RECOMMENDATIONS FOR THE USE OF INSECTICIDES AND RODENTICIDES IN COMMUNICABLE DISEASE CONTROL OPERATIONS IN 1951

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INTRODUCTION

Conducting of laboratory and field investigations to determine the effectiveness and toxic hazards of various economic poisons which offer promise for use in communicable disease control operations is one of the projects of Technical Development Services. The results of these investigations are used as a basis for recommendations on materials, dosages, and application techniques to be used in field operations. On the following pages recommendations for the 1951 season are briefly summarized. More detailed information concerning the individual insecticides and rodenticides may be obtained from the Operational and the Clinical Memoranda on Economic Poisons which are released by Technical Development Services. These memoranda and recommendations are kept up to date by modification from time to time as indicated by the results of current investigations.

INSECTICIDES

The problem of recommending insecticides for use in operational control programs continues to be a difficult one because of the variable degree of fly resistance to insecticides in different areas and the constantly changing status of resistance where it is encountered. For these reasons, experimental work conducted by Technical Development Services is not universally applicable to field conditions and recommendations for insecticidal usage must be somewhat generalized.

Mosquito Insecticides. Present indications are that *Anopheles quadrimaculatus* has developed little or no resistance to DDT under field conditions. Consequently, no changes are suggested in the present residual spraying operations for malaria mosquito control, nor in the short-term larviciding practices.

In situations where it is feasible, particularly in ponded areas with very little inflow or outflow, residual larviciding is recommended for consideration. If fish are present, the suggested treatment is the application of a water emulsion of technical benzene hexachloride (BHC) (12 percent gamma isomer) applied at the rate of 1 lb. BHC per acre. This may be conveniently accomplished by preparing a xylene concentrate containing 1 lb. of technical BHC and 2 percent emulsifier (Triton X-100 or X-155) per gallon of finished concentrate, mixing this concentrate with an equal volume of water, and applying the finished spray at the rate of 2 gal. per acre, using the equipment and spraying techniques normally used in larviciding operations. If there are no fish present, treatment may be made on an experimental basis, with dieldrin * at the rate of 1 lb. per acre or DDT at the rate of 3 lb. per acre, following the procedure outlined above for BHC, except that the DDT concentrate can be prepared to contain 3 lb. of DDT per gallon of concentrate. Based on experimental work on small landlocked ponds in the Savannah, Ga., areas, the suggested dosages of the above chemicals may be expected to give the following periods of effective control of mosquito breeding: BHC – 5 to 8 weeks; DDT – 13 to 20 weeks; and dieldrin 1 to 2 years. **DDT or dieldrin is highly destructive to fish and other aquatic organisms, and use of these materials should be restricted to such places as temporary pond areas where there is no hazard to fish and other wildlife. If dieldrin is used, appropriate caution should be exercised by the spray operator to avoid contamination during mixing and spraying.****

Fly Insecticides. There are still some areas where it appears that flies have not yet developed resistance to DDT. In such areas this insecticide is still the insecticide of choice, except for use in dairy barns.

Lindane at 25 mg./sq. ft. or methoxychlor at 200 mg./sq. ft. has been recommended for use in dairy barns or other situations where the use of

*Dieldrin is available in ample quantities for restricted use by Federal, State, and local agencies on an experimental basis. Suitable formulations of dieldrin are also permitted to be distributed commercially for use on cotton.

**See *Recommended Procedures for the Field Testing of Dieldrin in 1950*, Technical Development Services, February 15, 1950.

DDT, chlordan, or dieldrin might result in the contamination of milk. Both of these materials have given rather erratic results, particularly in situations where flies have become resistant to DDT or other chlorinated hydrocarbons.

In situations where flies have become resistant to DDT residual sprays, it is suggested that substitutes be used in accordance with the following recommendations:

1. Chlordan is recommended for selective spot treatment at the rate of 200 mg./sq. ft. inside dwellings and on porches, the insides of outbuildings, and other situations relatively protected from the weather. It should not be used for over-all interior house spraying, particularly in bedrooms.

2. Dieldrin is recommended for use by State and Federal health agencies as an outdoor residual spray only (including the inside of privies and the lower walls of other rural outbuildings not used in connection with milk production). It should be applied at the rate of 50 mg./sq. ft. of treated surface. The precautions recommended for the experimental operations of the past season should continue in effect and should be strictly observed.

3. In situations where flies have become resistant to all of the above residual chlorinated hydrocarbons, it is recommended that consideration be given to the use of space sprays of pyrethrum and piperonyl butoxide, BHC, or a 5 to 1 combination of DDT and DMC (p-dichloro-diphenyl methyl carbinol). In situations where the odor of the crude BHC would not be objectionable, a 5 percent water emulsion of technical BHC (12 percent gamma isomer) is recommended. Where odor is a factor, a 2 percent water emulsion of lindane is suggested. Both of these benzene hexachloride products have given good results as space sprays for a time against flies resistant to DDT, dieldrin, chlordan, and other chlorinated hydrocarbons. However, resistance to BHC is likely to occur after continued usage of it in areas where flies are resistant to other chlorinated hydrocarbons. Space sprays of pyrethrum and piperonyl butoxide when applied as emulsions or oil solutions containing from 0.05 to 0.1 percent pyrethrins and 0.5 to 1.0 percent piperonyl butoxide have given good results against insecticide-resistant flies without any apparent development of resistance to these materials. Late in 1950, field tests with outdoor space sprays of water emulsions containing 5 percent DDT and 1 percent DMC gave good results against both resistant and nonresistant flies. This 5 to 1 combination may be tried on an experimental basis on operational programs if it is deemed desirable. It is believed that further testing at Savannah may make it possible to recommend a combination containing lesser quantities of DMC. No data are presently available on the possible development of resistance to the DDT-DMC combination. (This combination was not effective in field tests as a residual spray against resistant flies at the same time that it proved effective as a space spray.)

4. Chlordan or technical BHC (12 percent gamma isomer) at 200 mg./sq. ft., and dieldrin or lindane at 50 mg./sq. ft. are recommended for limited use as fly larvicides, such as to treat garbage cans or the soil beneath them in municipal fly control operations, or to treat packing-house wastes and similar fly breeding materials as a temporary expedient pending the initiation of appropriate sanitation measures.

5. In situations where flies become resistant to all of the available residual and space sprays, do what should have been done originally – **clean up. Insecticides are only a supplement to and not a substitute for sanitation!**

RODENTICIDES

No new problems, such as resistance, have appeared in the control of rodents, but the old problems of primary bait refusal, bait shyness, cost of operation, and hazard to man and useful animals remain.

The recommendations for the use of the older rodenticides, including 1080, remain essentially unchanged; but the addition of one completely new rodenticide can now be recommended. This new material, warfarin, differs from all earlier effective rodenticides in two ways; (a) it will not kill rats effectively when given in a single dose, and (b) it induces no bait shyness. These characteristics make it necessary to use entirely new techniques when employing warfarin as a rodenticide. The following recommendations are made for the field use of rodenticides during the 1951 season:

Sodium Fluoroacetate (1080). Recommendations for this material are unchanged. It may be used for rat and mouse control on ships and in military installations, guarded municipal dumps, warehouses, and such other business establishments from which children and irresponsible persons may be excluded during exposure of the poison. This rodenticide should never be used in dwellings. It may be used in farm buildings only with bait stations and with particular attention to the danger

of secondary poisoning to farm animals and pets. Preparation and distribution of poisoned baits should be done by persons who are adequately trained and completely aware of the hazards to themselves and others where sodium fluoroacetate is used. It is preferable that all persons who have any direct contact with this material be regular employees who have received training or apprenticeship in rodent control for at least 3 weeks. Detailed instructions for labeling, storage, distribution, and disposal of this poison have been prepared and are available on request from Technical Development Services.

Only liquid bait, prepared by dissolving 12 gm. of rodenticide in 1 gal. of water, is recommended.

ANTU. This material is less effective than 1080 but offers less danger to man and domestic animals. Baits containing ANTU in concentrations of 2 to 3 percent are recommended for Norway rats but are considerably less effective for roof rats and cannot be recommended for their control. Norway rats that take the compound and are not killed by it develop bait shyness that lasts at least 4 months. Young Norway rats are less susceptible than adults.

Warfarin. Warfarin is a new anticoagulant, slow-acting rodenticide. Effective control with it can be expected in about 2 weeks from the time that baits are placed. Concentrations of poison used should be 0.10 mg./gm. (0.010 percent) for Norway rats and 0.25 mg./gm. (0.025 percent) for roof rats. Concentrations as low as 0.05 mg./gm. (0.005 percent) have proved effective against Norway rats in limited field tests and should be used for that species whenever facilities for proper evaluation are available. Yellow corn meal of a cooking grade is the bait of choice. Whole meal is slightly preferable, but the degerminated meal that can easily be obtained from grocery stores is quite satisfactory. Corn meal should be used in preference to all other baits unless the rats in question are definitely known to prefer some other bait or if success with corn meal is not achieved after fair trial.

Thorough mixing of the bait and poison is of the utmost importance. The use of an electric mixer is recommended. Bait should be distributed in bowls or wooden trays about 4 in. across and 2 in. high. Any baits that are placed where they may be found by children or domestic animals should be protected by a bait station. Bait should remain in place for a minimum of 2 weeks. There is no maximum for the baiting period. No kill should be expected before the 3d to 5th day. Baits must be inspected as frequently as is necessary to maintain an adequate supply of fresh bait. Daily or almost daily inspections may be required at first. Later, inspection every 4 to 6 weeks may be sufficient. If it becomes necessary to employ perishable baits, then, of course, they must be removed daily as long as they are used. Baits should be placed as near to runs and harborages as circumstances permit. It must be remembered that the home range of rodents is small and that an area as small as a city block may contain many entirely separate home ranges.

Warfarin offers the advantage of being highly effective if used properly. It also offers a considerable degree of safety although the hazard of its use should not be underestimated. Because it does not induce bait shyness, it may be used as a residual rodenticide to maintain control in an area subject to constant population pressure from the outside. This compound, then, offers a sort of chemical ratproofing in places where a conventional ratproofing is impractical for economic or other reasons.

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