El Salvador Ministry of Agriculture and Livestock
And
The United States Department of Agriculture

Cooperative Program
For the
Eradication of Screwworms

1991—1995: An Overview
The Cooperative Screwworm Eradication Program in El Salvador was part of the Regional Screwworm Eradication Program supported by the United States Department of Agriculture. The bilateral agreement between the U.S. Department of Agriculture and the El Salvador Ministry of Agriculture and Livestock was signed in July 1991 which created the Cooperative Program for the Eradication of Screwworms. El Salvador was declared free of screwworms in 1995 and the Program was then dissolved.

El Salvador is the smallest country in Central America yet, is the most populated. It is a country of volcanoes, mountains, forests, dense urban areas, and countless rural villages. Agriculture is well developed in El Salvador with many modern livestock operations. However, most of the livestock production is in the hands of, medium and small size producers whose operations are frequently underdeveloped and rustic. The Cooperative Program conducted a livestock census and discovered that many livestock producers did not own land and used public roadside land as pastures for cattle.

The Program was organized into technical departments including Field Operations, Dispersal Operations, Quality Control, and Public Awareness and Administration.
Field Operations was responsible for field surveillance to determine the incidence of screwworms in El Salvador for the purpose of evaluating Program progress. Field Technicians were responsible for encouraging producers to collaborate with the program by inspecting their animals, treating wounds susceptible to screwworm infestation, collecting larva samples, and marketing livestock free of myiasis. The country was divided into three regions and fourteen inspection sectors. One year later, based on evaluation of surveillance efficiency, the number of field inspectors was increased to twenty-eight.

Because of the large number of small producers with only a few head of livestock, a system of "Honorary Inspectors" was implemented that could more efficiently represent the Cooperative Program in numerous populated villages. Honorary Inspectors were selected and were given in-depth training about their responsibilities as Program representatives.

Inspection sectors were divided into work routes and Field Technicians were responsible for contacting principal collaborators on a regular basis. Most work routes were accessible by road; however, Field Technicians were frequently required to work areas of difficult access including aquatic routes and areas reached only by foot.

Field Technicians distributed sample collection kits, wound treatment powder, and educational/promotional material as well as educating producers about Program objectives and benefits for producers. Technicians also identified strategic locations where sample collection centers were established to facilitate delivery of larva samples to the Identification laboratory. The majority of these sample collection centers were located at rural commercial agricultural supplies outlets, veterinary pharmacies, as well
as governmental offices such as municipal offices and Ministry of Agriculture and Livestock extension offices. During the four years of the Program, Field Technicians contacted approximately 303,324 animal owners, and distributed 115,648 collection kits as well as 4,752 kilograms of wound treatment powder.

The larva identification laboratory was located at the Central Office. Program collaborators submitted 8,273 diagnostic samples and 5,324 were identified as Cochliomyia hominivorax. The majority of non-screwworm samples were identified as Dermatobia hominis and a lesser amount of other miscellaneous Diptera flies causing myiasis. Either the animal owner or other person in-charge of caring for the animals such as farm managers and cowboys collected 78.7 percent of samples while Program Technicians collected only 8.0 percent. The screwworm fly most frequently struck cattle (80%) and was evenly divided between calves and adult cattle, a lesser amount of samples was collected from swine, horses, and dogs. It is important to note that 3.3 percent of the samples were collected from humans and that human screwworm myiasis was a significant public health problem in El Salvador. The screwworm fly most frequently struck the navel of newborn calves and nearly as frequently, cutaneous lesions. A lesser number of samples were collected from wounds such as dog bites and vampire bat bites. It is interesting to note that 14.3 percent of samples were collected from wounds caused by spider bite. Farmers frequently stated that spiders caused wounds on the feet of cattle and horses, however, it was actually the result of infection by the virus agent causing Vesicular Stomatitis that resulted in a sore susceptible to myiasis.

Even though the screwworm fly is capable of expanding its territory, the primary means that screwworms are introduced into an area is through the movement of livestock and Field Operations was re-
sponsible for preventing the dissemination of screw-worms. El Salvador, because of its dense human population, imported significant numbers of cattle, especially from neighboring Honduras and Nicaragua. Inspectors were assigned to the principal official ports of entry, especially along the border with Honduras and livestock were inspected as they entered the country, even though the Program did not have facilities to adequately inspect these animals. However, it was learned that most cattle entered El Salvador through informal border crossings and entered commerce by way of livestock markets known as “tiangue”. These markets, located in several towns in the eastern half of the country, were operated by municipal authorities that issued sales documents which allowed cattle to become legalized and free to be transported to other parts of the country. In 1993, Field Operations reassigned eight inspectors to these markets, which were operated on specific days of the week in specific towns. The municipal authorities were very cooperative and allowed the inspectors to work the markets and review letters of sales to determine origin and destination of livestock. These markets provided an excellent opportunity to interview a large number of producers, solicit the cooperation of livestock shippers, and inspect a large number of animals; especially those introduced from Honduras. During the two years of operation, approximately 975,887 head of livestock passed through these markets and four cases of screwworms were discovered. Program personnel interviewed 46,652 producers and reviewed 107,030 letters of sales.

Field Operations was also responsible for investigating and controlling outbreaks of screwworm infestation. Under the direction of the Program Epidemiologist, several intensive inspection brigades were carried out. Brigades involved temporary reassignment of Field Technicians, Supervisors, and Public Awareness Officers as well as assignment of financial resources to conduct house to house inspection of specific geographic areas. In 1993, brigades were carried out in the southern area of the country where personnel visited 15,581 farms; 3 positive and 7 negative larva samples were collected. In 1994/1995, an area of persis-
tent infestation was identified in the central part of the country and a brigade was carried out in the area. Personnel visited 9,320 farms and 1 positive and 26 negative larva samples were collected.

Dispersal Operations was responsible for emerging flies from pupae and the aerial dispersal of these flies. Pupae were shipped to El Salvador from the sterile fly production plant in Tuxtla Gutierrez, Mexico by air transport. Pupae were placed into custom design environmental chambers and were maintained in hot rooms where flies were allowed to emerge under controlled temperature and humidity and darkness. As the flies emerged from the pupae, they were attracted to a cold room by bright light and flew to this room through narrow slits in the wall; the fly was immobilized by the cold temperature and collected in trays. When sufficient numbers of flies were collected, they were placed into specially designed boxes and loaded into aircraft. Pilots were instructed to fly over El Salvador in a grid form with dispersal lanes two nautical miles apart. It was calculated that approximately 3,000 flies were released per square nautical mile each week. During the four years of operation, 3,887,361,461 pupae were received from Mexico and approximately 2,506,305,067 flies were collected and released over El Salvador.

Quality Control was responsible for ensuring that the fly dispersed into the field was in optimum biological condition. Quality Control was divided into two components: laboratory and field.

Quality Control Technicians in the Laboratory conducted routine tests to evaluate the pupae and fly. Statistical data were collected regarding the quantity of pupae received and flies collected as well as the size and sex ratio. Quality Control Technicians calculated the percentage of flies that emerged from pupae, the mortality of flies, as well as percentage of flies not capable of flight. During the four years of operation, the average weight of the pupa was 40.5 milligrams and the average sex ratio was 54 males to 46 females. The average percent of yield of flies collected from the number of pupae received was 68 percent and the average fly mortality was 1.1 percent.

Quality Control Technicians in the field conducted tests to evaluate the effectiveness of the sterile fly as well as the quality of sterile fly dispersal. To test the effectiveness of the sterile fly, egg masses
collected from sentinel animals were analyzed for sterility. Sterility greater than 50 percent was considered as evidence that the sterile fly was able to compete with the native fly in the field. Sheep held in pens were used as sentinel animals and technicians would cause a surgical wound and collect any egg masses deposited by female screwworm flies. The egg masses were incubated for 24 hours and if larva hatched from the eggs it was considered fertile. The tests were conducted in different areas of El Salvador and after 15 months of operation, 540 egg masses were collected and 50 percent sterility was achieved in six months.

To test the quality of sterile fly dispersal, traps baited with an artificial attractant were used to capture live flies. Two types of traps were utilized and trap lines were placed in different areas of El Salvador. One trap, designed by Panamanian entomologist, Dr. Alberto Broce, was a "Wind Orientated Trap" which allowed flies to enter a screened pail. The other trap, designed by Australian entomologists, used a plate covered with a sticky substance that prevented the flies from escaping. It was proven that the Australian trap worked better in the tropics than the WOT which was designed to work in arid areas. During the three years of operation the average number of flies captured per trap per day was 0.68 for the WOT and 1.48 for the Australian trap.

Public Awareness was responsible for publicizing the Program in El Salvador as well as educating and informing the public about the Program and its progress. A Public Affairs Officer was assigned to each Region and activities were coordinated through a Public Relations Specialist. Mass media such as radio commercials and newspaper advertisements were utilized to publicize the Program. Likewise, wall paintings, roadside signs, posters, calendars, and promotional articles such caps, T-shirts, pens, pencils, etc. were also used to publicize the Program. The Regional Public Affairs Officer was also responsible for coordinating educational events such as public meetings and distribution of educational material such as bro-
chures. Exhibit stands were set up at public events such as livestock fairs and public address announcements were conducted in villages to further publicize the Program. Regional Public Affairs Officers participated in radio programs directed toward the agricultural sector and several television documentaries produced in cooperation with the Ministry of Agriculture and Livestock were used to educate the public about the Program. Press releases, television and radio commercials, newspaper and magazine articles, and fliers were used to inform the public about Program progress and activities. During four years of activities, local radio stations broadcast 82,240 commercials, 137 radio programs were aired, and 247 advertisements published in newspapers. Personnel painted 309 wall signs and 1,309 program logos in public places and distributed 359,032 pieces of printed material. They also presented 2,313 informational programs in which 107,625 persons attended.

The epidemiological curve reflecting the incidence of screwworm myiasis in El Salvador was quickly reduced to zero and the Screwworm Eradication Program was a success. The Program, while costing 14.2 million dollars, brought many times more benefits to the El Salvador livestock producer and consumers alike. And of particular note, the public health was improved and human suffering from screwworm myiasis was alleviated.

Prepared by Steve C. Smith, D.V.M.