SOME OBSERVATIONS ON WEED-KILLERS

- BASED ON THE WORK OF THE D. S. I. R. -

by

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MR. M. BLACK: The Agronomy Division did NOT set out to investigate chemical weed control as a special research problem. We were forced into it by circumstances, because we had special weed problems that we could not solve in any other way. But perhaps that very fact may add interest to the story of our investigations.

Weeds are plentiful with us, the worst being fat-hen, though we are also well supplied with wireweed and spurrey and can at times grow quite good crops of chickweed. Wild oats are bad in one block, onion twitch in another and there are many patches of Californian thistle. We have plenty of other weeds, but these are the worst, and to give you an idea just how bad they are, we sent soil samples to the Seed Analyst about 10 years ago, and he made counts of the weed seeds in them. In samples from the worst paddock he found up to 470 fat-hen seeds per lb. of soil. Now there are about $1\frac{1}{2}$ million pounds of soil in an acre (to a depth of 6") so 470 seeds per lb. of soil means over 700 million fat-hen seeds per acre, and if you like to broadcast it at the rate of 1 seed to every square inch, that is enough seed to last you for more than 100 years. Actually 60 or 70 fat-hen seedlings to a square foot is a very heavy infestation, so you could easily make this amount of seed last you for two centuries instead of one and still have an excellent crop of fat-hen every year even if none of it were allowed to re-seed.

We started experimenting with linen flax in 1936, and when the war started we intensified our work with it. We found of course, as many others have found, the linen flax cannot compete with weeds, and that you can't control weeds in it by drastic harrowing, as you can with cereals. We could manage small plots by laborious hand weeding, but there are very definite limits to the area you can handle like that.

Larger plots that were not so thoroughly hand-weeded were an awful problem at harvest; hunting for and pulling by hand individual flax plants in a forest of fat-hen is a backbreaking and heartbreaking job.

So it became obvious that we couldn't go far with linen-flax unless we could find some way of destroying fat-hen without harming flax, and it was urgently necessary to push on with linen-flax research.

Early small-scale experiments with copper sulphate, borax, sodium chlorate and arsenic pentoxide were not at all promising; either they didn't hurt the fat-hen, or they destroyed the flax. Eventually we learned in 1940 that a weed-killer known as Sinox was being used in California for destroying wild mustard in flax and barley, so although no mention was made of its action on fat-hen or wireweed, at least we knew that it could be used on flax, so we set about getting some for trial.

The material we got was a bright yellow rubbly powder, when we expected a sloppy yellow paste, so we enlisted the aid of the chemistry department at Canterbury College and found out from them that we had got the parent material D.N.O.C. (Di Nitro Ortho Cresol), and that to make this into Sinox we had to grind it up and mix it with certain quantities of caustic soda and water. We managed this all right, but for the next three or four years, all the Sinox we used was home-made.

The first trials delighted us. We sprayed the Sinox solution on a patch of self-sown flax about 4" high with a Flit gun at concentrations of 5% and 10% at about 15 to 20 gallons per acre. The results were marvellous; the flax was not checked, while Scotch thistle seedlings were killed in 24 hours, and within 10 days all fat-hen, wireweed, catsear, shepherd's purse and seedling docks were dead. The fact that older dandelions and docks recovered, and that the two chickweeds and scarlet pimpernel were scarcely affected, didn't worry us at all. They didn't matter if only we could cope with the fat-hen and wireweed.

Now that early experiment is important for two reasons: Firstly because it was the first indication that we might be able to control our worst

Spring weeds in linen flax and secondly because it is the first inkling we had of the very important principle that the concentration of the weed-killer doesn't matter, within wide limits. What does matter is the total amount of the active ingredient that is applied to a given area.

We verified this later, after we had found by various trials that we had to use 20 lb. of Sinox per acre to make a thorough job of the fat-hen. We found that the standard 100 gallons of spray per acre was unnecessary, because 20 lbs. of Sinox per acre gave exactly the same results whether it was mixed with 100 gallons of water or with 50 gallons.

The upper limit is the maximum amount of liquid that you can apply without wasting it through run-off and dripping off the plant. The lower limit is the smallest amount of liquid that you can distribute over the area sufficiently evenly to ensure that every weed gets its fair share. In those days with the equipment available for field-scale work, the lower limit was 50 gallons per acre, and that became our standard quantity. To-day, the production of low volume nozzles has reduced this lower limit to a tenth of what it was, and has made it possible to spray an acre with as little as 5 gallons of solution.

However, to get back to the work done, we tried Sinox on various other crops, and found that it could safely be used on wheat, oats, and barley, but that it was deadly to brassica crops, carrots and mangels. At the strength necessary to kill fat-hen it was also fatal to lupins. On a small scale I had very good results on onions at home.

Later, following overseas work, we found that 10 lb. of Sinox plus 1 lb. of Sulphate of Ammonia per acre gave just as good results as 20 lb. of straight Sinox, and was of course much cheaper. We found too that the mixture was more quickly absorbed and was therefore preferable if there was risk of rain, within 24 hours.

A drawback to the mixture is that its increased killing power reduces the margin of safety and makes it more important to apply just the right quantity.

We tried this mixture on a small block of Onward peas which were rather too far on, but got very satisfactory results. The peas were slightly checked, though not enough to matter, and there was an excellent kill of weeds, except where they were protected from the spray by the peas.

I am not going to take up your time by reciting a list of weeds that are susceptible or resistant to Sinox, and will only say that binweed and black potato, which are highly resistant to the hormones, are very easily killed by Sinox.

When we first heard of the hormones, in secret reports from England during the war, we were naturally very interested, and got some to try just as soon as we possibly could. At present I am not going to give any details about what crops and weeds are susceptible or resistant to the hormones we have used - namely Agroxone and Weedone. I will briefly compare Sinox with the hormones then spend the rest of my time on spray application.

Sinox, like arsenic and sodium chlorate and all the others we have used up till now, is a contact weed-killer. It kills only that part of the plant with which it comes in contact. It is NOT translocated (or carried) into the root. It follows from this that Sinox can NOT kill perennial weeds that are able to send up new shoots from below the ground.

The hormones on the other hand are translocated. They not only kill the part with which they come in contact, but they may be carried down into the roots and kill them too. So for the first time we have weed-killers that are capable of completely destroying perennial weeds. Deep penetration of the roots depends on a number of factors, not all of which are understood, but one of the most important is time of application, that is, the stage of development of the plant at which you spray.

For control of annual weeds which can NOT send up new shoots from below ground, Sinox is in many cases as good as the hormones, occasionally better, and occasionally not so good. So for the majority of these annual weeds the choice between Sinox and hormone will depend on cost and convenience.

Compared with the hormones, Sinox has certain disadvantages. It is a vivid yellow, and dyes your hands and clothes, and everything you touch. For experimental work where you want to use less than a gallon tin, you have to stir up the contents very thoroughly and weigh out the required quantity of the sloppy paste, which is a nuisance. It dissolves rather slowly, and it is, of course, important to get it all dissolved. Its biggest drawbacks are that its effects vary considerably with temperature and humidity, which makes it difficult to judge the proper rate of application, and it takes some time to penetrate the plant, so that rain falling shortly after application may wash it off completely.

In spite of these drawbacks, Sinox has a place for controlling weeds that are resistant to hormones, especially in a crop such as peas.

Now Sinox, even apart from the fact that it has enabled us to carry out work with linen flax that would otherwise have been impossible, has been immensely valuable to us in impressing the importance of even distribution of spray. When it dries on the plant, Sinox leaves little dots of yellow, so that you can easily see how effective your spray coverage has been.

And I can put the guts of the matter in a very few words. **YOU CANNOT KILL A WEED WITH ANY WEED-KILLER, UNLESS YOU PUT THE WEED-KILLER ON THAT WEED.** It sounds almost insulting to tell you that; it's so obvious put like that. But in all seriousness I urge you to keep that in the forefront of your minds in any work you do in spraying weeds.

It is NOT enough to drive a spray outfit up and down a paddock with the pump running and the tap turned on, as I know from bitter experience. You must do everything possible to ensure that every square inch of that paddock gets its fair share of the weed-killer. And that is by no means easy. I am sure that many of the disappointments in chemical weed control, and that many of the conflicting reports one reads, are due to faulty spray application. When you have checked the delivery rate of your pump through the particular set of nozzles you are using, the rate of application obviously depends on your rate of travel. If the correct rate demands that you travel at 6 m.p.h. you will obviously be spraying too lightly if you travel at 8 m.p.h., and too heavily at 4 m.p.h. In all our earlier work we had at least two or three chain-length strips marked with posts along the edge of the paddock, and had a man walking alongside the truck with a stop-watch to set the pace. This of course is impossible in large scale work, but, remember, speed of travel is enormously important.

Then, it is by no means easy to make sure that you cover the whole paddock without any overlapping and without missing any of it. To ensure this we have a length of half-inch pipe along the front bumper of our spray truck, with wires hanging down from the two ends. The length of this pipe is such that when the marker wire at the end is running along the previous wheel-track the two spray strips meet exactly. For spraying crops I think that something of that sort is essential.

The next, vitally important, factor is the blocking of spray nozzles. We have had a great deal of trouble with this. Obviously if any nozzle is blocked, or partly blocked, the weeds under that nozzle will get no spray, or insufficient spray. This particular problem will be much more important with the new low-volume sprays with their very fine jets, than with the 50 to 100 gallon per acre sprays with their much coarser jets. We have cut out a lot of this trouble by screwing the nozzles further into the boom. Originally, the bases of the nozzles were flush with the bottom of the boom pipe, and any dirt in the spray just dropped into them and blocked them. Now we have them screwed in further so that the base of the nozzle sticks up about 1/8" inside the boom so that quite a lot of dirt can get into the boom pipe without getting into the nozzles. Some people now recommend having the nozzles on the end of an inverted U pipe tapped into the top of the boom, and I think this is well worth considering.

Adequate filters are necessary in the pipe-line, but, and I emphasize this, don't be mis-led into thinking that blocked nozzles are due only to dirt in the spray tank. Dirt in the spray tank will block nozzles of course, and you must have filters to trap such dirt, but by far the greater part of your trouble will come from particles of rust from inside the pipes, if, as we do, you use galvanized iron piping. If, as I have done frequently, you were to spend an hour or two following up an outfit spraying Sinox on a crop,

and frequently cantering up and hanging on to the back of the truck with one hand while you try with the other to poke a pin into the small orifice of a blocked nozzle that's jiggling about all over the place, you would appreciate the importance of this point. New galvanized piping may be all right, but it will soon be all wrong. If I were contemplating the idea of taking on contact spraying, I wouldn't for a moment consider using any spray outfit that wasn't fitted with non-corrodible piping behind the last filter.

The last point in even distribution of spray is WIND. This is a real bug-bear at the Agronomy Division, where the crops we want to spray are small areas of 1 or 2 acres in long, narrow blocks, frequently flanked by highly susceptible crops of enormously valuable nucleus seed. For example, we have developed a club-root-resistant rape that promises to be of incalculable value for lamb-fattening. Our first seed-increase area of this was perilously close to a block I wanted to spray. So I had to wait till the wind was in the right direction and I couldn't spray when I wanted to. But if I'd done my spraying when it should have been done, and spray drift had wrecked the C.R.R., I shudder to think what would have happened to me. I doubt if I would have lived to talk to you to-day.

It may be that, because of our special difficulties in that respect, I am inclined to give too much importance to wind-drift. You must judge that for yourselves. But I want to say this: apart from the danger to neighbouring crops, wind is important. Since I started spray trials, I have never - at Lincoln - struck a calm lasting long enough to let me spray one acre. Even when we have had a light breeze it has never been constant in strength or directions for more than a few minutes, so that, in practice, it is impossible to get absolutely even spray distribution. And I think that erratic breezes make it necessary to use more spray than would do the job in a flat calm, in order that the lighter patches may get enough even if the heavier patches get more than enough.

I believe that trouble from wind will be worse with low volume spraying, because the finer spray drifts more easily than the other.

Now I want to comment briefly, very briefly, on the possibility of spraying crops on the farm. Cost, to the farmer, is extremely important. To us it has been of no importance whatever; and that is not because we are working with the taxpayers' money. It is because the seed we are producing is of almost incalculable value. The linen-flax grower to-day pays, I believe, £30 a ton for his seed. I doubt if the Linen Flax Corporation would boggle at paying us at the rate of £1000 a ton for the new rust-resistant varieties we have produced, so that the expenditure of £5 per acre for spray material plus a substantial sum for applying it is a small matter for such a valuable crop. Our application costs are high, though I have never tried to work them out. Originally we put on 100 gallons per acre, though we later cut this to 50 gallons. So after every acre, or two acres, we had to run back to the yard to fill up the tank and mix up a fresh lot of spray. At first, filling the tank took $\frac{3}{4}$ of an hour, but by putting in larger pipes we cut time to a $\frac{1}{4}$ hour. On the average farm the water supply is likely to be much further from the paddock to be sprayed than on our small place, so that putting on 100 gallons per acre would rule out chemical sprays except for specially valuable crops.

But the development of low-volume sprays, plus reduction in cost of material has brought spraying within the realm of possibility.

Now some of you may be disappointed that I haven't told you more about the effect of the hormone weed-killers on different crops and weeds. But I could spend the rest of to-day and most of tomorrow telling you even the little I know about that, and Mr. Lynch is much better fitted to give you that information than I am, because the Fields Division trials cover the whole Dominion.

In conclusion I would like to say this: There is a considerable difference of opinion as to whether research workers in New Zealand know enough about weed-killers to justify making general recommendations for their use.

My own personal view is that we don't know nearly enough. But if I had to keep quiet until I was satisfied that I knew enough to speak with authority, I would be condemned to eternal silence. The Department of

Agriculture and the Agronomy Division and others have done, and will continue to do, infinitely valuable work on a small scale.

I speak for myself, and only for myself, when I say that in my opinion farmers and contractors should carry on from here. Only they can find out if large scale spraying is commercially possible.

The research workers certainly do NOT know all the answers, but they have collected a great deal of valuable information, which is freely yours for the asking.

Gentlemen, the object of my talk has been to stimulate discussion on this subject. If I have succeeded in this I will be well satisfied. Go to it, and don't pull your punches.

DISCUSSION:

MR. COOKESLEY: I was interested in Mr. Black's talk. I now desire to put a case for the vegetable growers of New Zealand. We are interested in weed control because it is obvious that weeds can be very hard taskmasters. We are very happy to co-operate and there is a possibility that the costs even though they may be high, can be more readily recovered on intensive culture rather than open field crops. I refer to carrots, spinach, etc., grown in drills. They are not transplanted, therefore you will appreciate that those crops can be easily smothered out with weeds. In the case of early spring carrots - they are not on the market in this country. The reason for that is that it is extremely difficult to control weeds throughout the winter and early Spring. The only method we know of is to keep weeding them about every 14 days by hand labour and if there is a heavy dew following the weeding those weeds will almost immediately take hold again. To-day in New Zealand it is almost impossible to buy in the shops those little short early Spring carrots which are so very valuable and which are so valuable a food for growing infants. There are also the crops such as cauliflower and cabbage which are transplanted out afterwards. Those crops are broadcast there. Immediately they are sown there is a contest between the weeds and the crop. You cannot do a thing but stand on and look and hope that the crop will win. One of two things is bound to happen. You may get your crop, but when the weeds come and it is a competition, it causes the plants to grow long and stringy. We are willing to do a certain amount with sulphuric acid sprays both on pre-emergence and post-emergence, but we are definitely interested in this position. I was extremely pleased to hear this talk and I would like to put the case for our people and while I appreciate the weed control in drains and the cereal crops, my job is to put the case for us. I suggest that you pick your man if possible, a chap that could stand a more severe knock if the experiment was not entirely successful. We offer full co-operation with the Department. I would be very interested to see some steps taken to set up a co-ordinated body. Could I thank Mr. Black for his work and again offer our co-operation, but on the health scale and the economic scale, any increase in the quality of vegetables will mean more and better food for the housewife and will mean a lot to New Zealand.

MR. MACHIN: That is quite another challenging statement. I wonder whether I could meet it. What about the market gardeners picking out 20 of their best and most able men and taking up the results of research and putting them into practice and next time you may tell us how you get on. I think the scientists would be encouraged immensely if the practical men would say, "We will go on to use your researches to help ourselves". If you can get the painstaking annotations of the scientific men it would be extremely valuable.

DR. YEATES: I would like to support Mr. Cookesley very strongly. It is important from another point of view that the horticulture, apart from providing a large internal income for the country (I am thinking of orchards) the nurseries of the vegetable growers do represent a very large section of our population.

Although they do not usually figure greatly in export markets and even some of the stuff is consumed without ever coming into the markets. They are important from that point of view, but also from another point of view. They are on a smaller scale than what we are in our farming and yet it is a type of farming that on account of the smaller scale, has a

greater cost per acre, and they serve somewhat as an intermediate laboratory for the strictly scientific and larger scale work. You can try out things in horticulture and I do suggest that more intensive work will be done.

MR. WATKINS: I would like to support Dr. Yeates and Mr. Cookesley. Last year in the weed conference in America they discussed this very same thing. They covered very fully the use of flame throwers and weedcidals and I do very heartily endorse both these gentlemen's statements and would be very pleased to see Mr. Cookesley take up your challenge and I think it is a very fine thing especially if next year he can come back and bring reports on a commercial scale of how these things do work out in New Zealand. It is the reports like that that will be of immense value to our community, and I feel that all the help from this meeting should be given to such a project and I would like to support it entirely.

MR. J. F. BROWN: I feel that this business of putting it on to the farmers to do the work -- when I was carrying out my experiments locally I was experimenting with onions with Sinox. I carried out 30 successful experiments which killed the weeds and left the onions, and in no case do the farmers tell anyone else about it. There were three experiments in the early stages. Weather conditions with me were not right and it did not work. I would not be surprised if everyone in the South Island heard of the failures.

MR. L. B. SCOTT: I should like to ask Mr. Black whether he has had any experience in treating Californian thistle in peas and at what stage did he apply Sinox?

MR. BLACK: We have not tried that at all. I do not think Sinox would be very satisfactory for that because you would only kill the top and almost immediately it seems to come up anew; and bring up new shoots of the Californian thistle. It seems to act as a stimulant. If you sprayed it early you would not be very much more well off then before and if you waited you would probably kill the tops all right, but it is a pretty difficult job to get into the crop to do that on any scale. Small patches with the knapsack would be all right but with a general distribution of a mechanical spray I think it would do too much damage to the peas. Up to now we have relied on cultivation and drastic harrowing in our peas. We do intend to carry out large scale experiments when we can get the low volume spray equipment and try it out on that basis.

DR. YEATES: Perhaps I can describe briefly the results of a small trial put on in Masterton last Spring. A farmer had peas with Californian thistle. They tried out Sinox, one part in 100 sprayed on. The peas were just an inch or two high. It knocked the Californian thistle sufficiently to get the peas ahead and apparently did the job all right there. Then he was too busy to carry them out over the rest of the year.

MR. JARMAN: I understand there are 25 million acres of cereal crops throughout Canada and U.S.A., being done with 2-4D and I think that perhaps we are not going far enough with the experimenting here. I think 2-4D has been used in Canada and U.S.A. and South Africa. Surely our climatic conditions are the same in this country and surely we can procure a lot of data from them which would be much more useful? Much more so than having our local experiments? I think we could go a step further with working on the smaller plots of ground with market gardeners. I think we should go into it more fully. The cost would be negligible on such crops as turnips where yarr wipes the whole crop of turnips out. Mr. Watkins might be able to explain to us how applying 2-4D is done on cereal crops.

DR. DOAK: Partly in reply to the last speaker I would say that weeds that infest crops in these other places are not the same as we have in New Zealand, while some of the crops that he mentioned are very very susceptible to the weed-killers and even if they used these chemical sprays they would still have a negligible crop. We have to go very carefully on what they are using in other countries. I think in our Weed Control Committee's last meeting they had a case concerning Californian thistle. The South Island people said they would be able to control Californian thistle in pastures and the North Island people's experience was directly the opposite, that they thought there was not much chance of controlling it in pastures but only under cultivated conditions, so even in New Zealand one gets these different opinions and I should imagine the position is even worse when taking overseas work. Another broad instance is chickweed. It appeared overseas to be susceptible. It is certainly not susceptible regularly in this country.

MR. M. FLEMING: I do commend you for your remarks. What about taking it up with the S.I.R. ? I think that is a much better proposition than having Mr. Cookesley taking it up. If there is a failure everybody in the district knows and probably that failure is not a correct interpretation of the results. I am one who would strongly advocate the co-operation with the scientific men along with the farmers.

MR. MACHIN: Between the Federated Farmers and the market gardeners we would get somewhere.

MR. G. C. WARREN: I have read about the way the British people more or less adopted the hormone killer. We have looked upon it as a very valuable contribution to the war effort by increased production. I would like to ask Mr. Black if he could give us any information about the progress made in England during the latter war years. We heard of some companies that were prepared to treat thousands of acres of crops with the hormone weed-killer.

MR. BLACK: They do use Agroxone extensively and they have found it very satisfactory. We find that for controlling fat-hen you have to use 2 gallons per acre. For wild mustard or wild turnip you can get complete destruction using one gallon or less. The essential difference is the weed population you are going to tackle. There are two companies that have large scale equipment which enables them to cut costs considerably. The time of application for any deeprooted perennial is very important. As far as I can make out this holds generally for all deeprooted weeds: you must put on your spray at a time when you can reasonably expect the movement of sap in the plant to be downwards and that takes place normally, when the plant is growing but is no longer requiring a great amount of food for development. It uses a little for flowering and setting seed, but at that time it is making foodstuff which is travelling downward into the deep roots. It has been shown that the hormones travel with this manufactured or soluble food in the plant so the time to apply it for the destruction of perennial weeds is just at the early flowering or bud stage. At any other time you will not get anything like the same kind of kill. I am perfectly satisfied with that with Californian thistle.

MR. S. P. TAYLOR: Yesterday Mr. Lynch and Dr. Doak said that we have seen the high volume spraying method come and go and also 2-4D dusting. Would that not be a sign of progress ? Previously, to spray 10 acres took up to from 100 to 1000 gallons of water. To-day 20 gallons are required. Also for the back country men, the new method has made spraying a more possible proposition for more susceptible weeds. Mr. Scott mentioned the weeds growing along fences. The control of weeds is of national importance. All roads and rivers will have to be treated. I have in mind the spread of weeds in Greendale, especially Californian thistle coming from the Hawkins river. We have heard a lot about weed control and one of the things about weed control is every patch required spraying. If I were a farmer in the Leeston district where there is wild turnip and the 2-4D could control it, or a farmer in the Sheffield district where you could not grow a crop of barley on account of spurrey, do you not think that in this instance that the hormones have a place ?

DR. DOAK: My name was mentioned. I would like to point out that I do not say at all that we are not making progress in these things. The fact that low volume equipment is available and looks likely to be a success - I think it is a step in the right direction; as I attempted to show yesterday, the other methods have not proved to be 100%. I also tried to convey my opinion that the low volume spray has not been completely proved but I was very hopeful that it could be satisfactory.

MR. Y. T. SHAND: I just want to ask one question of Mr. Black. Granted that the control of weeds by the hormone system would be successful over a period of years, but would it not leave the soil in a more or less impoverished condition ? Would it not have an effect on the bacteria or the life of soil in time ?

MR. BLACK: I do not think there is any risk of that. Dr. Doak has done a lot of work on that. As far as we are concerned in the Agronomy Division, we believe the effect on the soil is very transitory. At the ordinary rate of application, Weedone is destroyed in the soil very rapidly. Perhaps in a week or two or a little longer, and I am reasonably sure it will have no effect on the bacteria of the soil because they do play a major part in breaking down these substances.

MR. Y. T. SHAND: I noticed complaints from the Nelson district from several fruitgrowers there, that their land was becoming as they thought, chemically sick from the constant dressing of the different sprays on the fruit trees. That was in the paper.

DR. DOAK: The point there is that these hormone substances stimulate bacterial activity rather than the reverse. It certainly stimulates a certain section of the bacterial population which are responsible for the breakdown of these compounds. There is some difference between the rate of break-down between the two classes of hormone. Depending on the soil temperatures, the breakdown is comparatively rapid. It is complete in 5 or 6 weeks and in many cases much quicker. I do not think you have any worry about the effect on the bacteria.

MR. MARTIN: I am particularly interested in the killing of all grass with regard to paving. I would like to ask Mr. Black if arsenics are the best stuff to use for that.

MR. BLACK: I cannot tell you the effect of arsenic on the soil. It is dangerous to use on the agricultural land. We have used it very efficiently to clean shingle with the Agronomy Division and I am reasonably sure that if we cleared the shingle afterwards we would get nothing at all. I know very little really about destroying grass because the main line we work on is to try and do as little harm as possible to grass. Possibly fuel oil, deiselene or Sinox dissolved might be worth considering. That would be more expensive I think, than arsenic at the present prices.

MR. P. BARRAUD: Mr. Black made mention of pre-emergence work with the hormone weed-killers. I think the conference would probably be interested to know what work has been done at Agronomy on pre-emergence.

MR. BLACK: We carried out a fairly large scale trial the season before last on peas and barley and more recently on oats and again on barley. We tried putting on 1% and 5% dust at the rate of 2 cwt. per acre up to 5 cwt. per acre, and dusted 1 cwt. at 5% dust. The difficulty with the pre-emergence spraying or dusting is that the effect does vary so much with the weather and the soil moisture at the time of application. In one case we got a rather curious result. The surface was very dry at the time of application and there was very little rain for some time. The control of weeds was pretty good, and when a shower of rain came later, when the flax was about four inches high, you could smell that characteristic smell. The stuff had apparently been lying dormant until the rain released it and the effect on the flax was very strong - it practically ring-barked the flax. We had great hopes originally for the use of dust as pre-emergence treatment because it is so very much more easily applied than sprays, and we thought it could be put on through a distributor but we have been disappointed with the dust and the reason is that even with the best manufactured distributor, you did not get a sufficiently even distribution. The stuff is there on the ground in small lumps all over the place. In places there are little spots that have had a heavy dressing of dust and in between there is none, or very little indeed. You secondly, do not get the control anticipated. In the right conditions, the spraying pre-emergence treatment gives very good results but it does require double the amount of spray and because of the uncertainty of the weather I am just a bit doubtful as to what extent the pre-emergence treatment will find favour. If the weather conditions are right you get just about as good a result. The advantage of post-emergence treatment is that you get a certain kill, but with the other, there is a gamble in it. I would like to mention the question of using these sprays for control of weeds in turnips or rape. That would be fatal. Rape and turnips are much more easily killed than any of the weeds. I very much like the idea of farmers trying out things, and I think that that should be encouraged as much as possible, but I do most strongly urge you to get information which is available, beforehand. We can save you quite a lot of fatal blunders and a lot of money. The second point is, please let us know the results of your trials. If you carry out successful trials please let us know so that we can pass it on. The rest of you will benefit from that.