SOME COMPARISONS OF WEED CONTROL PROBLEMS IN THE BRITISH ISLES AND NEW ZEALAND

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SUMMARY

By pointing out differences in methods of agriculture and in climate between the British Isles and New Zealand, differences in weed control problems between the two countries are explained and examined. Comparisons are made between the type and scope of research activities in weed control in each country and the field of work to which more attention might be paid in future. Some new developments in weed control are briefly described.

In 1956 I spent some 5½ months visiting research stations and farms in the British Isles, Holland, France, and Australia. I was on the move all the time and covered a lot of territory. I saw something of the usual tourist sights (and did my share of "rubber-necking"), but for the most part was out in the country areas with research and extension workers from the Government and from private firms. It seems that the time has now arrived to prove to you that I *did* study agricultural and weed control matters as well as the sights of London.

When comparisons are made between the weed control problems of any two areas the first step is to compare climates, soils, and forms of agriculture. Plants become weed problems when the climate and soil allow their vigorous growth and when the type of agriculture practised (or the lack of any agriculture) at some point allows the ingress and rapid spread of the weed. In Great Britain we find first of all a climate that has a much more severe and lengthy winter than the agricultural areas of New Zealand. In practically all parts of the country plant growth stops to all intents and purposes for several months during the winter. This basic fact has several important effects on agriculture:—

(a) It means that much of the farm area has to be devoted to the growing of supplementary crops for livestock feeding over this "dead" period. Even so, great reliance is usually placed on imported feeding stuffs as well.

(b) It also means that a much greater proportion of the grassland has to be cut for hay or silage to build up fodder reserves.

(c) As a result the stock are on grass for a much shorter period of the year than in New Zealand. In other words the number of stock-days per unit area of grassland is much lower in England than in New Zealand.

These three facts do not make for high-class pastures. They result in short-term pastures; they result in pastures often depleted by excessive cutting for hay, and pastures which do not have the beneficial effects of intensive stocking. If one adds to this picture a climate in which clover growth does not start to come away until the summer, it is easy to understand the reason for the starved nitrogen-deficient and clover-deficient pastures that are so common in Britain in the spring.

What is the effect of this on weed-control problems? The most striking effect is the relative lack of interest in weed control in pastures. Where some 50 per cent. of the farm is under crops (as is typical of large areas of all but the hilly and extensive-grazing land of Britain) and where sown pastures usually last from 3 to 4 years only, this is understandable. With

heavy nitrogenous fertilising and short-term pastures the perennial weeds typical of pastures in New Zealand do not usually have a chance to become serious before the plough is at work again.

The main exceptions to this state of affairs are found in the permanent grassland areas. The most important of these are of two types:—

(a) The poorly drained lands and “water meadows” where weeds like rushes and buttercups are troublesome, and

(b) The extensive sheep-grazing, moorland and heath-land country, which is usually bleak and hilly and covered in poor soil, often peaty. Here we have a large assortment of weeds of inhospitable climates and soils: the heaths and the heathers (not always regarded as a weed), bracken fern (not the New Zealand species), and the grass-like species such as molinia, which make up an association from which hardy breeds of sheep obtain a “picking”. Apart from some cutting or crushing of fern when it grows so thick as to smother everything else there is little weed control in the usually accepted sense of the term. In Scotland the heather may be set on fire to improve its palatability to sheep and large quantities are cut and packed in boxes for sale in the cities, but this does not constitute weed control. True weed control of these upland grazings is found only where they are developed and sown to improved pastures, which are managed, fertilised, and stocked in such a way as to create conditions favourable for the growth of grasses and clovers. As a result of such treatment these pasture species are able to suppress the natural vegetation.

If pasture weeds, on the whole, are considered much less seriously in Britain compared with New Zealand, the reverse is true with weeds of cropping land. This is understandable for out of a total agricultural area of about 30 million acres in England and Wales over one-third or 10 million acres is sown in arable crops. In New Zealand approximately the same area is farmed in one way or another but less than 1 million acres is sown to crops. The following table shows this clearly.

	Million Acres	
	England and Wales	New Zealand
Arable crops	10	Less than 1
Sown grassland	14	18
Rough grazing (N.Z. tussock)	5·5	11·5

It is not surprising that the British farmer is much more interested in crop husbandry than we are, nor, for that matter, is it surprising that the New Zealand farmer and research worker have been able to make such big advances in grassland management.

Scrub weeds as we know them here are relatively unimportant in Great Britain. There is a little gorse here and there, but it is quite insignificant. Our old friend, manuka, does not grow wild and there are a few patches of blackberry. Hedgerows of species like hawthorn get out of control occasionally, but there seems to be plenty of mechanical and manual labour available to cope with these. It is no wonder that there is little or no interest in the scrub-killing chemicals such as 2,4,5-T.

IRELAND

Ireland is different. Ireland has a much more equable climate than Great Britain and, on the whole, one much more favourable for the growing of

grass. Southern Ireland, for instance, has some 73 per cent. of an agricultural area of 13½ million acres occupied in grassland and only 13 per cent. or about 1½ million acres in arable crops. Grassland farming in Northern Ireland seemed to me to be progressive, but, with a few notable exceptions, there is much leeway to make up in Southern Ireland. As the Technical Assistance Mission stated (Organisation for European Economic Co-operation: Pasture and Fodder Production in North-West Europe (1954)) "Ireland has hereto exploited the resources of soil and climate to grow grass with the minimum application of fertilisers and largely in the absence of modern methods of grassland management." In the short time I was there I saw little evidence of much activity in the field of chemical methods of weed control and plenty of scope for the application of weedkilling chemicals. Perhaps it is just as well for New Zealand that such is the case. If and when Ireland develops her grassland and livestock farming to take full advantage of her soils and climate she will claim a large share of the British market now enjoyed by New Zealand.

RESEARCH IN WEED CONTROL IN GREAT BRITAIN

Weed control research in New Zealand is primarily a Government activity. In striking contrast to this a large proportion of weed control research in Great Britain is done by commercial firms. Some of these firms are huge concerns such as Imperial Chemical Industries Ltd., Fisons Ltd., Messrs. May and Baker, Shell Pty., Boots Ltd., all of whose research stations in weed control I was able to visit.

The Schools of Agriculture at some of the Universities are also active: outstanding centres being at Oxford and at Wye (University of London). At both of these Universities there are units of the Agricultural Research Council which are supported by Government funds: at Oxford it is the A.R.C. Unit of Experimental Agronomy under Professor Blackman and at Wye the A.R.C. Growth Substance and Fungicide Unit under Professor Wain. Both of these have been most active in the study of more fundamental problems associated with weed control, whereas commercial firms' research is primarily directed toward finding new chemicals.

Field trials in weed control are conducted quite widely by commercial interests and also by the National Agricultural Advisory Service (N.A.A.S.), which is the Government extension service and in many ways is comparable with the Extension Division of the Department of Agriculture in New Zealand. The scope and detail of the weed control research of N.A.A.S. are, however, small by comparison with those of the private firms.

The commercial interests are mostly concerned with the screening of chemicals for use as weedkillers, insecticides, or fungicides. There is great competition in this field. The laboratories each turn out hundreds of chemicals a year and these pass through a series of laboratory, pot, glasshouse, and finally field tests before being released on the commercial market. The drawback to this approach, as I see it, is that the study of weed and pest control as a complex of many factors such as crop health and productivity and soil fertility and management tends to be neglected. Chemicals are, after all, only another tool in the hands of the farmer and cannot be relied on to produce good results independently of good farm management.

It is in this sense that the work of N.A.A.S. is of importance and should, in my opinion, be greatly extended. For instance, it is not a question only of finding which is the best chemical for ragwort control. It is also essential to find the best way of using that chemical and the farm management methods that will best keep ragwort in check both with and without the chemical tool. There are plenty of instances of a misdirection of the chemical method on difficult-to-kill weeds. Good farm management will keep all but

a few weeds in check and the weeds that are really important are mostly those that thrive under good soil and pasture or crop management.

The A.R.C. Units at the universities in England have done and are doing very good work of a more fundamental nature. Professor Wain and his team at Wye College have, for example, done an outstanding job in the development of the phenoxy butyric series. At the moment most work is being done at Oxford. At Wye more attention is being paid to fungicides than to weedkillers.

We are doing no fundamental research worthy of the name in New Zealand and no developmental work in the chemical field. However, I think there is more than enough work being done in England and America in the search for new chemicals and we have our hands full in trying to cope with the flood of new products coming forward. I would like to see more critical work at the universities on weeds and weed control matters in view of the importance of the subject. Most research of the Department of Agriculture must of necessity be practical in nature and devoted to the immediate problem on hand. We have not the staff or facilities to do more than we are doing at present. With all due modesty I think our field trial work is of quite a high standard in comparison with that done overseas. It is the most important work from the short-term point of view. More is needed, and we need more staff and facilities to test adequately new chemicals that keep coming to hand. At the same time we do pitifully little work in the Government or in the university on those fundamental physiological and ecological problems the solution of which would so greatly assist our research in the practical and applied field.

SOME NEW DEVELOPMENTS IN WEED CONTROL IN GREAT BRITAIN

In a talk of this nature it is impossible to deal adequately with the new ideas in this field. However, some of the work in progress may have application in New Zealand.

Control of Weeds in Brassica Crops, Especially Kale (Chou Moellier)

Quite a lot of interest is taken in the use of sulphuric acid for weed control in kale. Best results are said to be obtained when the weeds are practically smothering the crop so that they absorb most of the acid. The usual recommendation is 80 gallons per acre of a 10 per cent. solution, though more concentrated solutions are being tried also. The kale is scorched by the acid, but is said to recover more quickly than the weeds. Fertiliser application (especially of nitrogenous fertilisers) is recommended after spraying. A similar result has been secured with potassium cyanate sprays, especially against charlock, bindweed, and red shank. Fat-hen is not damaged.

These are both drastic "last resort" sprays, which are difficult to apply and probably will not find favour in New Zealand. However, two commercial firms spoke of new hormone-type chemicals for control of weeds in brassicas, and 4-CPB was indicated as a possible material by another source. All firms are devoting much research to this problem and there is some hope of progress. The use of pre-emergence chemicals like TCA is not regarded hopefully due to difficulties of getting soil and weather conditions just right for their successful application. This conclusion is supported by results of experiments in New Zealand.

Control of Weeds in Peas

Messrs. May and Baker Ltd. at Ongar (near London) have done much work with the butyric group of hormones on peas. They have been interested in differences in susceptibility of different varieties of peas to MCPB. Onwards seem fairly susceptible to MCPB, whereas Cannors Perfection were more resistant. Mixtures of MCPA and MCPB were being

tried (such as 1 part MCPA : 7 parts MCPB) and the effects of these were additive. The low rate of MCPA is sufficient for weeds like wild radish, which is tolerant of MCPB, and this rate is not sufficient to harm the peas.

Control of Weeds in Undersown Cereals

One of the widest uses of the butyrics, MCPB (and 2,4D-B to a more limited extent) in Britain is on cereal crops which have been undersown with clovers. MCPA, when used to control weeds in cereals, is particularly harmful to white clover sown in this way, whereas MCPB is much less severe. It seems that MCPB can be used at a much earlier stage of growth of the cereals than can MCPA. By treating crops early the weeds are more likely to be in the seedling stage when the use of MCPB is satisfactory, though its toxicity toward most weeds is lower than that of MCPA. At Oxford workers considered 2,4D-B to be superior to MCPA on Polygonum weeds (red shank, bindweed, etc.) in cereals, and much better than MCPB. 2,4D-B was considered to be safe on cereals at almost any time of application.

Crop Desiccant Chemicals

Of the range of chemicals tried at various centres 5lb. PCP in 15 gallons of oil per acre is generally considered the most useful material. It does a good job and leaves no harmful residues such as occurs with arsenicals. Arsenic renders the straw of treated crops unsafe for feeding to stock or for use as bedding. Crop desiccant chemicals are particularly valuable in a climate such as that of much of Great Britain. In many years persistent high humidity makes the harvesting of pasture seeds and grains most difficult and artificial means of drying the crop are essential.

Physics of Spraying

Fisons Ltd. at their Chesterford Park Station are actively studying this problem in a well-equipped laboratory. They have examined the distortion, bouncing, and spreading of droplets of different solutions on different surfaces. It was most interesting to see the effect of hairs on a leaf. On hairy leaves coarse drops did not penetrate to the leaf surface while fine drops did. They have found that solutions with the same surface tension behave differently according to the size and shape of the molecules of which they are made up. Some will remain in contact with the leaf, others will not. They found differences between the sodium and potassium salts of MCPA in this respect: the potassium salt "struck" much better on pea leaves than the sodium salt and caused more damage to the peas.

The **speed** of absorption of hormone chemicals was found to be an important factor affecting their toxicity. When temperatures are high and humidities low, salts crystallise out on leaves more readily and are less effective because their rate of absorption is lower. A difference of this type may cause the difference between damage and no damage in a sensitive crop such as peas sprayed under different weather conditions.

CULTIVATION FOR WEED CONTROL

The British farmer can in most cases put his New Zealand counterpart in the shade when it comes to growing clean crops. This is due to many factors and of these I think three are particularly important.

1. An adequate supply of skilled labour. The traditional British farm labourer is not as plentiful now as formerly. To an ever-increasing degree he is being replaced by mechanisation. Despite this, however, the farm labour force in Britain is still much stronger numerically than in New Zealand. The small army of workers on the larger arable farms is indicative of a labour-supply extremely generous by New Zealand standards. There is much more work to do, particularly when stock are housed and stall-

fed through the winter, but the existence of such labour means that time can also be spent at other times of the year in keeping crops clean when they require it. If one adds to this a skilled craftsmanship and a pride in doing a job well, the result is clean, well-drilled crops that are a delight to see.

2. The greater importance of arable crops in Britain means that capital can be economically spent on machinery and equipment to handle such crops. Mechanisation of British farms is for the most part much more advanced than in New Zealand. Special items of equipment for sowing, cultivating, and harvesting various crops can be obtained.

3. Farmers in general are much more alive to the weed problem in crops and are prepared to do more to combat weeds by means of chemicals, cultivation, and good crop husbandry generally. The casual attitude of many New Zealand farmers who will let weeds seed freely in crops would horrify most British farmers. Where land is continuously in crops or where crops are grown for at least half of the time in the rotation such an attitude would soon make the land so "dirty" as to make crop growing virtually impossible. In other words British farmers must grow clean crops or they soon would not be able to grow any crops at all. New Zealand farmers put the land in pasture when weeds get too thick and start to infest a fresh piece of ground with weed seeds!

Some interesting items of equipment for sowing and cultivating crops were seen. For root crops, especially sugar beet and turnips, precision seeders are freely used. Most of these depend for accurate placement of seed on an endless rubber belt that travels in the opposite direction to the machine. Holes in this belt take one seed at a time to the point of discharge. Composite seeds such as sugar beet must be segmented before being used in such machines, and larger models will sow larger seeds such as peas and maize.

The use of such machines gives evenly spaced plants in the row and enables "cross-blocking" to be accurately carried out mechanically. The result is a mechanically thinned and accurately spaced crop. Cultivation both down and across rows is then possible for a time. The use of "steerage moles" enables cultivation close to the plant. This steerage mole makes miniature mole channels in the field when sowing. When the crop is intercultivated the mole runs in this channel and "steers" the cultivating machinery.

In research circles in Great Britain there is increasing awareness that "cultivation for the sake of cultivation" is not only unnecessary but may well be harmful. Cultivation for weed control is another matter. Experience in New Zealand supports these findings. The logical outcome of this is that where the chemical control of weeds in crops is successful, inter-cultivation is not necessary. In fact it may do harm by damaging crop roots and by bringing up a fresh crop of weed seeds to the surface where they can germinate and re-infest the crop.

SOME CONCLUDING THOUGHTS

I have been asked time and time again "what is the most interesting thing you saw overseas?" That's a question impossible to answer. Looking back it is true that certain things made a strong impression at the time, but these are mainly because of some personal association. It is, I feel, better to consider not one or two isolated incidents, but the picture as a whole. I have tried to do that tonight, if in an imperfect fashion.

Perhaps I can best show this broad picture as a comparison between an arable and a grassland country and an arable and a grassland climate. Ireland is much nearer to New Zealand in types of farming than is Great Britain and it has more of a grassland climate than Great Britain. The emphasis on

crop growing in Britain is partly due to climate (and one must not forget the effect of long cold winters); it is also partly due to economic considerations, for the market to absorb such products is on the spot; it is also partly due to the need for more intensive production due to pressure on available land, for crop production is a much more intensive form of farming than is animal production. It is also partly due to a more favourable topography. New Zealand has only a limited area that can be ploughed, but there is not much of England that is really unploughable. This emphasis on arable farming means an emphasis on weed control in crops and consequently less interest in pasture management and in weed control in pastures. The British farmer is most concerned with annual weeds, while in New Zealand perennial weeds are the more important.

There is some resentment of the superior attitude of "fly-by-night" visitors like myself who criticise British farming and British pastures without appreciation of the difficulties of farming in the British climate. It is likewise most unsafe to apply results of agricultural research in Britain directly to New Zealand without prior testing in New Zealand because of the differences between the two countries. We must always do our own work here to see how new findings can be adapted to the New Zealand climate and the New Zealand method of farming.

Research in Great Britain is good on the fundamental side, good on the development side particularly with respect to agricultural chemicals, but, I think, is lacking somewhat in the field testing of results of fundamental research and the placing of new chemicals to their best use in agriculture. By contrast New Zealand is strong on the field side and weak on fundamental research in weed control. I think we each have something to learn from the other.

Before concluding I must say a word of appreciation for the kindness, hospitality, and readiness to assist that I found among all with whom I had contact. In a country which is literally over-run with visitors this attitude was all the more appreciated. It is unfortunately true that we have, proportionately, far fewer visitors from the British Isles than Britain receives from New Zealand. It is all the more desirable, therefore, that we should do all in our power to make welcome those who do come here and to encourage more to visit us.