greater importance in practice, financial dependence on the State has, so far, been a real hindrance to developing a really high calibre staff. For various political reasons, salaries of scientists—particularly at the leader level—are scaled relative to rates ruling throughout the public service. The salaries of a bacteriologist, geneticist or chemist tend to be determined more by the rates payable to a gaoler at Mt. Eden, a stationmaster at Otahuhu, or a clerk in the Hamilton Income Tax Department, as they are by scientific merit or by the international salary level of scientific workers. This service control of scientific salaries has made it difficult to attract promising staff, more difficult to hold proven staff, and resulted in a situation where this country is relying to a dangerous degree on the loyalty of its scientific personnel. Our best men are tempted by great financial

rewards from overseas; a continuous drain goes on. The policy is obviously foolhardy; monies spent on research can be monies completely wasted unless handled by competent workers.

State controlled and financed research is claimed to involve the risk of political interference and direction. Science cannot thrive in such an atmosphere, but it is to the credit of Governments during the short life of animal research in this country, that this has not been a serious problem. So far our Governments have apparently believed in the policy of backing the men whom they have placed in senior administrative research posts. So long as this policy continues, there is little fear of harmful layman interferences of the type to which the Duke of Edinburgh recently referred. That the danger exists, however, must be accepted as a risk inherent in dependence upon Governments for research finance.

The separation of plant and animal research between two departments has aroused amazed and amused comment from many prominent scientific visitors, and has been the basis of much valid criticism in New Zealand. It is so illogical that, more than any other factor, it has been responsible for many of us believing that the best type of research organisation for New Zealand is one patterned on the principles of the British Agricultural Research Council which would control all agricultural research. Whatever one's views on this issue may be, it is at least a matter of common honesty for me to place on record my experience that, despite predictions to the contrary, the Department of Agriculture has shown itself capable of fostering and catering for a live and healthy research organisation.

The relative neglect of our Agricultural Colleges as animal research centres is a serious disadvantage. It is almost platitudinous to emphasise that the quality of research depends primarily on the quality of personnel; that the quality of personnel depends largely on the quality of teaching; that the quality of teaching depends upon its close association with the living force of research. I have yet to hear anyone deny the soundness of these three concepts, yet we have not exploited the research potential of our colleges to more than an insignificant degree. I do not suggest that this is the fault of Government, of Departmental bureaucracy, or of the colleges themselves. In my view and experience, all three must accept a share of responsibility. The important point is not to apportion blame, but to appreciate that the weakness referred to is inherent in our existing animal research organisation.

Concentration on two main centres—while fundamentally sound on grounds of maximum efficiency and economy in the use of limited manpower and finance during formative stages—has the potential danger that such centres can become too large. Any research centre is too large when its director no longer can keep in sufficiently close touch with his staff for his leadership to be a worthwhile stimulus. On this score, I feel that the unit for which I am responsible is already too large; continued concentration on but two centres certainly could make it far too large.

On the final point of lack of industry participation in finance and control, the major disadvantage is probably psychological. Animal Research is not worth while unless the knowledge gained is made use of. On the whole, the farmer probably does try to get his money's worth from things that he pays for directly. To many producers, the scientists of the State are "back-room boys" with no real appreciation of the practical chores and problems of everyday farming. As such, they are hardly worth taking notice of except as subjects of scornful conversation. If the producer paid us, there is a reasonable chance that we would be shifted quickly to the front room—or quietly dispensed with.

So much for weaknesses; what of the good features of our present set-up?

In the first place, dependence on State finance gives the organisation great strength and is probably the only practical and relatively stable way of financing national research. It is a fair way since the whole community benefits from every advance made. Failure to appreciate this latter fact is responsible for the completely unfair contention that farmers should meet the whole cost of research in their industry. As taxpayers they contribute their share. Let us assume that by the application of new knowledge, farmers increase the output of butterfat by 25 per cent. Every member of the community benefits, and only a small proportion of the gross gain becomes a net gain to the farmer. This extra yield needs more labour and other costs in its production, transport and manufacture; it needs more factory space, machinery, power and services of a dozen and one varieties; it needs more rail, wharf, shipping and banking facilities in its marketing; it earns more foreign exchange which brings more imports of goods not otherwise available; it means more profits to producers, manufacturers, marketers and workers; from all these our Finance Minister extracts more taxes to provide us all with still more services and a still higher standard of living. In fact, it is surely a little stimulating to contemplate what happens to the economic and social cycle as a result of the injection into it of an extra pound of butterfat.

The recent strong advocacy of large-scale farmer responsibility for research finance is economically unsound. It has the potential danger that the known risks of interference by parliamentary politicians would merely be exchanged for unknown dangers from their farming counterparts. At the same time, and mainly on grounds of the more effective application of research, a case does exist for subsidiary finance from the industry and for participation in control by the most efficient of our farming leaders.

Separate departmental control of the two major branches of agricultural research in New Zealand has one real advantage. It has resulted in the development of a healthy competitive spirit between the two departments. This is apparent from the highest administrative levels to the lowest form of research life—the newly appointed research officer. Looking up from below, I am not at all sure that scientists at the worker level would have received the very good treatment given them of recent years were it not for this rivalry at the top. Looking down from my precarious perch as a local controlling officer, I am quite sure that the level of work of my unit is higher because of the existence of our D.S.I.R. and college friends. In any case, it cannot be too strongly stressed that most of the workers in the two departments are friends and that, in consequence, the separation is much more apparent than real in matters affecting actual work. Once a firm critic of separate control, my experience has convinced me that, on balance, separation has been a good thing. Even further, I have become more than a little frightened that amalgamation of all research bodies in agriculture into one huge octopus organisation would be the surest way of sending our research leaders permanently to sleep.

In anything said so far, quite inadequate emphasis has been placed on the importance of the man in research. Any research organisation must fail if it does not attract and hold the kind of research workers needed. It is a comparatively easy matter for competent and experienced leaders to take the first practical step in their job—the selection of animal industry problems needing solution and susceptible to research attack. It is for this reason that I am not unduly perturbed at not having discussed future research problems and possibilities in this address. So long as the organisation attracts the right kind of research leader, the kind of problems worth tackling will be reasonably obvious whatever the future may bring.

It is quite another matter, however, to bring together the right problem and the right man. Thus, for years we have been aware of the overall importance of infertility in dairy cattle, but we are still seeking the man to start serious research in this field; for years we have

sought—but only recently obtained—a suitable young worker to handle special problems of hill country sheep husbandry; problems that have not just arisen, but that have always existed. Recently, as a country, we have lost the only two men adequately trained in dairy cattle genetic research, and this at a time when problems of national dairy herd improvement have assumed a completely new importance in the light of modern advances in artificial breeding.

The future will undoubtedly bring new problems and throw new emphasis upon old ones. Our future organisation must be geared to enlisting the aid of specialists, the need for many of whom can be forecast now. Apart from the question of salaries, research facilities, and research atmosphere, of which mention has been made, this requires above all, better training facilities, particularly for our younger recruits to research. Quite inadequate opportunities exist in our present animal research organisation for attracting young workers of high calibre and of subsequently providing them with essential specialised training in overseas centres to equip them to handle problems we already are conscious of. Even senior workers need to escape from time to time from the scientific isolation of this country and to suffer the stimulus of contact with their fellows in other lands if their leadership is to continue at a high level. The recent official attitude of Government to these basic needs is more than disturbing to those conscious of requirements and concerned for national welfare.

I am sorry that this address has been so long and tedious. If you have followed my muddled and laboured thinking, it should not come as a surprise that my ideas on the desirable future animal research organisation are fairly straightforward and—a sign of advancing age—far from revolutionary. My personal hopes are for an organisation with the following major features:—

1. The maintenance of organised disorder where healthy competition at all levels between an increasing number of participating bodies is a permanent feature.
2. Continued recognition by the State of its responsibility to finance research as a national obligation.
3. Encouragement of limited direct farm industry participation in both finance and control to speed the application of new knowledge.
4. More effective exploitation of the facilities of the Agricultural Colleges to ensure a supply of high calibre recruits.
5. Much more extensive opportunity for selected personnel to obtain specialist training both within and without New Zealand so that problems needing solution can be attacked with reasonable prospects of success.
6. Practical recognition of existence of an international market for the services of top quality scientists by the payment of competitive salary rates.

REFERENCE:

Hammond, J. (1938); N.Z.J. Sci. Tech. 19 : 762.

Discussion

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The outstanding characteristic of Mr. Greig's paper is the statesmanlike approach to the problem. It is good to know that the Director-General of Lands is a man of vision, and the paper gives some impressive data illustrating how his vision is being realised. Equally impressive is the indication that there is in the northern half of the North Island about 1½ million acres of "undeveloped farmable land." This would be a very significant addition to the seven million acres of grassland topdressed last year.

It was very refreshing to hear a senior Public Servant draw attention to the religious fervour with which the Dutch, both ancient and modern, regard their duty to the land. Many New Zealand farmers also are inspired by a real love of the land but I could wish that they would proclaim it more often instead of perpetually referring to incentive in terms of £.s.d.

Dr. Melville has asked that his paper be read in conjunction with that presented by him last year. In both he emphasises the importance of the pasture-grazing animal complex, but he still remains a gardener at heart who regards the grazing animal as something which influences the pasture for good or ill.

Our dairy herds which average 400lb. of butterfat per cow; our steers which at two years produce 650lb. of chiller beef; our down cross lambs and our well-woolled ewes to Dr. Melville are merely "a determining component of the environment" of his well beloved pasture. Perhaps it was this attitude of mind which prompted the amazing statement "our real problems . . . do not lie in plant, animal or soil husbandry. They are problems of chemistry, physiology and genetics."

In 10 years Ruakura has raised the per acre production of meat and butterfat to about double the district averages. This has been done almost entirely by improvements in plant and animal husbandry, I believe that these will prove equally important in improving the efficiency of animal production in the future for the following reasons:—

- (1) Animal production is likely to remain a better criterion of pasture quality than chemical analysis.
- (2) Seasonal differences in pasture production are magnified as the maximum of pasture production rises.
- (3) The higher the pasture yield the greater the percentage waste by the grazing animal.

As Dr. Melville has indicated animals have feet as well as mouths. He has emphasised that only superficially is the aim of the pastoral farmer to grow the maximum amount of plant product per unit of area and of time. Presumably recent experience has taught him that it is easier to convert grass into milk with calculating machines than with cows. An increase of pasture production to the highest achievable per-acre level on our best land would probably mean that it could not be efficiently utilised by grazing animals but would have to be harvested. This has already happened in some European countries where pasture is grown primarily for conservation as hay, silage and dried grass. It is possible that the demands of growing world population may some day force this in New Zealand, but it would mean a revolution in our farming methods and would interfere with our ability to produce meat and milk more cheaply than any other coun-

try in the world. Within our present agricultural economy I would suggest that there is probably an optimum level of pasture production per acre below and above which economic animal production will fall. I do not see how this optimum level can be determined, achieved or managed without the aid of soil, pasture and animal husbandry.

Of course I do not wish to infer that the problems listed by Dr. Melville are not important. They are important and chemistry, physiology and genetics will prove of value for their solution. If Dr. Melville had said our real problems are problems of chemistry, physiology, genetics and soil, plant and animal husbandry, I would not have quarrelled with him over the order in which the various disciplines were mentioned.

I agree wholeheartedly about the importance of recruiting bright brains and burnishing them to an even higher lustre by post-graduate training, but something more is needed. Banting, of insulin fame, once said: "We have never hired a person to do experimental work but we do hire people who want to do experimental work. They and they alone are the research workers who will eventually pay dividends." (F. G. Banting, Med. Res. N.Y. State J. of Med., March 15, 1932.)

Unless the teachers in our University Schools of Chemistry and Biology implant in some of their bright students an interest in agricultural problems we cannot hope to enlist many of them as effective agricultural research workers. It may be that we should adopt Dr. McMeekan's suggestion and stimulate more research in our University Agricultural Colleges if only to ensure that they produce more agricultural research workers.

Dr. McMeekan's paper reached me only last night. It is possible that a more prolonged period of study might have discovered something in it about the future of animal research. As time did not permit this I propose to give you some ideas of my own about the future of animal research—ideas which have been stimulated by many discussions with Dr. McMeekan; ideas which he has been busy implementing; ideas which would surely have found a place in his paper if his Irish ancestry had not obtruded itself. I believe that animal research in the future, as in the past, must concentrate on problems relating to the economic conversion of pasture into milk and meat and wool by the grazing animal. The front line of attack must of necessity be in the paddock and the first task is the development of suitable techniques—techniques for determining what grazing animals eat, how much of each food constituent they eat, how much of these they use for maintenance, for energy in grazing, and what is left for production; techniques to determine the relative contributions of heredity and environment to production by the grazing animal.

We are now engaged with this task and it is one that we must undertake for ourselves. While I agree with both Dr. Melville and Dr. McMeekan about the importance of overseas visits, I believe that in this sphere New Zealand is destined to become a leader to which scientists from other countries will come for training. That is happening already and Dr. McMeekan is one of the leaders who is attracting such visitors.

Paddock investigation must outline the problems which require solution. It may even help to reduce what Dr. Melville calls unprofitable research. Having defined the problems, paddock research, with its new techniques, will solve some of them without aid, but others will require the assistance of laboratory workers. Sometimes a facet of a problem will be studied in the laboratory alone. At other times field and laboratory workers will be engaged simultaneously in a team investigating the problem. Eventually the finding of the laboratory must be taken back to the paddock and used there to obtain the final solution.

That is my vision of the future of animal research in New Zealand—friendly and fruitful collaboration between field and laboratory workers. I care not whether they be in one department or in many so long as they are happy in their work, which, of course, implies that they are properly trained, adequately paid, suitably equipped and sympathetically led.

For the purpose of promoting discussion I have deliberately over-emphasised some of the more contentious sections in the papers but this does not mean that they are the most important sections. The Animal Production Society is indeed fortunate in having heard such excellent papers on such important topics by such eminent men. The farmers of New Zealand are even more fortunate that these same men occupy official positions in which they can so profoundly influence the future development of agriculture.

General Discussion

Professor COOP: There is a need for better finance, facilities and stimulation for research in the Agricultural Colleges. The quality of agricultural students is not very high and it may be the fault of the other University Colleges who are not interested in Agriculture and so tend to direct the brighter students elsewhere. The ideal set-up would be where there is time for teaching, research and extension work.

Mr. THOMPSON: I believe that many farmers are not interested in Agriculture, and the farmer organisations are not active enough in doing something practical to increase production.

Mr. WOOD: A scheme such as the Franklin Farm Improvement Scheme will have some effect in lifting production. A second group is being formed at the moment. It is fair to state that better pasture management and the use of better animals will do at least as much as an increase in the amount of pasture grown.

Dr. MITCHELL: Increased production is brought about by grazing better pastures with better stock, and different soil types must be handled differently.

Mr. HAUGHEY: Some of our greatest problems are those diseases that are nutritional in origin. These are most important on the most highly improved pastures.

Mr. LYNCH: Plant breeders have produced pastures that are not suitable for lambs. It is a problem of animal production and not one of chemistry or biochemistry.

Mr. CORKILL: When specific toxic substances have been identified in pasture it is then and only then that the plant breeder can do anything about it. One example is prussic acid. When it is shown that this is dangerous then low-HCN strains of plants could be used.

Dr. MELVILLE: The basic problems lie in certain fundamental disciplines. Dr. Filmer outlined problems as paddock and laboratory problems—the digestion of pasture and its conversion into meat, milk and wool. A balance must be maintained to solve these so-called paddock problems.