From Forest Nursery Notes Winter 2013

178. © A systems approach for management of pests and pathogens of nursery crops. Parke, J. L. and Grunwald, N. J. Plant Disease 96(9):1236-1244. 2012.

A Systems Approach for Management of Pests and Pathogens of Nursery Crops

Jennifer L. Parke
Department of Crop and Soil Science & Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331

Niklaus J. Grünwald
Horticultural Crops Research Laboratory (HCRL), USDA ARS, Corvallis, OR 97330

Nursery Production Systems Are Complex Systems

Horticultural nurseries are exceedingly complex agricultural systems, making pest and pathogen management very challenging. Compared to crop monocultures, nurseries are characterized by extreme heterogeneity in plant material. The typical agricultural row crop contains a single cultivar of a single species, grown over hundreds or even thousands of acres, whereas a single horticultural nursery of 40 acres may grow upward of 500 different plant taxa in any given field season (Fig. 1). The typical agricultural crop is started from a uniform propagative material: seeds, clonally propagated tubers, or cuttings from a single source. In contrast, many nurseries propagate multiple species, each from a variety of sources including seeds, bulbs, tubers, cuttings, scions, grafted rootstocks, and tissue culture. This propagative material may originate from multiple sources including on-site production blocks and domestic and overseas markets and can be comingled in propagation blocks.

Nurseries are also characterized by extreme spatial and temporal heterogeneity. Plants typically undergo repotting several times as they are transferred from micropropagation cells (tissue culture plantlets) or flats (seeds or cuttings), and are moved from the propagation house to production greenhouses to container yards or the field. Plants are densely packed in the early stages of growth, and are spread further apart as the canopies expand. Container stock is constantly moved from place to place in the nursery and comingled with other lots. Different plant species require different potting media with particular biological, chemical, and physical properties. Blocks of plants with similar water use are grouped together, but there may be several different irrigation systems (drip, microsprinklers, overhead spray) in a single nursery, and several different irrigation frequencies. In contrast, the typical monoculture row crop is grown in a fairly uniform growing environment, generally in a single soil type with similar physical, chemical, and biological properties, although slope and aspect may vary within the field. Cropping history, tillage, organic matter management, soil fertility, irrigation regime, sunlight, and plant spacing are also fairly uniform within monoculture crops. Unlike nursery crops, most agricultural crops stay in the same place once planted.

Corresponding authors:
J. L. Parke, E-mail: Jennifer.Parke@oregonstate.edu
N. J. Grünwald, E-mail: Nik.Grunwald@ars.usda.gov

http://dx.doi.org/10.1094/PDIS-11-11-0986-FE

Complexity Confounds Pest Management

Pest management is complicated by the heterogeneity of production systems typical for nurseries consisting of a large diversity of plant material grown, the variety of cultural methods employed, compounded by the spectrum of microenvironments (3,4,17). Each plant species is host to a range of plant diseases, insect pests, and abiotic disorders. These must be scouted, recognized, and managed using pest management tools and approaches that often differ among plant taxa. For example, a single nursery in Oklahoma trains scouts to recognize 38 different disorders (18). Epidemiological models and forecasting systems so helpful in managing diseases of agricultural crops such as potato late blight, wheat rust, and soybean rust are almost completely lacking for even the most important diseases that affect nursery crops. A predictive model for rose downy mildew is being developed but is not yet applied commercially (1). Disease forecasting models for apple scab and fireblight on fruit trees could be applied to related tree varieties grown as ornamentals, but this is not a common practice in nurseries. For these reasons, nursery personnel with limited training in plant pathology and entomology face a daunting task in responding appropriately to disease and pest outbreaks.

Nursery Plants Can Be Vectors of High-Stake Pests and Pathogens

Despite all these challenges, management of disease and pest outbreaks in nurseries is particularly critical. Nursery stock can be an important long-distance vector for many pests and pathogens, including exotic organisms that threaten not only ornamentals but also agricultural crops and forests (Table 1). There are numerous historical examples of pathogen and pest introductions via the nursery trade, some of which have caused widespread and catastrophic epidemics. For example, *Cronartium ribicola*, the cause of white pine blister rust, was introduced to 226 locations in the U.S. Midwest on German nursery stock, nearly wiping out white pine (21,26). Chestnut blight, caused by *Cryphonectria parasitica*, was introduced from Asia on nursery stock of Japanese chestnut sold by mail order nurseries beginning in the 1890s (7). By 1926, the disease had spread throughout the eastern North American forests,