IV. B.

DISCUSSION OF SELECTED TOPICS

Moderator: Dr. Wisseman

When Should Conventional Insecticides Be Used?

Dr. Busvine: Dr. Wisseman, insecticides were presumably used against considerable louse resistance in Burundi. Could you give us some observations on the extent to which they were beneficial?

Dr. Wisseman: That is a difficult question to answer because there was one still commonly available insecticide to which the lice were sensitive—lindane. It was not for lack of an effective insecticide that louse control programs were not effective, but because of the complexity of the living conditions, the communications, the political situation, and the logistics of the louse control campaign. There were also the usual human frailties that led to the diversion of supplies and the like. But there is no doubt that a properly mounted louse control program with adequate money, manpower, and materiel could have stopped the epidemic.

Dr. Murray: The sporadic cases or small epidemics of louse-borne typhus exemplified by those that Dr. Gaon has been combating in Yugoslavia are ideal examples of a situation in which a conventional insecticide alone can almost completely stop disease transmission. Insecticides can also be used quite effectively in sudden, massive epidemics such as that in Naples during World War II.

The question of the conditions under which insecticides could not be expected to be effective is related to what Dr. Fabrikant said about the presence of lice after an insecticide program has been carried out. It also relates to the prevalence and density of lice. If the prevalence of lice is higher than 15 per cent and density is also high, as in Burundi and probably in South America, then the major typhus epidemic and also new epidemics caused by new Brill-Zinsser disease cases will continue after the insecticide program is finished. Under such circumstances there may be Brill-Zinsser cases and sporadic epidemics that will have to be attacked and eliminated, as has been done in Yugoslavia. It is under conditions of high louse infestation that insecticides by themselves will not in most cases prove effective or economically feasible in achieving long-term control. If the louse infestation is low, it may be low enough so that new typhus epidemics will not develop and epidemics in progress will die out because the potential for disease transmission is too low.

Dr. Wisseman: Would it be safe to say that the use of insecticides produces only a transient effect unless they are repeatedly applied under ideal circumstances? But also that this kind of effect can be very useful in controlling typhus in acute situations, as when a society is temporarily disrupted but is expected to return to its normal louse-free state in a relatively short time?

In general, however, I think that the use of

insecticides in endemic situations is quite limited if eradication is the goal.

Dr. Murray: I agree, as long as you keep in mind that Dr. Gaon can find lice in Bosnia up to the 3 per cent level with low densities. Despite this there are no epidemics in Bosnia. The problem is thus not eradicating lice. Insecticides should be perfectly adequate in areas where there is a low prevalence of lice. If the prevalence is high, not all lice have to be eradicated; one need only bring louse prevalence down below the 3 per cent level with low density, and then an entirely different situation obtains.

Dr. Wisseman: In the Mexican situation I mentioned earlier the prevalence was between 7 and 10 per cent, which still broke the transmission chain. Cutting the chain is a short-term objective rather than a long-term attempt at eradication, though. I would like to differentiate between the two concepts.

Dr. Kostrzewski: I would suggest that we entomologists, epidemiologists, and microbiologists cannot solve the problems of lice and louse-borne diseases by ourselves; we need the help of sociologists, economists, and members of other disciplines.

Dr. Wisseman: You are entirely correct, but I think that from the biologic viewpoint we can now define the conditions under which we can expect insecticides or other control methods to work or not. It is then up to the economists, sociologists, and others to determine the method's economy, cost benefit, and so on.

Dr. Smith: The use of insecticides for louse control requires exactly the same approach as the use of insecticides for the control of anything else. First things first: If you want to attack a filth-breeding insect, you first control the filth; if the insect is aquatic, you manage the water; if it is a crop pest, you can plow under crop residues or carry them off. You employ any type of sanitation you can. Certainly the first thing in louse control is to keep clean if you can. The next thing we advocate is mechanical or cultural control methods.

Since the beginning of the first insect control programs with lead arsenate and Paris green, entomologists have been saying they are confessing failure when they have to recommend the use of an insecticide. We have not been able to manage the population as we should like to. We don't have the knowledge we should have. Any use of insecticide is a temporary measure. We use it because we don't have anything better.

When I went to typhus infested areas I got vaccinated, and I felt a lot safer having been inoculated than I would have felt with DDT, malathion, or lindane in my clothing. Certainly vaccination is the best protection one can have against typhus.

You may know that at a certain time of the year a certain insect is going to attack a certain crop. You don't wait for an infestation to build up; instead, you treat the crop at a predetermined time. If an insect appears some years in pest porportions and in other years not, an insecticide should not be used until it is determined whether it will appear in pest proportions that particular year.

Lately we have been emphasizing the measurement of damage potential as opposed to the mere presence of an insect. Ten per cent infestation occurs in certain crops and is insignificant. It is easier and cheaper to lose 10 per cent of the crop than it is to treat for certain insects. But if an insect carries a plant disease, one insect per plant may wipe out an entire crop and so no insect presence can be tolerated.

Louse control is similar. If a population is lousy but not diseased and there is no individual or social demand for louse control, routine insecticide application might not be indicated. But if there is a demand for control—from the people themselves because they object to lousiness or from health

agencies that fear the danger of disease—then the problem should be attacked with the best methods and materials available, including insecticides to provide temporary louse control.

Dr. Fabrikant: In defense of the people in Burundi, Dr. Smith, I commented that the records indicate that they presented themselves willingly for delousing on two occasions we know of, once during the 1933-34 epidemic and the other time when DDT was first introduced in Ngozi Province in 1949. Moreover, their willingness to get rid of epidemic typhus was quite apparent when we were in Burundi. For example, we informed a local administrator at noon on a Saturday of our intended vaccination schedule for the following week, and 2,000 people were waiting to be vaccinated when we arrived at the vaccination site Monday morning.

Dr. Reeves: I realize that lice are ectoparasites of man and are protected from the environment when they are under garments. I can't help but ask, particularly if we are trying to reduce a louse population below a threshold to dampen transmission, whether anyone has studied the effect of ultralow-volume (ULV) applications of malathion or other insecticides on lice over large areas? Such large-scale applications are now being carried out in Thailand for mosquito control in urban areas. A good, quick look could be taken to see what is happening to the louse populations in these areas.

ULV sprays penetrate fairly effectively into houses and clothing. It is amazing how insecticides can penetrate to mosquitoes when you don't expect the spray to get to them. I suspect that aerial ULV sprays or ground cold fogs with a material like malathion have not been applied very often to a human population in which lice exist. These two methods of insecticide application are different from those usually used for louse control.

Dr. Gratz: We have not anticipated very much control of body lice for two reasons. First, as far as we can determine, very few people in the treated Bangkok area were louse-infested; we certainly never say any. Second, the only way I can imagine that ULV applications would have an effect, assuming that lousiness was a problem, would be for the spraying to be done directly into the house so that it would reach everywhere, including clothing. In that way it would probably kill hatching lice attached to the clothing. I can't imagine that there would be enough droplets from aerial ULV spraying to kill lice everywhere in a city, let alone enough persistence to kill hatching lice.

Dr. Smith: Ultralow-volume application rates are more or less 350 g per hectare. That amount does constitute many milligrams per square meter, and it does take a fairly good residual application to kill lice with malathion. I doubt that even direct application in the house would deliver enough volume to get the insecticide inside clothing.

Dr. Fox: We have been discussing when to use insecticides, and the next question is whether long-term louse control in large areas is feasible. Let me give an example relevant to both these questions by describing a project in which insecticides were used inappropriately.

With the Pan American Health Organization's blessing, a program existed in the early 1950's to apply DDT semiannually to a 50 km strip on both sides of the border between Bolivia and Peru. The intent was obviously to keep rickettsiae, lice, or both from crossing the border. Since the conditions on both sides of the border were identical, however, the effort was relatively futile.

How Feasible Is Long-Term Louse Control Through Insecticiding?

Dr. Gratz: I think long-term louse control with insecticides is possible, as long as the human population is accessible and the

insecticiding is adequately supervised. But insecticide resistance tests would also have to be made continually and alternative insecticides would have to be identified and readied. I am not quite sure what the objective would be if it were not halting disease transmission.

Dr. Wisseman: Stopping disease transmission would be a secondary benefit. I would hate to focus on disease transmission alone because it may be only part of the picture. One of the fallacies of some of the programs I have seen has been that they got started only when the disease expressed itself recognizably; they ignored the underlying problem. That is why I would like to confine this discussion to louse control.

Dr. Murray: I want to elaborate a little on one of the subjects I mentioned this morning, the louse's clothing milieu. Basically, what we are trying to do is to make this milieu unfavorable and uncomfortable for the louse. Drs. Busvine, Wisseman, Fabrikant, and Makara have already commented on this in one way or another.

The problem is to arrange it so that people in lousy areas have more clothes and change them fairly regularly. This is not impossible, since Dr. Fabrikant noted that the people in Burundi now wear clothes quite different from those they wore in the 1930's. It is not unprecedented, then, for people to change the kind of clothing they wear. Dr. Makara has noted that if people change their clothes once a week or so, they will get rid of a vast number of lice. I was much heartened to hear that in Bolivia they were able to establish some kind of laundry in a not-too-wealthy community and that the people used it.

If money were available, someone could make a broad study of the social and other life habits of these peoples. If you wish to change their dressing habits slightly, you will have to know how to do it.

Dr. Ormsbee: It should be pointed out emphatically that our armamentarium of insecticides is finite since there are really only two that are available and useful. Because of that the use of either for the long-term control of lice would be a wasteful use of tools that might be extremely important for combating either explosive epidemics or endemic epidemics. We should be very careful about using a valuable weapon against a secondary problem and in so doing perhaps rendering it ultimately ineffective through the development of insecticide resistance.

Dr. Gratz: I don't think there are many vector control specialists who would want to rely only on insecticides for long-term control. Any of us who is responsible for a vector-control program would start out with insecticides to lower the louse population and avoid disease transmission, but he would also soon look around for any other measure that could be introduced.

As Dr. Ormsbee said, we do not have terribly many insecticides, but lately we have been rather better off. Two per cent Abate, 5 per cent carbaryl, iodofenphos, and lindane are still active in many parts of the world, and there are a number of others. The pyrethrins can be used. A number of other compounds of low toxicity that are emerging from the WHO testing and evaluation program could be introduced.

What Is The Role Of Health Education In Combating Lousiness?

Dr. Wisseman: It seems to me that one important way we can deal with lousiness is through health education programs. Are there comments?

Dr. Tarizzo: Though all control methods should be integrated, health education is probably the one that will give the best financial returns in the long run, if not returns of time and effort. It is also some-

thing that can fairly quickly be delegated to local personnel.

Dr. Makara: Health education should first be directed to the nurses and auxiliary medical personnel who deal with the lousy because such workers are influential with the people they serve, yet many of them lack knowledge of louse biology and control methods. Only after we have educated paramedical personnel should we direct our attention to the public.

Dr. Gaon: The first thing is for a competent health educator to study the customs and living habits of a people to determine all the relevant factors that enhance the spread and maintenance of lousiness. These factors may differ greatly among ethnic groups. The second step is to find good teachers. The teacher is the main person in the village who can influence and stimulate people to kill lice themselves. Oral and written health propaganda would be another way to influence people. Finally, we must encourage governments to use mass communications media to get the message across.

Dr. Gear: Almost every family in southern Africa has a transistor radio. Radio is by far the best way of reaching the population for the dissemination of health propaganda.

Dr. Wisseman: Even in developing countries people have radios, but sometimes the radio isn't too helpful. The station in Burundi once broadcast completely misinformed comments about typhus epidemiology, for instance. Its instructions were to shave one's head and shoot the rats!

Dr. Murray: What sort of health care and education facilities exist in Burundi?

Dr. Wisseman: They don't have an elaborate health system in Burundi yet, but in countries like Burundi and Bolivia they do have schools. In the latter country we saw posters about lice and typhus everywhere we went. Some of them said "DDT," but others showed how to use an iron on clothes or soap and water to get rid of lice. The posters were directed at school children because it is recognized that many of the older people are relatively inflexible in their habits. Another thing we found in Bolivia was health teams speaking the local Aymará or Quechua language and using diagrams to explain the role of lice in disease transmission. That was a simple but apparently effective way of getting the message across to the people.

Dr. Tarizzo: In Burundi they are now using a fairly large number of quite satisfactory posters about typhus and lice written in Kirundi, the local language. They are probably effective. Health propaganda must also be tailored to local conditions; the use of irons to kill lice on clothing, as in Bolivia, would not work in Burundi, for instance.

Dr. Wisseman: I can think of two other examples of poor message tailoring. In one instance the government of one of the South Pacific islands included a statement in a brochure about flies that read, "If flies in the bedroom are too bothersome and too numerous, try a bucket of manure in the kitchen." In the other, an attempt was made 20-odd years ago in North Borneo to get across the ideas of simple sanitation. A fine movie was prepared in which were shown a latrine and an outhouse and the proper disposition of feces, and then in color this red stuff went out and contaminated the water supply. When the viewers left the theater they were asked questions to see if they had understood the film. It was their impression that as long as the water did not turn red, it was all right.

Dr. Busvine: One suggestion, which may or may not be useful, is that WHO hire someone skilled in writing leaflets at the right language level about lice and louse control and make the leaflets available so that any government could translate them into its own language and distribute it. The Food and Agriculture Organization once

hired someone with such skills to write such a pamphlet on insecticide resistance for agricultural extension officers and advisers in developing countries.

Dr. Makara: In Hungary we distribute two publications, one for doctors and similar people telling everything about typhus and its prevention, and the other for nurses, disinfectors, and others listing simple preventive methods that can be used anywhere.

Dr. Traub: We really should not criticize local people too much for their ideas on sanitation. Oftentimes they know what to do but there is nothing much they can do. In the Himalayas or the mountains of Borneo, for instance, it is just too cold to wash oneself or one's clothes very often. I know quite a few Caucasians, including members of our own teams, who washed as little as the local people—in other words, as little as possible. It is true that we could change our clothes, which was more than they could do; but even if the natives had had a change of clothing, would that be a real solution? If they wore woolens, there is no way they could wash such fabrics without ruining them. They don't have access to our modern cleaning chemicals.

Dr. Vinson: I quite agree that education at this level is extremely important. It is even more important, however, that governmental planners and economists responsible for making decisions that affect large numbers of people receive at least a rudimentary health education. Decisions at the governmental level profoundly affect a population's socioeconomy. Ultimate control of body lice results from socioeconomic improvement.

During the Symposium we have been talking good classical public health. Public health as a system has traditionally appeared to operate as though it were in a vacuum, isolated from other activities in our society that often have a greater impact on the incidence of disease. The current epidemic of typhus in Burundi appears to be a case in point. The lice transmitting typhus in that country have apparently become resistant to insecticides because the insecticides have been extensively used in agriculture. Instruction in personal hygiene seems a meaningless exercise to people who do not have enough water to wash with or a change of costume in case they could wash their clothes. Though an intensive immunization program would undoubtedly modify the course of the epidemic, real control will come about only with economic improvement. I want to support Dr. Kostrzewski's earlier statement that we need economists and government planners in this kind of discussion, because their intelligent understanding of the problem is essential if they are to make wise decisions.

Should Some Insecticides Be Reserved For Louse Control?

Dr. Smith: Numerous insecticides that have been dropped in early testing might be developed for louse control. They were effective in preliminary evaluation but were withdrawn because the manufacturers chose not to develop them, either because of patent difficulties or high production costs, or—more often—because the manufacturers had other insecticides that were chemically similar but had a broader range of application.

But who is going to pay for the cost of development? This involves toxicologic studies, formulation (which is very important), and development of methods to produce compounds of high purity. All that is expensive.

There might be some cross-resistance, but I believe it would not be too difficult to find a compound that would be a good louse toxicant and would not be used for other purposes if someone were willing to assume the expense of developing it.

Dr. Gratz: Most of the insecticides that are going to be developed to the point of

being purchasable are probably going to have an agricultural market. We now have about 1,800 compounds in the WHO insecticide evaluation scheme, which means that the insecticide industry has probably considered between 40,000 and 60,000 compounds before we got the 1,800 to look at. Most of the 1,800 are not commercially available. Some of them were entered in the screening process because the manufacturer wanted them looked at in the early stages of development. They got up to stage 4 or 5, at which point we said to the manufacturer, "It looks good, so can you let us have 150 kg for a village-scale trial?" The manufacturer would usually respond that it was not economically feasible to make it.

Among the 1,800 compounds are some that would probably be very suitable since they are low in mammalian toxicity, though toxicologists might say that studies should be made of their chronic toxicity. But I would be very pessimistic about the possibility of reserving favorable insecticides for use against body lice alone, or even for broad public health use alone, because manufacturers would not think them profitable.

There are some compounds that have been developed through a fluke, in part because of encouragement from public health agencies, that have not had a wide agricultural market. Abate is one such compound; it is used for a number of truck crops, though such use is comparatively restricted; in addition, its agricultural uses are ones that are unlikely to induce resistance in insects of public health importance. It will be used more and more widely as a mosquito larvicide in potable water because of its low mammalian toxicity. We are encouraging the company manufacturing it to get it licensed as a 2 per cent louse powder as quickly as possible. In fact, since the licensing is going to take so long, we ourselves have accepted the mammalian toxicity data in the literature and the toxicologists have agreed to the use of this compound against body lice.

Dr. Makara: I have the feeling that we already have too many insecticides which are not used in some countries. Where a compound is not used and lice are susceptible, any such insecticide could be used. On the other hand, if we preserve any insecticide, we should take into consideration that a number of new insecticides are proved each year. Why preserve an old one?

Dr. Gratz: I would like to take issue with Dr. Makara. The number of new insecticides coming out every year is dropping. Ten years ago we might get 300 or 400 candidate insecticides into the WHO evaluation program, but today if we get 20 or 30 a year we are doing very well. When industry has to pay between $1 million and $5 million for the necessary toxicologic and environmental clearance, it is going to restrict the number of insecticides it brings forth to the smallest possible number. It will do all the biologic testing to make sure it has a winner before it puts a compound on the market. Thus, I think we have to guard the insecticides we have and make the most out of them.

Dr. Perry: Yesterday we touched lightly on the subject of synergistic compounds, which is really going to the root of the resistance problem. It is known that resistance is in most cases due to enzymatic attack on the molecule itself, and that the synergist inhibits that detoxication mechanism and restores the system more or less to its susceptible level. We are now discarding one insecticide after another because of this resistance phenomenon. Yet in the laboratory or even in the field we have always used pyrethrins with piperonyl butoxide. We never use pyrethrins alone because that is useless; we add piperonyl butoxide to synergize pyrethrins to prevent breakdown.

But we have never suggested that piperonyl butoxide be used with propoxur

or carbaryl, which would make the combination considerably more effective and would also lower the concentration of the insecticide necessary to kill the resistance strain.

This is one subject that I have talked about many times at meetings, but no one has yet capitalized on it by suggesting formulations that could be used to control resistant strain, instead of just dumping everything that we have. I believe we can bring back many of the insecticides that we now consider "useless" for control of resistant insects if we apply a little ingenuity and find ways to inhibit the enzyme system that is responsible for the detoxication of the insecticide.

Dr. Smith: Synergists have been tried. We tried several for DDT, for instance, and the resistant insects developed resistance to the synergist combination. We might use synergists for some compounds such as carbaryl, but for compounds like propoxur it costs more to add the synergists than it does to double or triple the concentration of propoxur, which in this case provides the same effect.

Dr. Wisseman: Should an insecticide restricted to louse control be developed?

Dr. Gratz: Rather than doing that, I would suggest that we look at those compounds that, for one reason or another, have not been taken up in agriculture or have fallen out of agricultural use to determine their suitability for louse control. One such compound we have been looking at is methoxychlor which, it turns out, is biodegradable and has a low mammalian toxicity.

Dr. Eldridge: I would like to suggest that we should find a pesticide that would be prohibited for uses other than louse control. DDT is already prohibited for other uses. I think that it requires emphasis from symposia such as this to make sure that not only DDT but other chlorinated hydrocarbons and the organophosphates are protected from banishment for purposes such as emergency louse control.

Dr. Smith: Who is going to prohibit the use of these compounds for purposes other than louse control around the world? Presumably, we might convince a few governments to restrict their use, but there are many countries. Is there any agency that would have the authority to restrict their use everywhere?

Dr. Wisseman: I doubt if anyone could answer your question about what international agency could restrict the use of compounds in question. But we can state certain principles that might be useful. One would be to select compounds that are not in demand for other uses, and the other would be for international organizations to publish and distribute such recommendations to governments so that they would be influenced to some extent.

Dr. Busvine: I am afraid that I am a little pessimistic about this. Though there may be dozens and dozens of names in the insecticide books, cross-resistance is going to rule out a large number of them. We have almost got to rely on three existing types, BHC, DDT, and organophosphorus insecticides, which have more or less cross-resistance. Let us not imagine that we have an unlimited number of new insecticides coming along. I would support Dr. Gratz's suggestion that we should keep in mind insecticides like methoxychlor and lindane that are going out of agricultural use.

Should Vaccination Be Relied On To Prevent Typhus?

Dr. Fox: It seems to me that there are two major questions about vaccines. In the United States, at least, and probably in many parts of the world, it would be quickly discovered that no vaccine would be available if suddenly needed for a typhus outbreak. One of the things that should come out of this meeting, therefore, is a strong effort to insure that effective vaccines are available and can be shipped in adequate amounts

when and where they are needed.

The other question is the type of vaccine. The only type that has been licensed for use in the United States, and I assume the same is true in other countries, is a killed rickettsial vaccine. Although there have been few if any field studies that confirm the effectiveness of such a vaccine, I think the military experience in World War II and the experience of laboratory personnel working with rickettsial diseases is pretty good testimony that such vaccines can be effective. The vaccine we have had in recent times in the United States was probably not effective, but it was never put to a test.

The other kind of vaccine is the living, attenuated E strain vaccine or its equivalent. I don't know of any equivalents that have been extensively used. The problem is that not only is there no substantial supply of this vaccine now available (though I understand a modest supply will be produced in the near future), but that even if it were available, it has never been licensed. Who is going to authorize the use of a vaccine that has not been licensed, even though it is effective?

One might ask why it has not been licensed, and I suppose the reason is a commercial one. In the United States at least, a manufacturer has to have a profit-making motive to want to produce a vaccine and then he has to apply for a license. Because there are few typhus cases in the United States, there is no commercial reason for producing such a vaccine. How, then, can we encourage someone to apply for Government approval so that we can work with a licensed vaccine instead of an unlicensed one?

Finally, when should a vaccine be used? In addition to vaccinating travelers or persons in epidemic areas, I think we should use a vaccine in truly endemic areas or in areas such as Burundi where typhus has not yet really become endemic but exists in force. Used in endemic areas, such a vaccine would present problems of administration. Where a multiple-dose regimen and reimmunization would be difficult, it is obvious that a one-dose, long-lasting vaccine would be ideal. The E strain vaccine fulfills such a requirement.

Dr. Tarizzo: Two killed vaccines are commercially available, one in Canada and the other in France. I cannot say what their quality and efficacy are because we do not have detailed information.

Dr. Wisseman: Such a vaccine is also available in the United States, but its varying quality has raised some questions.

Dr. Tarizzo: There is also another vaccine that has been available only since the outbreak in Lesotho was reported. It was prepared in South Africa.

The E strain vaccine, which was tried in Burundi under WHO sponsorship, is still experimental to a certain extent. It is effective. Studies are not in progress in Bolivia to test its acceptability, and work is being done elsewhere to test its stability under laboratory conditions.

Dr. Gear: If the need existed, it would be possible for vaccine production to be stepped up again so that several million doses could be produced annually, as was done during World War II. A live vaccine may be more effective in eliminating infection, and such a vaccine may well be the answer to typhus as it occurs in some parts of Africa, as was the 17-D vaccine to yellow fever.

Dr. Murray: What is the per-person cost of some of the various typhus and louse control procedures such as vaccination, insecticiding, and health education?

Dr. Tarizzo: The killed vaccine costs between 30 and 70 U.S. cents per dose. With regard to antibiotics, I would like to stress again that single-dose treatment with doxycycline has given very satisfactory results, but doxycycline costs about 50 U.S. cents

per dose. Standard treatment with tetracycline costs a little less, but delivery costs are higher. This is why it is very difficult to give a program's cost, since it depends on the priorities that exist and on the funds that are available.

Dr. Murray: How much does it cost to delouse a single person?

Dr. Gratz: Technical DDT is as cheap as 7 U.S. cents a kilogram, but has now gone up to about 9 U.S. cents because it is no longer produced in as large quantities. Twenty-five g per person is necessary, including wastage, but the exact amount will vary depending on whether power or hand dusters are used. But reckoning wastage and other factors, and considering a 10 per cent powder, the cost would be about 10 U.S. cents per person for DDT insecticiding alone. The cost of such items as transport and supervision would have to be added.

The newer compounds would cost about 14 or 15 times as much as DDT, though they would not be used at a 10 per cent concentration but at 2 or 3 per cent, or, in the case of carbaryl, at 5 per cent.

Dr. Tarizzo: These figures are very approximate.