# Best Management Practices at Monrovia Growers to Prevent the Introduction and Spread of *Phytophthora ramorum*©

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*Phytophthora ramorum*, the causal agent of Ramorurn Blight or Sudden Oak Death, is a quarantine organism. Nurseries found to be infected with *P. ramorum* face significant financial and regulatory consequences. In response to the 2004 infection of its Azusa, California nursery, Monrovia Growers developed a set of about 50 best management practices (BMP) to prevent the introduction and spread of *P. ramorum*. These practices are used at all six Monrovia Growers locations. The BMP are in addition to those practices required for maintenance of our Compliance Agreement for Nurseries Shipping Host and Associated-host Plants of *Phytophthora ramorum* Interstate as per the Federal Order Restricting Movement of Nursery Stock from California, Oregon, and Washington Nurseries, 22 Dec. 2004 <www.aphis.usda.gov/ppq/ispm/pramorum/>. Many of these BMP are similar to those listed on the California Oak Mortality Task Force web site <www.suddenoakdeath.org>.

## EXCLUSION

One of the most likely routes of entry into the nursery for P. *ramorum* is on infected plant. material. Monrovia propagates most of its own plants, and this limits exposure to this route of entry. However, the company does bring plant materials onto its nurseries from outside vendors for new crops, crop shortages, and new plant evaluations. If these plants are host. and associated plant (HAP) genera <www.aphis.usda.gov/ppq/ispm/pramorum/>, then they are tested upon arrival at the nursery and are not released to production until the tests prove negative. Inventory systems allow the tracking of these plants through the production cycle. Monrovia Growers also transfers plants between its growing locations. Host and associated plant genera are tested before they leave the source nursery and their movement through the production process at the destination nursery can be tracked through the inventory management system. Customer returns on delivery trucks are no longer accepted as these plants could become infected at the customer's nursery.

Raw materials are another potential route of pathogen entry. Bark and sawdust for growing media are sourced from outside of the current natural range of *P ramorum*. Surface irrigation water, which is known to be a source of *Phytophthora* propagules worldwide, is disinfected prior to use.

## EARLY DETECTION

The company expends considerable effort testing plants for *Phytophthora*. As previously mentioned, plants from outside vendors and intracompany transfers are tested before they are used in production. All *P ramorum* Host and Associated Plant (HAP) genera are tested during the time of year when the disease is most likely to be expressed, namely during rainy periods in the fall and spring. This amounts to several thousand samples per year. Monrovia has the facilities and personnel to conduct this testing in-house. ELISA (enzyme linked immunosorbent assay) is used

to screen samples for the presence of the genus *Phytophthora*. Any ELISA-positive samples are cultured on semi-selective medium to determine if viable *Phytophthora* propagules are present. Cultures with *Phytophthora* growth are tested by nested-PCR. (polymerase chain reaction) to determine if the species *P. ramorum* is present.

## PREVENTION OF ESTABLISHMENT AND SPREAD

Cultural practices used for *P. ramorum* prevention are common to many disease pathogens. These practices include sanitation measures such as disinfection of tools, removal of plant debris from growing beds, maintenance of beds with a clean gravel or ground cloth surface, and rouging-out of potentially infected plant material. Water management is important for water molds such as P *ramorum*. Beds are graded to allow drainage of run off water and leaking irrigation valves are repaired to prevent areas of standing water. Host and associated plants are irrigated in the morning hours to allow the plant foliage to dry before nightfall. Microirrigation is used where practical to prevent wetting the foliage.

All crops are scouted at least once a month. Scouts are trained on disease symptoms and other basic disease information. Host and associated plants are treated with preventative fungicides. Frequency of application and material used depends on the host and time of year.

Best management practices are only useful to the extent that employees know and follow them in their daily activities. Therefore, the Monrovia BMP are incorporated into training materials used at the nursery. These training materials are step-by-step instructions for various tasks at the nursery such as pruning, potting, and shipping. New employees and existing employees transferring to another department receive this training before beginning their new responsibilities. Furthermore, refresher training is given to all employees annually.