CHEMICAL WEED CONTROL.
and the
INDUSTRIAL DEVELOPMENT OF NEW PRODUCTS.

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Only last week I received a research report from one of the weed control conferences in the United States - over TWO HUNDRED closely-typed pages of reports on experiments carried out by the leading weeds research workers in the Eastern and North Central United States. Results were of their investigations with Chemical Weed Killers.

Yes, great strides have, and are being made in this huge field of research. During the last two years more new herbicides have come into use, or more new uses of old herbicides have been discovered, than in any ten years previously.

Personally, and I am sure that this feeling is shared by many others, I have faith in weed control as a necessary and useful adjunct to better farming, and I believe that these research workers are constructing a sound base on which to build our endeavours for increased production. I am confident that we really are on the threshold of a new era in agriculture, in which the age-old and laborious struggle with weeds that has so long been a millstone around the farmer's neck, is at last to be shaken off.

We estimate that last year, 5000 acres were treated with hormone weedkillers by contractors, and 25,000 acres by farmers themselves. To these acreages must be added the many thousands of acres that the arecolals and chlorates were used to treat. Previously, contract weed control was almost unheard of, and the average farmer worried about weeds only if he had to.

This year a much larger acreage will be treated. I know that over 200 special low-volume sprayers will be operating, as against 10 last year, and over 25 more contractor units than last year will be working throughout the country. Truly, a remarkable increase when we consider that weed control was not considered very important two years ago, and that commercial application really started in New Zealand only in September, 1948. It may interest you to know how some of these newer herbicides and growth regulators and, as a matter of fact, fungicides, insecticides and other agricultural chemicals are "discovered". Until recent years, and one can really date the "real" beginning of active research as 1935, most of our insecticides and, more particularly, weed-killers, were 'found' by mere chance or by keen observation. The first instance of this was the discovery by James and Orton in 1899, and of Stone in 1909, that the arsenicals and sodium chloride were effective herbicides. This 'discovery' was preceded by that of copper as a contact herbicide in 1896-1897; and soon after successful use of ammonium sulphate, iron sulphate, sulphuric acid and others were reported from Europe and elsewhere. The advent of DDT as an insecticide and 2,4-D as a herbicide, gave a very definite stimulus to active research, and so began the era I spoke of earlier.

Now, Organic and inorganic chemists all over the world are busy making new chemicals and even going back over their earlier work. The old and new chemical compounds are "screened". By "screened", I mean each compound is put through an exhaustive test to ascertain if it has any merit as a weedkiller, insecticide or fungicide. Naturally, only a very few of the thousands

tested show sufficient promise to warrant further testing. With the newer organics, usually a few grams are available initially, and so, if the compound has passed the "primers" the next step is large-scale laboratory manufacture. Even the restricted second stage of small-scale field testing and larger greenhouse or laboratory trials consume relatively large quantities of materials.

Finally - should the new compound continue to show promise and so obtain its "proficiency" still larger quantities are produced for the extensive and widely-dispersed field trials that are necessary to ensure that the compound will, under a wide range of conditions, produce the same results as in the earlier and limited tests. These broad outlines really only tend to make the 'debut' of a new weedkiller seem a simple and quick process. But, believe me and I know my associates in the agricultural chemical trade will agree, the difficulties from the test-tube of the research chemist to the laboratory synthesis, to pilot plant and finally to commercial production, are many. Sometimes even very promising materials have to be laid aside because of 'formulation' difficulties.

I would like to explain what I mean by 'formulation' worries. These new organic compounds present many new problems; a wetting agent suitable for one is useless for another. A clay or talc used as a diluent for one chemical inactivates other chemicals. There is no safe, simple rule for the formulation of these new organic compounds, and sometimes months or even years of research are necessary before the final commercial product is ready for release to the public.

You will wonder who does all this research. Well, the system varies in each country, but generally research can be grouped into three classes: (1) industry research, (2) research foundations and (3) Governmental research. Industry research is normally and naturally on the problems of, and primarily for the benefit of, the sponsoring company. Research foundations are, in the United States at least, organised to study, for a consideration, special problems that are brought to them. The Government research programmes are, on the other hand, for the benefit of the public in general. In the United States there are many co-operative projects between industry and Government research groups.

This then brings me to one of the real reasons for my addressing this meeting. As I told you earlier, I have been asked to represent the N.Z. Agricultural Chemical Manufacturers' Federation and to try to express the industry's views for your consideration; but more important still, to offer their fullest co-operation to the project on 'war on weeds'. Some of the views expressed in this talk may not be subscribed to by all my fellow-manufacturers, but I am sure that you and they will agree with the object of better and more active co-operation.

In order to discuss this co-operation, it is essential that official research and extension be treated separately. Industry is already co-operating with the research workers of this country to a limited extent, and it is hoped that in future active co-operation on the field operational side will be possible. We in industry fully realise that we should, whenever possible, carry our 'new' products through the preliminary and intermediate stages of development, and to the point where new materials have a reasonable chance of success.

From here, co-operation is, I believe, not only desirable but essential. It would be, I admit, a

definite advantage to industry to have this co-operation at this stage, but I suggest that any gain to the industry would be a small price to pay as against the huge advantage to the official research worker, and the ultimate user alike. There are occasions when the industry is asked to supply basic or partly compounded chemical to official research workers who are working on some special problem, and, of course, this is a matter of individual, not national, co-operation.

I have just stated that co-operation in the later stages of development of a new product or process is necessary for all concerned. Our primary producers, naturally and rightly, look to the Department of Agriculture or Department of Scientific and Industrial Research for recommendations for use of agricultural chemicals, and unless the officers in those Departments have actually worked with the new products, they cannot be expected to advise intelligently. Industry, on the other hand, is not in a good position to market a new herbicide or insecticide until the new product has been evaluated by the public research groups. Co-operation, then, at this point is highly desirable, making it possible for the industry to obtain earlier approval of new materials and to have them tested under a much wider range of conditions than would otherwise be possible. Again, such co-operation allows the public research worker access to advance information on, and experience with, new products by the time they are ready for release to the consumer. The farmer, orchardist and market gardener are thus able to obtain the 'latest' sooner, and to have the most reliable use of recommendations.

How, then, can this co-operation be best planned?

Overseas co-operation on development of new products is divided into three types -

- (1) The manufacturer supplies the material to the research workers and others for trials.
- (2) By making of a 'grant' of financial and other aid to supplement the public funds available for the particular research problems being considered, and
- (3) covering the field of basic research, by setting up a "fellowship", which often runs for 2 or 3 years.

We come up against one definite problem, whichever path we take. It is the division between research and promotion. Too often do we hear that an article in an official publication is not understood. The chemical names, especially of the new organics, confuse the reader. And yet, if the writer of the article refers to 'trade' products, we hear those whose products were not included complaining of unfair practices.

Industry does not require official promotion for its products - all it wants is official recognition and recommendations as to the best methods of use. Believe me when I say that we, in industry, are just as critical in our reports on some of our own products as are sometimes the official research workers. We instruct our chemists and field staff "to produce facts, be they in favour of the product or against it." I believe that, soundly planned, research is the very basis of a sales programme, and no product will last long unless it is backed by active research.

I am going to suggest that if the products of the industry are going to be properly tested, then there must be a free exchange of ideas between industry and the official research worker. Results should be discussed before release to the public, for it is easy for a product

to be damned by the publication of misleading results. A product may have been applied incorrectly, or it may have been used to control some weed or pest other than that for which it was originally formulated; and in these cases it is only right that a special note be made to this effect. If an official research worker condemns a product then the manufacturer should be entitled to debate this published statement. These matters are best handled by the formation of a research committee with representatives of both official and industry research workers; and before the close of this conference, I am going to move a resolution that such a committee be set up, to plan co-operative research between both groups, as part of this Weeds Conference's future activities.

The following is an extract from "Science serves the Farmer", published by Michigan State College, U.S.A.; and if you will, bear with me, I will read this to you:

"According to theory, all the work of the scientific research stations is organised on the basis of definitely outlined projects, each having its specific objectives, procedures, personnel, etc. However, it doesn't always work out that way. Leads appear which need to be followed. Some of them take the investigator far afield, and the original outline is soon outmoded. Often these leads prove very productive, and the side-line may be more valuable than the original project.

"Many things are brought to the attention of the research worker in the course of the year. His counsel is sought on matters pertaining to his specialty. He is asked to make addresses, identifications, diagnoses, tests and recommendations. The more prominent his project the greater these outside demands. The result often is that his time for research is substantially curtailed. He becomes, in part, a teacher, consultant, extension agent. He is rendering service rather than investigating. In some instances these services may take a fifth or even a fourth of a staff's time.

"Consultation, however, is not entirely a one-way affair. There is 'take' as well as 'give'. The research worker gains much from his consultations and from others who have problems to which his project may apply. People in industry, especially those employed in industrial research laboratories, often have much to contribute to the agricultural research worker, and usually their services are freely offered."

I feel that the extract you have just heard will give at least some of you a new outlook on the need for co-operation between research workers, industry and, last but not least, the primary producer.

There are, however, some other matters I should like to clarify before I close.

Now and again we, and I mean both the industry and the official research worker, are embarrassed by PREMATURE PUBLICITY. Newspaper and the international 'popular science' magazines are the main sources of our embarrassment, but some companies are not exactly conservative, and put products on the market before proper tests are completed.

On the other hand, the official research worker often causes complications by the release of results or recommendations on the basis of limited experiments. Farmers are led to believe that such and such a chemical or product will, or will not, control a specified weed or garden pest. Too often industry has been put to considerable expense and inconvenience to inform inquirers that the reported product is not available or is not

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ready for release on the incomplete results available. Who is to judge when results should be published? Must industry wait for the official Research worker, or vice versa? This real query adds fuel to my previous remarks regarding co-operation.

We hear a lot about HOME-MADE products. These have been, and in fact are still being, recommended or suggested by many official research workers. Previously, there was rhyme and reason for such recommendations. There were few reliable commercial products available and the home-made article seemed to be cheaper. However, with the advent of the new organics it is a very doubtful practice, and the official who is thinking of recommending such practices should make a very thorough investigation of the subject before doing so.

Another matter we hear mentioned frequently concerns the misconstrued idea that new products are made from BY-PRODUCTS that were being previously burned or wasted. I do know of some instances where so-called by-products have been utilised. However, you must believe me when I tell you that the opposite is usually the case. Most of the newer agricultural chemicals are manufactured in several stages - as Mr. Gundeson will be explaining - and the manufacturer has the difficult task of finding a use for the reaction products.

I doubt if any single by-product can be marketed without additional costs. Actually, if the companion products can be economically marketed, then the consumer benefits, by the reduction in wastage and other overheads, in a lower unit price for the main product.

You will be interested to know why some manufacturers have to charge what are considered, by the uninformed, such high prices for new products. In years gone by agricultural chemicals, once introduced and accepted, could be reasonably expected to become sure sellers for a considerable period. The manufacturer would spend a considerable sum on plant and be more or less assured that his capital outlay would be repaid. However, nowadays the 'turn-over' in new products is rapid, and this year's best seller may become a 'has been' next year. Under these conditions many producers hesitate to tie up a large amount of capital in specialised plant, unless the demand is steady. An example well known to many of you is 2,4-D a laboratory curiosity in 1939 at £20 per lb., and an experimental material for growth control and a possible weedkiller in 1944 at 22/- per lb. In 1945 the price dropped to 12/6 per lb., in 1946 to 9/6 per lb., in 1947 to 7/6 per lb., and we are pleased to note a further downward trend in the United States this year.

All supplies of this material, of course, now come from the sterling area, where this price-fall has not become apparent, but we are sure that by next year prices for supplies from this source will also be reduced.

Another problem that faces industry is the apparent confusion arising from the introduction of so many "one-use" products. Many, in fact most, of the new organic herbicides, insecticides and fungicides are 'specific' in their action. They control one group of weeds and leave others unharmed; kill one group of insects and leave others to multiply; control one fungus disease whilst other diseases flourish unchecked. This characteristic can be very desirable, especially with herbicides, but there are complications. The manufacturer has to produce, and the storekeeper has to stock, a multiplicity of products, each with its special use. The lives of agronomists, entomologists and plant pathologists are made more miserable trying to find time to evaluate each new product and get out recommendations.

But I put it to you - are we to stand in the way of the advances of agricultural research, or should we endeavour to assist in the world-wide fight to increase production through research?

Must we, in industry, be accused of moving too fast when the public - the farmer, orchardist and market gardener, the man with a problem - is pushing us for the answer to this and that? Every time a new weedkiller is found for one particular pest, a hundred inquiries come in wanting answers to entirely different problems.

Recent advances in agricultural research have awakened a healthy interest in better methods for better farming; and I will close by reminding you that if we are to achieve our goal of increased primary production, let us all co-operate now and work for future prosperity.

GENERAL DISCUSSION.

Mr. P. B. Lynch: (Crop Experimentalist, Department of Agriculture) - I appreciate Mr. Watkins's talk. He has dealt ably with co-operation in research. From the point of view of the Government research worker, I think, firstly that the Government research worker cannot afford to be tied in at all to a commercial organisation. This does not mean that he cannot with profit have relationship with such organisations, but he must be in a position to apply his work impartially to all commercial organisations. This is the fundamental difficulty, that we have had to use commercial formulations to date. We appreciate the help received from firms, especially Messrs. Ivon Watkins Ltd. in Taranaki, but we feel it would be better if we used our own specifications. My second point concerns the release of information to the public. Mr. Watkins has suggested that it would be better for a committee of manufacturers and Government research workers to "screen" information before release. My own opinion is that it would be undesirable, because there should be no restrictions whatever on the research worker in the publication of information. If he has done a good job of research, he should be able to stand up to it. There are times when this might embarrass the manufacturer if he hasn't the materials for sale. If the research worker has made an incorrect statement it will be found out very shortly. If we had to wait for perfection in everything we would not publish anything at all. We don't want any suggestion that research workers should be hampered in publication.

Mr. Watkins - You misunderstood me. I had in mind no suggestion that reports should be hacked around by commercial people. Research workers cannot possibly publish all reports. There is no journal available for everything. I would suggest something similar to that in Canada and U.S.A. where the commercial man and the research worker get together for discussion and bring down some form of recommendation. I think this conference is a place whence recommendation should be sent. After this meeting many people will ask us for our recommendations. I am sure there will be none. If we can discuss reports and decide on a recommendation based on a dual investigation, I am sure this will be much fairer and sounder. Regarding basic research and field-scale evaluations, I think the Government should work with pure chemicals, but it would be only by a terrific expenditure that Government workers could formulate something acceptable to the public and the industry. Many years of research and much money have gone into the investigations by companies overseas. I doubt whether the pure chemicals used and formulated by Departments would be a sound method of checking industry.