

Research on the Quarantine Pathogen *Phytophthora ramorum* at the National Ornamentals Research Site at Dominican University of California¹

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Abstract

The National Ornamentals Research Site at Dominican University of California (NORS-DUC) was founded in the year 2009 by a Farm Bill grant to study *Phytophthora ramorum* in a sophisticated research nursery that reflects an authentic commercial nursery setting (www.dominican.edu/norsduc). NORS-DUC goals are to develop practical solutions for containment, remediation, and eradication of quarantine pathogens in nurseries and to reduce the risk of long-range spread of pests through infested nursery stock shipments. Research at NORS-DUC is conducted by a team of permanent staff as well as by *P. ramorum* experts from other institutions who can apply for grants to work at NORS-DUC. The research site offers a unique opportunity to study different aspects of ornamental diseases caused by *P. ramorum* and other quarantine organisms that cannot easily be accomplished using experiments in a laboratory.

Mission and Purpose

The National Ornamentals Research Site at Dominican University of California mission is to provide nursery growers with solutions and collaborating researchers with lab and field support to aid in their project success in the areas of horticulture and plant disease management.

- NORS-DUC is the only research site in the USA dedicated to the study of invasive quarantine pathogens of ornamental plants in an open, nursery-like environment.
- NORS-DUC is a collaboration between Dominican University of California, the United States Department of Agriculture (USDA), and the California Department of Food and Agriculture (CDFA).
- NORS-DUC invites scientists from other universities as well as public and private research centers to conduct studies on quarantine soil-borne organisms at a state-of-the-art research facility.
- NORS-DUC focuses on diseases of ornamental and forest plants, especially those caused by members of the genus *Phytophthora*, like *P. ramorum*, causal agent of Sudden Oak Death, and more recently *P. tentaculata*, a newly discovered plant pathogen in North America impacting native plant nurseries in CA.
- NORS-DUC primarily focuses on applied research, such as validation and development of best management practices; development of remediation options for soil, water, and infested plants; and development of monitoring and control strategies.
- NORS-DUC shares research results with the public through a strong outreach program as well as scientific and technical publications.
- NORS-DUC invites DUC students to participate in research activities in the lab and the research nursery.

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Recent Projects and Collaborations

During the first 5 years of NORS-DUC, researchers from UC Berkeley, UC Davis, Washington State University, Oregon State University, Ohio State University, Colorado State University, Clemson University, and several USDA laboratories conducted experiments at the NORS-DUC site. They focused on such diverse topics as: chemical, thermal, and biological control of *P. ramorum*; long-term survival and sporulation capacity of the pathogen in the soil; resistance mechanisms of host plants; genetic stability of *P. ramorum* isolates growing on host and non-host plants; effect of physiological stress on host plant susceptibility; and disease epidemiology in nurseries.

Recently, studies on new emerging invasive *Phytophthora* species, such as *P. tentaculata*, were also initiated at NORS-DUC, focusing on early detection and development of control strategies. Research at NORS-DUC resulted in the acceptance of steaming as a method for treating *P. ramorum*-infested soils by the USDA Animal and Plant Health Inspection Service (APHIS), and a strong outreach program aims to disseminate scientific results quickly and efficiently to nursery and landscape industries as well as other stakeholders.

Infrastructure

NORS-DUC contains two research sites: site SOUTH (fig. 1) is trapezoid shaped (40 x 36.5 x 47 x 21 m) and site NORTH is rectangular (65 x 16 m). The perimeters of both sites are fenced with a single entry point. Each site contains six individually fenced-in research plots (fig. 2); within each research plot exists a research bed that can be used for the experiments. Most research beds are 3.5 x 9 m and can be subdivided into two 3.5 x 4.5 m half beds. Four research beds are filled with soil for in-soil experiments (fig. 3). The other eight research beds are used for experiments with potted plants (fig. 4); one plot contains a green house (3.6 x 5.5 m). All research beds are lined with a waterproof pond liner to maintain and collect water, which then is filtered, UV-treated and checked for *P. ramorum* presence before release from the research site. A sentinel plant system is used to detect aerial pathogen spread (fig. 5). Incoming plants are held at a quarantine site for 6 weeks before moving into the research plots (fig. 6). The NORS-DUC lab is equipped for microbiological, biochemical, and molecular analysis.

Future Directions

- Study the biology, spreading pattern, and control options of new, invasive pathogens like *P. tentaculata* and other *Phytophthoras*.
- Develop collaborations with new partners, like the nursery industry, universities, and private companies with an interest in plant pathology, horticulture, and agriculture.
- Become a local leader in sustainable management of diseases of ornamental plants.

Information on request for proposals to work at NORS-DUC can be found at www.dominican.edu/norsduc.

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Figure 1-Aerial photo of nursery site SOUTH. Figure 2-Fenced-in research plots. Figure 3-Plot for in-soil experiments. Figure 4-Plot for research with potted plants. Figure 5-Sentinel and barrier plants on the outside perimeter of the research site. Figure 6-Quarantine site for incoming plants.