

In using the plow, the mole is kept up in the sod and cuts are made at intervals of about twenty-five feet, cut through from ditch to ditch, so if we assume that the mole hole drains both ways from its mid length, each cut would drain about twenty-five hundred square feet of meadow surface. By this means, the direction of flow of water through the sod is changed and the length of flow is reduced from approximately one hundred feet to twelve feet. As the blade of the plow cuts a slot only about two inches wide, no damage is done to meadows where hay is harvested.

We are not prepared to state how long these mole holes will remain effective but even if we have to open new cuts at intervals of three years we believe that we will have reduced the amount of oiling necessary to maintain control, to such an extent that the mole plow will prove to be the more economical method of control.

MALARIA CONTROL FROM A SANITARY ENGINEERING POINT OF VIEW

**By Edward Wright, Chairman
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History has been made by engineers and physicians in the control of malaria and other mosquito-borne diseases in such mosquito-infested regions as Cuba and Panama and in other tropical countries. Monuments have been erected to the pioneers such as Ross, Reed, Gorgas and LePrince. In fact, it can be considered that the Panama Canal is a monument to the mosquito control work carried on by the American engineer after the French had abandoned the work as hopeless because of the mosquito.

We in Massachusetts have not thus far been seriously concerned with malaria except in comparatively minor instances and for some years there has been practically no malaria in Massachusetts other than that imported from other countries. The picture changes with the war as it did somewhat during World War No. I when over 25,000 soldiers who had malaria were invalidated home from tropical countries. The records show, according to Dr. L. T. Coggeshall, Professor of Epidemiology, School of Public Health, University of Michigan, that malaria is the most important and most deadly disease in many tropical countries. He has stated that there are over 3,000,000 cases of malaria in Russia, for example, and that at one time there were 88 cases per thousand of population in Panama. There are indications that over 50 per cent of our soldiers in the South Pacific and in tropical Africa now have various forms of malaria. It has been stated that in Liberia 70 per cent of the population have malaria parasites in their blood. The supply of quinine is becoming quite limited in various parts of the world and it is understood that in one tropical country the supply has been sufficient to treat only 40 per cent of the cases. Upon the return of our soldiers from the tropical battlefields to their homes and particularly to the general hospitals now being operated by the U. S. Army, such as those at Camp Edwards, Camp Myles Standish, Fort Devens and that being constructed in Framingham, there is a possibility of a spread of this disease to the civilian population unless the patients are treated in hospitals that are thoroughly screened to prevent access of potential malaria-bearing mosquitoes to the patients, and provided the species of malaria mosquitoes are present in any considerable quantities. Because the parasites may exist in the blood for some years there is also the danger of the spread of this disease when the patients are released if the Anopheles mosquitoes are present in any considerable numbers.

In the report of the Department of Public Health on "The Prevalence of Mosquitoes in the Commonwealth," House Document 2260 of the Legislature of 1941, reference was made to the vectors of malaria; and, the most probable vector, *Anopheles quadrimaculatus*, was found in that survey in all counties in the State excepting Dukes and Nantucket. The numbers found

in connection with this survey were not particularly great, however, but the *Anopheles* did comprise 19.3 per cent of the larvae and 5.1 per cent of the adults found in this survey.

The *Anopheles* mosquito operates largely at night and apparently prefers to bite man indoors; hence, the hospitals where malaria patients may be housed later this summer and until well after the war is over should be thoroughly screened. The *Anopheles* mosquito is not known to fly to any great distance and control work in and around army cantonments in known malaria regions is not being carried on at distances greater than about one mile from the limits of the cantonment. This is a different picture from that relating to various pest mosquitoes such as the salt marsh variety which is known to travel upwards of 15 miles.

There has been considerable correspondence with the U. S. Public Health Service relative to the use of Federal funds delegated to that bureau for malaria control work in the vicinity of army cantonments and war department hospitals in Massachusetts. The U. S. Public Health Service has set up the so-called "Malaria Control in War Areas" Division of which Dr. Louis L. Williams, Jr., is Medical Director. His office is in Atlanta, Georgia. Under the appropriations made to the U. S. Public Health Service for malaria control no money has been expended for this work in the northern states except in Illinois and apparently it will be necessary to convince the U. S. Public Health Service that malaria is being spread in the northern states before much assistance from the Federal Government can be obtained other than in military reservations. However, after various conferences with representatives of Dr. Williams' office, there is every reason to believe that a careful survey will be made this summer in the vicinity of Fort Devens, Camp Edwards, Camp Myles Standish and in the vicinity of the Framingham General Hospital of the U. S. Army. The post surgeons at the larger cantonments in Massachusetts are cognizant of the possible spread of malaria and are doing what they can to carry on control work in their reservations. Much work has been accomplished in the Fort Devens reservation, in the Camp Edwards reservation and some is now being accomplished in the Camp Myles Standish reservation. A very thorough mosquito control project has been in operation for some years in the vicinity of Camp Edwards. Studies are being made for projects in the vicinity of Camp Myles Standish, Fort Devens and Westover Field.

A late publication of the U. S. Public Health Service, Division on Malaria Control in War Areas, refers to the work being done by the Bureau in the southern states, Puerto Rico, the District of Columbia, California and Illinois, the latter state being the only northern state in which that Division appears thus far to have operated.

This Service has a considerable amount of Federal funds for malaria control in war areas. In the month of April over 5000 pounds of paris green were used in dusting malaria-breeding areas, over 73,000 gallons of oil were the trench. The depth of the trench is determined by the seepage stratum and by the elevation of the outlet. Parallel contour ditches are sometimes constructed. The drain line should be as straight as possible and when changes in line and grade occur, smooth curves should be provided. Profiles are necessary before the drains are laid. Holes and depressions containing standing water are generally filled to grade unless adequate drainage can be provided. Larger aggregate should be used in the bottom filling with finer material toward the top.

In connection with the extensive Tennessee Valley Authority work, much care has been exercised in preventing malaria and a large scale malaria control project has been carried on. This work consists of shore line control including the removal of vegetation, provisions for the control of water levels in the various reservoirs and storage basins, dusting with paris green and larvicidal control by various larvicides. Reports of the TVA show that

the Anopheline mosquito breeds abundantly where there is vegetation along the shores of lakes, rivers, storage reservoirs and ponds but not along such shores where vegetation does not occur. Accordingly, much work has been carried on in removing shore line vegetation and in controlling the water level so that eggs laid in quiet water along the shores can be exposed to the rays of the sun by lowering the water level. This has been effective because the eggs do not hatch even in warmer climates for periods of several days. Drainage of salt marshes is comparatively simple from an engineering standpoint as the marshes generally are practically flat. Fresh water areas cannot be drained so readily because of topographical and soil conditions. Surveys are required. Much dynamiting of ditches has been carried on in the Fort Devens Reservation. Spraying with light oil must be resorted to where drainage is not practicable. The breeding areas thus far known here in this State are not such as to require dusting from airplanes as has been done in certain states. Comparative rainfall records must be studied. Most important of all is the work of the entomologist in determining the location of the vectors. This must be followed up by the engineer with plans for drainage of areas pointed out by the entomologist and oiling of known breeding areas where drainage is economically impracticable.

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