

are likely to occur with constant or occasional use, with the effect of these residues, and with the question, are there any residues, and if so, what are they?

The other side of the matter is toxicology which deals with the activity of a compound at levels at least one hundredfold over what is likely to be found as residue in plant or animal use, and in human consumption. So toxicology is concerned with excessive exposure. We usually do this over two years with experiment on two mammals, usually a rat and a dog, and through two cycles of reproduction. We determine the one hundredfold effect of the residues likely to appear. We assume that a one hundredfold margin of safety is sufficient to preclude the possibility that the residues which might appear do harm to the consumer after exposure. If we find that 1,000 parts per million of, let us say, "X" compound is the minimum amount which appears to be toxic, and that this was the rate after chronic exposure over two years, the maximum residue allowed under United States law would be ten parts per million of a certain product. But if it were found that a farmer could get by with an amount that would only leave one part per million, this usually assists us in determining the maximum that we will allow. But if later on it turns out that a little more is needed, that amount could come up to seven; but they usually think of 100 as a margin of safety. However this has not always been the case. This has come into practice in the last 10 to 15 years. Formerly they were a little more generous. But as occasion and knowledge expanded they have reduced it to one part as a margin of safety. That is what that is. We estimate that it costs us from \$300,000 to \$350,000 per pound.

Mr. OTTO: In our attempt to increase the availability of arable land, and to increase food production, we are concerned with two fields; one is the control of insects, parasites, and so on, through insecticides and pesticides. The other field is through more intensive training, and the possible use of fertilizers.

In which field do you think, over the next 50 years, there would be the best chance of increasing food stuff production, through the use of new fertilizers, intensive training, and more intensive farming, or through the use of better control of insects and parasites?

Mr. WHITE-STEVENS: I do not think you can put one ahead of the other. That is the reason we have been so successful in North America during the last 100 years. We have really supplied four legs to the table. The first leg is education. The primary function of the library and of research is to bring the finding of the research laboratory to the experimental farm, and out to the grower on the land so that he may put these things to work. The second is the field of biology in which I would of course include genetics, physiology, and pathology, in order to improve our plants and animal stocks so that we can get the most out of our seed, as it were. But the third leg under the table of course is agricultural engineering which has allowed us to have one man perform the work which formerly took 100 men to do. And finally, the fourth leg under the table of course is agricultural chemistry which itself may be divided into distinct areas: growth promotion in the form of favourable crops and animals, and in the form of nutrition fertilizers, so that we may get more mileage, as it were, out of our seed stock and our land; and the other aspect of agricultural chemistry can be regarded as growth suppression of undesirable pests, insects, and diseases, which attack our domestic crops and animals.

So in a nutshell, this is the concept of what agricultural science has been, and what, I think most of us would agree, it should be.

I would not want to see pesticide research done at the expense of education. To do this would be foolish. We must carry out training. There is no point to a discovery without finding out where it can be put to work. Burying it in the laboratory does not have the efficacy of carrying it out in practice. We must maintain education among our young people so that they may make use of every modern development which comes down the pipe.