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TECHNIQUES OF SPRAYING
SPRAYING EQUIPMENT
TRAINING OF SPRAYMEN - SUPERVISION - EVALUATION

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General

The basic objective of spray operations* is to place a uniform coating of the selected insecticide on the walls and other significant surfaces of all homes in the zone of operation, to ensure the most complete kill of the anophelene malaria vectors during the period of malaria transmission. For Ethiopia, the selected insecticide is DDT 75 per cent water wettable powder with some possible use of Dieldrin. The objective is to apply 2 gms. per square meter or more, say up to 3 gms. per square meter of the technical insecticide. The transmission season in the areas proposed for spraying in FY 1952 is generally from August through December in a normal year. As rains commence in July, the most favourable period for spray operations is from March through June. These facts form a basic background to what follows.

Techniques of Spraying

To obtain a 2 gram per square meter coverage, it is essential that the following factors be controlled closely:

1. The concentration of the insecticide.
2. The type nozzle tip with respect to rate of delivery at average pressure (3) and pattern of application at a standard distance from the wall surface (4).
3. The average pressure of delivery at the nozzle of the spray pump supply line.

4. The distance from the nozzle tip to the wall surface in the direction of the spray stream.
5. The sprayman's rhythm or rate of application.

The concentration with respect to DDT is usually standardized at 5 per cent technical DDT, which corresponds to the solubility of DDT in kerosene solution at normal temperatures. Using an 8002 nozzle tip, a delivery of 0.2 gallons of solution is made with an average pressure of 40 lbs. per square inch. Using a distance of 18 inches or approximately 0.5 meters, a pattern of application 30 inches or 75 cms. wide is obtained, and this combined with a spray rhythm of 1.5 feet (0.5 meters) per second gives a deposit of 2 grams per square meter of wall surface.

The type of house structure found generally in Ethiopia and in much of Africa is the circular "tukul" - built primarily of interlaced sticks more or less filled in with mud mortar mixtures, and having a thatch roof. Interior partitions usually follow the circular pattern and are of similar construction to the outside walls. Diameters range from 3 meters to up to 8 meters. Cooking is done largely in the home without any special provision for smoke emission and consequently the under side of the conical roof becomes heavily coated with smoke. In view of the irregularity of construction materials, the lack of factual information on absorption, and cost factors involved, it is planned to aim at an application of over 2 gms. per square meter, possibly up to 2.5 or even 3 gms. per square meter. This will be done by slowing down the rhythm until all spraymen are using a rate of 0.5 meters per second or less, and by more attention to securing complete and careful coverage of all significant surfaces. Emphasis on the accuracy of wall distance, pump pressure, DDT concentration, and nozzle tips will be maintained.

In spraying this type of structure, greater efficiency is obtainable with the use of horizontal application for much of the surface. In the narrow outer rooms formed by partitions, which are only about 1 meter wide, vertical application to walls is impossible. Similarly, the conical roof in the center of the tukul is best sprayed in a horizontal manner to avoid multiple applications toward the peak of the cone. The overall spraying of a "tukul" should follow a more or less standard routine starting at the door and moving clockwise around the walls, then completing the ceiling, and moving to outer perimeter rooms again, maintaining the clockwise direction starting at the door. Marking of tukuls should be in two stages, first a mark indicating that spraying has been initiated and second, that it has been completed. Something similar to the open V followed by a closure to make it a triangle is proposed for future operations.

Spraying of interior poles and auxiliary earthen pots, etc. requires special skill on the part of the sprayman. House furnishings are very scanty, usually including dried, untanned skins, bedding and clay pots. Bedding and skins should I believe be sprayed.

Spraying Equipment

The prime unit of spraying equipment is the Hudson X-Pert, 2 gallon tank. I have been particularly impressed with the way in which these smaller pumps have stood up to rough usage here as compared with what I have seen of the larger 3 gallon model. As mentioned above, these pumps were all equipped with pressure regulators. These regulators have proved to be ineffective, despite many attempts to make them work satisfactorily. As a consequence, the controls have been adjusted to convert them to flow through fittings and they will be taken off as soon as the necessary substitute connectors are available. The introduction of the new nozzle tip rubber diaphragm regulator is being watched closely and it is hoped that these can be used to help give better pressure regulation. Present pressure regulation depends simply upon pumping to as high a pressure as cylinder pop-off valve will permit for high pressure control and upon the sound of the spray "hiss" for low pressure control. The principal problems associated with this pump are the variety of nut sizes, and changes in parts due to model changes.

DDT is mixed in 50 gallon (200 liter) oil drums on a batch basis. The 75% W.W.P. has been measured but it is hoped that weighing can be substituted for this procedure. The use of locally made beam balances using a standard lead weight to counterbalance the desired weight of insecticide plus container is proposed. Standard Jerry cans (20 liter) are used for carrying the suspension to the spraymen within the village.

Transportation on the Pilot projects has been almost entirely by motor vehicle, principally Land Rover pickup trucks. This is natural, as the project areas were partly selected for accessibility. However, many areas will not be accessible by motor vehicle and it is also questionable as to whether vehicles should be driven as far as they will go. Tentatively, it is planned to use vehicles to carry personnel and supplies to selected base points and that operations from these points will proceed on foot or with the aid of mules, donkeys and camels, etc. Only practical experience can evaluate the effectiveness and cost of this type operation.

Water is one of our biggest problems. Spray operations will be proceeding during the last half of the dry season when streams are often dry. Water must be transported for distances of up to 30 kilometers over rough terrain with poor trails for vehicles. We have procured water trailers which it is hoped will solve this problem. First use of these trailers proved unsatisfactory, probably because we tried to haul them too far into rough territory. The base point idea may help to overcome this difficulty.

One factor that may effect the completeness of spray coverage is the re-finishing of walls and the rebuilding of tukuls. Experience to date indicates that as soon as it is known that fertile valleys, now largely depopulated due to malaria, are safe, the population starts moving in. Thus follow-up spraying will be necessary in

many areas. The method of meeting this problem will vary considerably with the nature of the country and the extent of the problem.

Training of Spraymen

As it will be necessary to hire local spraymen with a range of operation of up to about 50 kilometers on the basis of a 3 months spray season, it is very important that these men receive good intense training under supervision at the beginning of each spray season. This is doubly necessary as the squad supervisors will also be semi-permanent employees or employees who work at other tasks during the remainder of the year. It is planned that this training be done at the Sector level with competent supervision during the week or so before operations, using a mock-up wall for spraying. The men, including squad supervisors, will be trained in the use and maintenance of the pump, mixing of insecticide, field procedure, public relations, and record keeping. This training must be practical and physical drilling will be emphasized. The standard of spraying must be greatly improved and I believe that this will be possible.

It is hoped that the same spraymen can be re-hired for the most part in succeeding years, but the period of training will probably continue to be necessary.

Supervision

To ensure adequate performance by the sprayman, it is essential that the squad supervisor does an effective job. This is, I believe, our biggest problem, as so far I have noticed a strong resistance against giving and enforcing instructions. It is hoped that during the week's training that senior supervisors will be able to get squad supervisors "in the habit" of actually supervising.

While senior supervision at the sector chief and zone level is not so crucial to the job of getting the spray on the walls efficiently, it is important to ensure proper support for the spray operation and to the preparation of proper records. Considerable effort will have to be made to obtain and train suitable personnel at this level. For the time being, the greatest emphasis will be placed on field level training as we must start building from there.

Evaluation

While certain phases of evaluation of the spray operation are such that they can be carried out by spray operations personnel, it is my feeling that the principal responsibility should rest with the epidemiological section. The proof of effectiveness depends upon effective interruption of transmission. If breaks occur, their nature should be investigated on the basis of factual local information. If ineffective spray operations are the indicated cause, then the reason should be investigated and remedies proposed by the spray operations group. In all cases there must be effective team work on the part of both sections.