II. Insect Problems and Irrigation

By JOHN A. ROWE, Ph.D.

Water development in this country has produced a host of mosquito problems stemming from various types of projects. Some of these problems have come about through faulty construction while others are due to bad practices in the use or operation of projects. Mosquito problems associated with water development programs result from water standing too long on the surface of the ground, thus creating breeding places for mosquitoes. Until recently, neither the builders nor the operators of projects were fully aware of the nature and size of these mosquito problems and, hence, could not be expected to initiate measures to prevent them. Local, State, and Federal health agencies for several years have studied these problems in an effort to find practical methods for preventing and controlling mosquitoes.

Mosquito problems associated with storage reservoirs or other impoundments have been fairly well delineated through field studies. The results of these studies have been published in numerous technical papers. They are summarized in "Malaria Control on Impounded Water" (U. S. Government Printing Office, 1947). It is not desirable at this time to review water impoundment problems and the control measures which are thoroughly covered in this summary, but rather to describe briefly and discuss examples of major mosquito problems associated with irrigation.

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Irrigation of Pastures

In the Western States, probably the most serious mosquito problems result from the irrigation of native grass pastures and "wild" hay lands. The severity of these problems is well known to the inhabitants of the valleys of California and Utah, and to those of the valleys of the Milk River in Montana, the Platte River in Nebraska and Colorado, and elsewhere. The numbers of mosquitoes produced on these irrigated pastures reach astronomical proportions. In California, for example, one mosquito trap operated near an irrigated pasture for three nights collected nearly a gallon of mosquitoes. Mosquito-egg counts from pasture sod samples have shown that as many as 20,000,000 eggs of *Aedes nigromaculis*, a western pasture mosquito, may be present on an acre of irrigated pasture. These tremendous numbers of mosquitoes do not occur in only one or two broods each year, as may be the case in "dry land" areas, but a new brood is produced following each successive flooding of the pastures throughout the irrigation season.

Studies in the North Platte Valley and elsewhere show that a combination of factors produce the severe mosquito problem on these pastures and hay lands. In many instances the fields were not prepared to receive irrigation water, and consequently their surfaces are irregular and unlevel. Because of this, the irrigators must force tremendous amounts of water over the land in order to cover the high spots. Extensive areas covered to a depth of 18 inches may be observed regularly. In many instances, even where land is fairly level, huge amounts of water are literally poured onto the pastures. As a result of these practices, high-

way and railroad rights-of-way and large tracts of unused land are inundated during each irrigation turn. Over extensive areas of bottom pasture land the major drainage structures have deteriorated and become ineffective, and in most areas no drainage structures are evident for the removal of water from roadways or unused land, or for draining off excessive amounts of water from pastures.

These conditions over literally thousands of acres of native grass pasture have created choice ecologic habitats for several of the most predacious mosquito species in our western fauna. To the layman it appears also that the quality and productiveness of the land have been adversely affected.

The control of mosquito problems on irrigated native grass pastures cannot be accomplished unless the principles of "conservation-irrigation" are effectively applied. Because of established customs and habits, and because of the apparently abundant supply of irrigation water, in certain areas, the successful application of these principles to existing irrigated pastures will be difficult and will require the active cooperation of all agencies, groups, organizations, and farmers involved. The prevention of such problems on future irrigation developments, however, should be an easier task and one which, when successfully accomplished, should result in great public benefits. Unless the water development agencies and others concerned willingly attack this problem on existing and future irrigation projects, the States whose people utilize the projects ultimately will be forced to spend large amounts of public funds on an annually recurrent basis for artificial and difficult mosquito control measures as in California, Utah, and elsewhere. Otherwise the fullest potential productiveness of the projects will be retarded.

Seepage Areas

From the very beginning of irrigation in this country, seepage areas have been a major problem confronting the farmers, the irrigation companies, and the water- and soil-development agencies. To these groups "seep areas" mean reduced production, inefficient water distribution, water loss, and the depletion of desirable qualities of the soil. Some regions report as much as 50 percent of the water diverted from streams or from storage reservoirs is "lost" to seepage, and in certain irrigation districts thousands of acres of seep land exist. Health agencies are concerned with seepage areas because of the mosquito problems involved. Available data indicate that many types of seeps, where the water actually reaches or covers the surface of the soil, produce extremely large numbers of *Aedes*, *Culex*, and *Anopheles* mosquitoes.

The control or prevention of seepage areas is a difficult and expensive task. In many instances it involves the treatment of canals and laterals to prevent water loss. In other instances, it requires closer attention to the water requirements of specific crops in order that seepage resulting from deep water percolation may be reduced. Statements have been made to the effect that because of downstream recoveries, water arising from "flowing seeps" is not entirely wasted. This may be true; nevertheless, these seepage areas represent acute mosquito problems which appear to be increasing in magnitude.

In present and future irrigation developments the anticipation of seepage problems is a major concern of the responsible water development groups. Structures to prevent seepage from canals and laterals should be installed where needed and surface water arising from deep percolation should be channeled and concentrated to the greatest possible extent.

Drainage

Major mosquito problems on irrigation projects often result from inadequate provisions for drainage. Field studies show that this is especially true on the older irrigation developments. When old irrigation developments are compared with new ones, progress in the drainage features of the project are readily recognized. The water development agencies responsible for this progress are to be complimented. For the most effective mosquito prevention, however, further progressive drainage actions are needed. On most projects, the extension of drainage provisions would go a long way toward eliminating mosquito problems cre-

ated by the wastage of water into highway and railroad rights-of-way and other waste areas. For instance, field data from studies of recently completed projects on certain grade A lands show that the only mosquito problems in these areas were those created by the wastage of water from cultivated fields. There is no doubt that if, during the construction phases of these projects, the basic drainage plan had been extended to include drainage of roadways and other waste areas, virtually mosquito-free projects would have resulted.

In overcoming this problem it is realized that the jurisdictions of groups other than the primary construction agencies are involved. These include units of State and local governments, private companies, and individuals. Nevertheless, it would seem that opportunities are presented during the planning and developmental phases of the projects for the discussion of these problems and for making basic provisions for such drainage extensions.

The conditions which have been described are examples of only a few major mosquito problems associated with the development and operation of irrigation projects. Many other situations are known which constitute significant problems in certain areas, such as (*a*) surface water due to overflow or leakage from poorly maintained irrigation distribution systems; (*b*) impoundment of water in natural drainage ways due to the faulty emplacement of drainage and other structures; and (*c*) residual water in irrigation structures such as siphons, turnouts, and drops, and in secondary canals and ditches. Individually, these and other conditions may not seem to be very significant, but when they occur repeatedly throughout a project they collectively become problems of considerable magnitude. Because the water involved serves no useful purpose, it is considered wasted.

Preventive Program

In cooperation with State health departments, the Public Health Service, through its Communicable Disease Center, is developing a program to aid the various water development agencies and groups in preventing mosquito problems on future water development projects, and to reduce the severity of existing problems on completed projects. The effectiveness and success of this program depend to a large extent on the support and cooperation received from other groups or agencies. These include not only the Federal planning and construction agencies, but also units of State, county, and city governments; farm organizations; irrigation companies; and other water development groups.

The program is threefold: field investigations and research, cooperative basin-wide activities, and development of State programs.

Field investigations have been established in representative areas to determine, evaluate, and grade the factors which produce mosquito problems associated with water development programs and to develop and test field techniques and methods for overcoming these problems. It is hoped that certain additional field research studies can be initiated in cooperation with the research groups of other agencies. Investigations will involve both biological and engineering features.

The Public Health Service will carry out its responsibilities relating to mosquito problems in connection with basin-wide investigations and reports. The Public Health Service Drainage Basin Offices have initiated activities whereby the planning and construction agencies will be kept fully informed relative to major mosquito problems involved in water development programs. Reports of various agencies will be reviewed and the vector aspects will be called to the attention of the agencies concerned. Field surveys will be made of major representative units or projects, which are in the investigational stage of development, for the purpose of obtaining basic data which will permit the anticipation of vector problems. These surveys will be conducted in accordance with established Public Health Service policies.

Development and direction of activities relating to its own projects are, of course, the primary responsibility of the State. Where the development programs are more extensive and complicated, assistance may be possible through the loan of technical personnel to the State health departments. These men will be available to work on existing problems and will assist water development agencies working in

the State to prevent mosquito problems on future projects. The long-range goal is to assist in the establishment of sound, adequate programs in those States which have mosquito problems.

The program, in all its ramifications, is a positive one, to aid and assist in the fullest and most beneficial development of our water resources. We hope that, through this program and with the cooperation of all interested persons and groups, the factors which have produced serious mosquito problems on water development projects in the past will be eliminated from the projects of the future.

Community Volunteers and Mosquito Control

By R. E. DORER

Volunteer mosquito control work by the residents of Stony Creek, Va., brought the town relief from the usual mosquito annoyance during the past summer.

The Stony Creek Woman's Club initiated and supervised the project, the school children did the inspection work, and the townspeople cooperated by eliminating mosquito breeding places on their premises.

The woman's club, seeking a youth activity it could sponsor in the community as part of a national club program, turned to the Virginia State Department of Health for advice on the feasibility of a mosquito control project.

In June 1951, the bureau of insect and rodent control in the department inspected and analyzed the conditions in the Stony Creek area, an agricultural community of approximately 400 people in the southern part of Virginia, 75 miles inland.

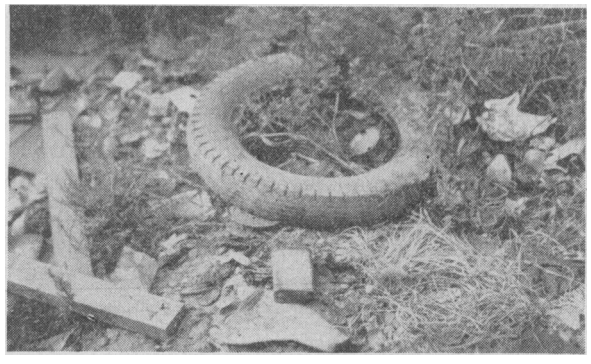
About a mile from town, there is a fresh-water marsh area of several acres. After checking on the mosquito species in the marsh, the surveyors decided the marsh could be disregarded as a primary mosquito source. Few mosquitoes of these species would find their way into town. Subsequent light-trap catches confirmed the practicability of this decision.

The drainage ditch running through part of the town was marked for treatment with oil insecticides by the town sergeant and was thus disposed of as an inspection problem.

The major part of eliminating the fairly heavy production of domestic mosquitoes would depend upon alert and systematic house-to-house inspections and cooperation of the townspeople, the surveyors decided. They concluded that a voluntary program using the older school children during their vacation period was feasible and promising.

A detailed plan of procedure, which placed all the responsibility for its execution on the citizens of Stony Creek, was accepted and put into operation July 1, following a brief training course in the field for both youngsters and grown-ups.

Approximately 20 school children participated in the work until September 30. The town was divided into numbered districts, and



A typical mosquito source found in Stony Creek and removed by the young inspectors in the mosquito control project.

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