

# Special Projects . . .

## SOME POSSIBLE CAUSES OF COMPLAINTS ON THE DECLINE IN EFFECTIVENESS OF D D T RESIDUAL SPRAYING IN 1947

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**B**eginning late in 1946, and with increasing frequency during 1947, reports have been received from both foreign and domestic sources indicating that the more recent applications of DDT residual sprays have not been as effective against flies as those applied in 1945 or 1946. Some of the possible causes of these complaints are discussed below. Most of the complaints are undoubtedly attributable to a combination of several of these possible causes, the various individual causes alternating as the principal one under the variety of circumstances involved in each case. Since practically every complaint was based on the alleged failure to control house flies, the following discussions deal principally with that insect.

### Attempted Substitution of DDT for Sanitation

**1** The extravagant claims which characterized much of the wartime publicity which DDT received before its availability for general use, and its remarkable effectiveness, have led some to depend upon residual spraying to control fly breeding without maintaining proper premise sanitation. This tendency has been encouraged by the failure of many publications on the use of DDT to stress the need for continuing good sanitation. At dairies, food processing plants, and on farms, where an abundance of fly breeding material occurs, DDT cannot be used as a substitute for good sanitation. Field tests conducted in the Technical Development Division have repeatedly shown that DDT treatments which are effective in the presence of adequate sanitation, fail to give effective control in the presence of poor sanitation which permits the buildup of fly populations so great that the available DDT-treated surfaces cannot satisfactorily control them. Such a change may occur quickly in hot weather when fly breeding is very rapid. Many people whose former fly problem was eliminated by the initial applications of DDT combined with the sanitation which they then practiced, have made possible the return of their fly problems by becoming lax in their sanitation practices. In the absence

of proper education and guidance from trained personnel, such people tend to blame the return of their fly problem on the failure of DDT. A vigorous educational program should practically eliminate this cause of complaint.

## **Difference in Fly Population Trends from Year to Year**

2 The surfaces on which house flies tend to rest indoors differ greatly from those on which mosquitoes typically rest. The present house spraying program is designed to treat mosquito resting surfaces. House flies tend to rest on tables, floors, and furniture, especially if food is present, and these places are seldom treated. Consequently a considerable length of time may elapse before house flies in a home receive a toxic dose of DDT. Furthermore, flies which have been irritated by contact with DDT attempt to leave the house, and will do so if possible, so that the lack of dead flies and the presence of live ones are not always conclusive evidence that the DDT is not effective. Checks made in the house early in the morning, however, should give some indication of the effectiveness of the treatment in killing flies which entered the house during the latter part of the previous day.

The present house spraying program also limits treatments to the houses only, leaving untreated the outbuildings where treatment would give the best results for fly control.

## **Popular Misconception as to what Spray Treatments should be Expected to Accomplish**

3 Most of the complaints are based on the numbers of house flies observed. Some complain because roaches are seen walking across treated walls without dropping off. Others complain of the failure of the DDT to kill mice, dog flies that bite them on porches or outdoors, and other insects around porch lights.

Complaints of this type are a clear indication of the need for a strong educational program to acquaint the public with the objectives of the control program.

## **Present Malaria Control Spraying Procedures are not Designed for Fly Control**

4 Some complaints were made on the basis that there was no difference noted in the fly population before and after the first spraying in 1947. Due to the late cold winter in the southeast, the fly population was later in developing in 1947 than in previous years. In many cases there were no appreciable numbers of flies present immediately before or after the first spraying, so that it is not surprising that there was no detectable difference in the population. In 1946, house flies reached the peak of their population in southeastern Georgia in June, while in 1947 flies were relatively scarce in June and did not reach their population peak until late August and early September. These differences in population development might well account for

## Psychological Factor

some of the variations in population comparisons at any given period of the two years.

5 The psychological reaction of the public toward the control program is probably the most important single factor involved in the complaints. Visits to homes from which complaints had originated have repeatedly indicated that householders who were formerly annoyed by the continual presence of hundreds of insects now consider a very few insects intolerable. The drastic reduction in the insect population brought about by the first treatment of DDT created such a favorable comparison that the few remaining insects were essentially ignored. The householder has become progressively more conscious and more critical of a lesser and lesser number of insects as the control program has continued in operation. A contributing factor has been the inclusion of the public in the financing of the control program. Where the residents are paying for the spraying service, they are inclined to demand perfection.

On several occasions, members of the Technical Development Division who visited some of the homes from which complaints had been received were greeted with a statement such as "Flies are worse now than ever, even before DDT spraying began." On making a survey of the premises, however, only two or three flies could be found on the porches, even in the presence of food for pets, and none could be found indoors. The presence of numerous fly specks showed, however, that a large fly population had been present prior to initiation of DDT spraying. In one instance, the complaining householder operated a community store and had apparently influenced others in the neighborhood, as the complaints were relatively uniform from several nearby homes, none of which were justified on the basis of the few flies observed at the time they were visited. In every instance where wall cage tests were made on the premises of complaining householders, the results indicated that effective DDT residues were still present at the time of the tests.

The fallacy of attempting to depend upon memory to accurately compare one season's insect population with that of another season has been repeatedly demonstrated. During field tests at dairies this year, some operators commented frequently that more flies were present on their premises this year than were observed last year, while recorded fly counts taken in the same manner by the same worker actually indicated that approximately the same fly population was present both years.

Although they were inclined to grumble about the fly population present, the greater majority of the people visited readily agreed that their present problem was quite small as compared to the period before the use of DDT, and

expressed the hope that the control program would be continued.

## Use of Old or Non-Standard Spray Material

6 Many of the complaints, from both foreign and domestic sources, are traceable to the use of old DDT concentrates purchased from the War Assets Administration or other non-standard materials such as DDT by-product. Analysis of some of these products indicated that the amount of DDT which they contained varied greatly and some of the War Assets concentrate contained 20 percent emulsifier.

Chemical analysis of two drums of standard 35 percent DDT concentrate purchased in the summer of 1946 and stored over winter, indicated that the DDT content after a little over one year of storage was only 28-30 percent. Another drum of 35 percent DDT concentrate, which originally contained 10 percent Tween 80 emulsifier, 3.5 percent Thanite, 46.5 xylene, 5 percent Iso-propane and 35 percent DDT, and which was stored under similar conditions, was found to contain only 23 percent DDT; the odor of the concentrate was very disagreeable; it was a dark-orange color and formed an emulsion which was stable for only about five minutes.

Biological tests with technical DDT and 90 percent DDT water wettable powder stored for over a year under dry, protected conditions gave slightly less effective results than new material.

These facts, meager though they are, indicate the undesirability of using old and non-standard materials. Care should be taken to avoid the procurement of excessive quantities of DDT, particularly in the liquid state, and the consequent long-term storage which that involves.

## Treatment of New Surfaces May be More Effective than Treatment of Previously Treated Surfaces

7 When the first complaints began to be received, indicating that retreatments may not be as effective as an original treatment, laboratory and field tests were begun at Savannah to evaluate the effectiveness of the two types of treatments. Both types of tests indicate that the first retreatment gives slightly less effective results against *Anopheles quadrimaculatus* mosquitoes than does the original treatment of new surfaces. Field tests failed to show any difference against house flies; however, the insect with which most of the complaints were concerned. The field tests also indicated that a retreatment three months following the original treatment gave better results against *Anopheles quadrimaculatus* during the fourth, fifth, and sixth months of the test period than did a single treatment applied at the beginning of the test period. It is believed that the difference between an original treatment and a single retreatment is so slight that it could not be detected by gross observations. Research work to test the

effects of additional retreatments is under way in the Technical Development Division.

## Possible Inherited Resistance of Flies

8 In those areas where the control program has been in operation for two or three years, it is possible that there may have been a buildup in population of a strain of flies which are resistant to DDT. Such a resistance phenomenon has been observed with other insects and insecticides in the past. The Orlando, Florida, laboratory of the Bureau of Entomology and Plant Quarantine has had some success in developing in the laboratory a strain of house flies that show some resistance to DDT.\* The conditions under which this resistant strain has been developed was by repeated exposure to a space spray, whereas on the extended program operations a residual deposit is used. Thus the applicability of the results to field conditions is not known. At the present time, with the limited data on this phenomenon, apparent failures in DDT residual treatment should not be attributed to resistant strains of insects. Work on this problem is being continued and it will probably require several years to evaluate fully the importance of this factor in the future use of DDT. The Technical Development Division is investigating the possible inherited resistance of *Anopheles quadrimaculatus* to this insecticide.

## Variations in Dosage Applied

9 Since the inauguration of the extended program there has been a gradual tendency for some States to modify the recommended application dosages of 200 mg. of DDT per sq. ft. of treated area. This has resulted in some States using a single application of 300 mg. per sq. ft., some are using two treatments of 100 mg. per sq. ft., and some are continuing the recommended program of two treatments per season at the rate of 200 mg. per sq. ft. These variations undoubtedly produce variable results. Investigations are under way at Savannah to develop information as to the optimum dosage for repeated applications, and data on this problem will be released as rapidly as possible.

## Attitude of Spray Crews

10 Some evidence was noted that the approach and attitude of some spray crews were conducive to the development of a feeling among residents that the spray program was not what it should be. Instances were encountered in which the crew belittled the first treatment, in which the War Assets material had been used, in an effort to "sell" the second

\* Wilson, H. G. and Gahan, J. B.; DDT-Resistant Houseflies and Their Comparative Resistance to Other Insecticidal Sprays. Paper presented before the American Society of Tropical Medicine in Atlanta, Georgia, December 4, 1947.

treatment. Several residents reported that they didn't believe the spray crews themselves thought much of the treatment from the indifferent way in which they went about applying it. In a few cases, evidence of poor spraying was noted by the presence of "hour-glass" marks on the walls with untreated spots present. Householders occasionally based their complaints on the short time spent by the crew in treating their homes.

## **Administrative Attitude Toward Spray Program**

11 In some instances, those responsible for the administration of the spray program have possibly contributed to the development of some of the points mentioned in the previous paragraph, by stressing too strongly the quantity production of the spray crew rather than quality. Good administration must, of necessity, continually strive to reduce costs by improving operating speed and techniques. However, placing too much emphasis on the amount of work produced without due regard to the quality as well, will soon result in hasty, and consequently poorer, work by the crews. This point should be given very careful consideration in future planning in those areas where only one treatment is to be applied each year.

## **CONCLUSIONS**

Several general conclusions may be drawn from study of the above comments. The first and perhaps most important conclusion is that a vigorous educational program is needed to acquaint the public with the objectives and limitations of the control program, how DDT kills insects, and the part each resident must play in maintaining good sanitation in order to derive maximum benefits from the control work. Such an educational program would help correct much of the popular misconception regarding DDT and the extended program, and should tend to counteract the presently important psychological factor resulting from the reduction in the residents' tolerance to flies.

Some of the possible causes of complaint can be eliminated by careful planning and procurement of supplies to avoid long-term storage of materials and the use of questionable materials.

Spray crew personnel should be "sold" on the program in order that they can properly present it to the public. Equal importance should be given to the quality of their work as well as quantity.

The proper evaluation on the importance of some of the possible causes of complaints must await further investigational work which is being conducted as rapidly as possible, data on which will be released as soon as it becomes available.