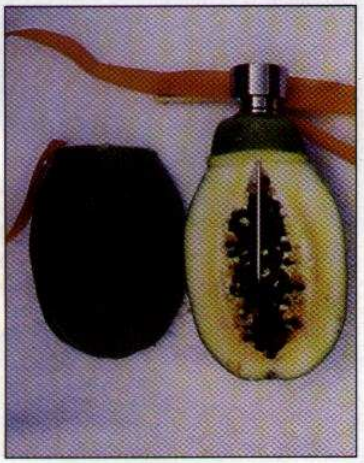
on the line

Inside Information

Temperature sensors placed in papayas find application verifying the efficiency of vapor heat treatment for terminating fruit flies.

Fruit flies may lay their eggs in papayas, a fruit imported from the Hawaiian Islands to the mainland on a regular basis. In order to prevent the spread of these insects to fruit-fly-free countries, papayas typically are placed in non-chemical quarantine and treated with vapor heat that kills fruit fly eggs and larvae. The treated fruit is then showered with cold water to combat heat damage to the product.



Datatrace sensor in a cut papaya. The ribbon helps locate sensor after tests.

Papaya processors in Hawaii construct computerized, process-controlled vapor heat chambers to treat large quantities of papayas. These chambers operate based on established scientific research, and must be tested annually for efficacy. This testing is the responsibility of US Department of Agriculture's Animal & Plant Health Inspection Service (APHIS), Plant Protection & Quarantine (PPQ).

Staffers from APHIS, PPQ at the Phoenix Methods Development Center, in conjunction with staffers at PPQ, Western Region in Hilo, HI, have developed an improved vapor heat treatment certification system that employs remote, self-contained temperature sensors from the Datatrace Division of Mesa Laboratories, Lakewood CO. The Micropack Lo Temp™ Datatrace® temperature sensors are placed in the papayas to collect and store heat data during the vapor heat treatment process. The rapid set-up sensing system is easy and efficient for port officers to use and is accurate to 0.1°C.

Port officials can download temperature data gathered by the sensors into a laptop computer for immediate analysis.

Dr. Michelle Walters, an entomologist with the APHIS Phoenix Methods Development Center, explains how the project evolved. "Two years ago, Glenn Hinsdale, State Plant Health Director of APHIS' Western Region Hawaii, Plant Protection and Quarantine Office, and Ed Uyeda, Officer in Charge at Hilo, asked us to come to Hawaii to assess the fruit fly situation. Dr. David Pierce and I gathered data on-site, and Daniel Frazier, a computer programmer, wrote software for a new temperature monitoring system for vapor heat quarantine treatment."

Walters pointed out that high-accuracy, high-reliability heat sensor probes were a key element of the new system. "We felt that Mesa Labs' Datatrace Tracer sensors best fulfilled our criteria. They are NIST-traceable [National Institute of Standards and Technology], have no cabling, and do not require calibration prior to use. Thus, they require minimal set-up time as well as being highly accurate. They are hermetically sealed and don't have to be disassembled for programming or interrogation."

Using a boxcar-size chamber, treatment operators place 120 temperature sensor probes in 120 sample papayas throughout a full lot of about 12,000 papayas. This scattered placement helps keep tabs on unavoidable air-flow inconsistency throughout the batch and precludes having to place a sensor in or near every piece of fruit in order to get a reliable overall read. Each sensor is pre-programmed and instructed as to how often to perform temperature readings. Reading frequency could be every second, minute or hour, but APHIS opts for per-minute readings. Applying dry heat, lot temperature is raised gently and gradually over about a 4 1/2-hour

period until internal fruit temperature is 47.2°C. The temperature is raised slowly to minimize heat damage to the fruit. Water vapor is introduced during the last hour to assist the transfer of heat into the fruit. Post-treatment, the fruit is cold-water-rinsed, and the sensors are retrieved so that the data they have collected can be downloaded into a laptop computer. Data analysis is immediate and provided in an easy-to-use format.

Walters said that Mesa Labs has been instrumental in making this project a success. "They went out of their way to help make the hardware work for us, as well as facilitate software development. Their technology has met our strict specifications. They delivered what they promised."

Asked about application of this vapor heat treatment sensing system beyond fruit flies in papayas, Walters commented, "We see huge potential for collecting heat data with high accuracy on treatments for other pests in various fruits and vegetables. These sensors are durable, can run for long periods of time, don't drift in calibration, are field-serviceable, portable, and hermetically sealed in stainless steel, which is a necessity in food applications."

Mesa Laboratories Inc.
Datatrace Div.
Lakewood, CO
303-987-8000
fax 303-987-8989