

FEATURED NEWS

CONTENTS

Featured News	1
Advisory Panel Spotlight ..	2
Featured Research	3
Extension Highlights	5
Project Meeting Brief	5
Announcements	6
Recent Publications	6
Recent Presentations	7
Project Directors	7
Advisory Panel	8

DELIVERABLES (June to August 2024)

Research

- 3 Refereed journal articles
- 4 Conference presentations

Extension & Outreach

- 1 Extension article
- 7 Extension presentations
- 19 Samples diagnosed
- 42 Email/phone inquiries answered
- 4,327 People reached with articles/news

Education

- 5 Post-doctoral and -graduate associates
- 1 Graduate student
- 2 Internship

A Visitor to Dr. Fulya Baysal-Gurel's Laboratory Learns Hands-on Techniques

By Dr. Fulya Baysal-Gurel, Tennessee State University

Dr. Ayse Filiz Gurel, ORISE researcher with USDA-ARS, U.S. National Arboretum, Floral and Nursery Plants Research Unit in Beltsville, MD in Dr. Pooler's Lab, visited the Baysal-Gurel lab at Tennessee State University, Otis L. Floyd Nursery Research Center in McMinnville, Tennessee between August 26-30, 2024. During her visit, UV-C Light-Emitting-Diode irradiation equipment setup, methodology, dose calculations, and mathematical modeling were demonstrated, specifically focusing on the fungus *Calonectria pseudonaviculata*, the pathogen causing boxwood blight in North America.

On August 29, Dr. Ayse Filiz Gurel gave a brief presentation at the nursery research center on her UV-C project. The visit ended with discussions about potential future collaborations, focusing on combining the strengths and research interests of various BBIG scientists on UV-C irradiation treatment of *C. pseudonaviculata*.



ADVISORY PANEL SPOTLIGHT

Interview of Michael Gaines conducted by Dr. Xiaoping Li of Virginia Tech

Michael (Mike) Gaines has an affinity for trees and shrubs. Mike is the president and founder of CW Arborists, Ltd, a company providing professional solutions and services to the landscaping needs of many homeowners on Long Island and in areas of Connecticut. Especially, he and his team are dedicated to the ongoing battle against boxwood blight and beech leaf disease, aiming to keep those beloved plants healthy in private and public greenspaces.

As a member of the Advisory Panel in the Boxwood Blight Insight Group (BBIG), Mike has a central role. He connects BBIG scientists to landscapers and homeowners, who are fighting at the two frontlines of the battle against the blight. His firsthand experience in detecting and managing the disease provides timely counter actions to the rapid spread of the blight pathogen in private and public properties. In the meantime, Mike has been working closely with Dr. Margery Daughtrey, co-project director of BBIG and senior extension associate at Cornell University, to develop the best boxwood care programs for homeowners. His talk ‘Boxwood in the Landscape: Success and Shortcomings’ at the Advisory Panel Meeting in 2023 strikes a positive note: Boxwood health can be successfully managed through careful planning, dedicated actions, and collaborative teamwork!



Culture matters. Mike often observes that too much water is being applied to boxwood through dripping and overhead irrigation in public and residential landscapes. As a result, this stresses boxwood. He continuously reiterates that boxwood is a low-maintenance plant that is tolerant to drought. Overhead irrigation also elevates the level of the moisture trapped by the dense boxwood foliage, creating a conducive environment not only to the blight pathogen but also to other pathogens. He uses the phrase “right plant, right place” to emphasize the importance of knowing your plant and knowing the appropriate care for best managing boxwood.

Mike does not have any favorite plant as he treats each one as a unique individual. Like a caregiver, he devotes all his energy and focus to the one that needs his care at the moment. “Asking me which plant is my favorite is like asking which kid I love the most”, he jokes.

Home sure is Mike’s favorite place. In order to spend more time with his family, he became a pilot 10 years ago. His plane is the fastest transportation for his daily commute between Killingworth, Connecticut and eastern Long Island, New York. Flying over Long Island Sound, the view is mesmerizing—the rays of the setting sun blur the boundary of the ocean and sky, and the horizon seems touchable for the first time. Mike knows home is close.

Interview of Bennett Saunders provided by Taylor Phelps of Virginia Tech

Bennett Saunders, General Manager of Saunders Genetics, has dedicated his career to advancing the horticulture industry. His family’s business, Saunders Brothers, Inc., a wholesale nursery in central Virginia, has long been known for its diverse range of woody plants, trees, annuals, and perennials supplied to the Eastern Seaboard. Within this thriving operation, a younger branch called Saunders Genetics has emerged, focusing on addressing challenges with boxwood through breeding, testing, selecting, and marketing new and improved cultivars. This initiative includes research into leafminer resistance, which began in 2008, and boxwood blight resistance, which has been a priority since 2011.

With an impressive 35-year tenure as Production Manager of the field and orchards at Saunders Brothers, Bennett oversaw the cultivation of field boxwood, peaches, and apples. His leadership extends beyond the family business, too; he has also served as President of the American Boxwood Society.

One of his proudest professional achievements is the development of the NewGen® boxwood line, created in response to the emergence of the boxwood blight pathogen in the United States. Recognizing the threat

posed by this pathogen, Bennett and his team swiftly identified and began producing superior cultivars with enhanced insect and disease resistance. These improved cultivars safeguarded boxwood production and enhanced impulse cosmetics.



His passion for horticulture is deeply rooted, tracing back to early childhood when he began working in the industry at just six years old. His first job was watering the propagation beds, where he enjoyed watching new cuttings begin to root. This lifelong enthusiasm for nurturing plants continues to drive him, particularly in finding solutions to boxwood problems. "I am still motivated by seeing new roots on a boxwood cutting," he says, reflecting the ongoing excitement he finds in his work.

Looking ahead, Bennett envisions expanding the NewGen® line into a diverse collection of boxwood forms, sizes, and colors, aiming to create stunning landscapes. His vision is to provide an artist's palette of boxwood varieties that offer a "WOW" factor, captivating and inspiring gardeners and landscapers alike.

Beyond his professional accomplishments, Bennett enjoys exploring local history and spending time with his grandchildren. When asked about his favorite plant, his answer was unsurprising: "My favorite plant is a beautiful boxwood with no insects or diseases," a testament to his

unwavering commitment to excellence.

Bennett Saunders' journey in horticulture is one of dedication, innovation, and the pursuit of perfection. His contributions continue to shape the industry, ensuring that future generations will benefit from his passion and expertise. He credits BBIG's dedicated and proactive approach for transforming what was once seen as a horticultural crisis into a situation that can now be effectively managed.

FEATURED RESEARCH

Towards Identification of Weather Factors Driving Boxwood Blight Epidemics by Chuan Hong, Virginia Tech, Virginia Beach, VA

The boxwood blight disease cycle consists of several major steps – pathogen reproduction, dispersal, germination, infection of boxwood and other host plants, and symptom development. What makes this disease so explosive is its ability to complete an entire disease cycle and initiate new infections within a week under conducive weather conditions and to compound over time.

As with other diseases, wet conditions are essential to blight pathogen reproduction, germination and infection. Its infection has an optimal temperature around 23.7°C (74.7°F) according to a recent study under controlled environments. There have been several other lab and controlled environment studies evaluating temperature and/or wetness impacts on blight pathogen growth and reproduction. However, how this disease behaves under field conditions has remained largely unknown. One objective of this project is to identify the weather factors driving boxwood blight epidemics through two case studies – analyzing the data of field trials conducted in the USA (2014 to 2017) and Germany (2006 to 2020).

The USA case included 86 trials that were performed in western North Carolina and Virginia, where boxwood blight was first observed and confirmed in 2011. These trials started with placing blight-free but highly susceptible detector boxwood plants in a field with infected plantings and leaf debris to expose them to the natural inoculum for periods of time. Detector plants were rotated out of the field after 7 days in 70 of the 86 trials, while they were rotated out after 5 to 28 days in the remaining 16 trials depending upon the weather and other conditions. The exposed plants were brought back to the lab and were incubated under ideal temperatures for another 7 days to allow symptom development before infected leaves were counted. Meanwhile, temperature (T, °C), wetness period (h), relative humidity (RH, %), rainfall (mm), and wind direction and speed (m/s) were recorded every 15 minutes through an automatic weather station.

The Germany case included eleven trials that were conducted initially to evaluate different boxwood cultivars and fungicides against boxwood blight. From within these trials, only the data from English boxwood plants that had not received any fungicide treatment were considered. Specifically, for cultivar evaluation trials that were done over a 4-year period with a yearly blight assessment, only the first-year data on percent leaf drop were included. For the fungicide evaluation trials that were conducted within a season with one or more blight assessments, only the last assessment was considered. These fungicide trials had rather different growing season (from planting to disease assessment) durations, ranging from 18 to 200 days. Temperature, relative humidity, and wind speed were recorded every 20 minutes while rainfall was recorded daily.

Correlation analysis was conducted to relate boxwood blight ratings to weather data after they were summarized for individual trials/growing seasons. When summarizing the weather data, several considerations were taken into account

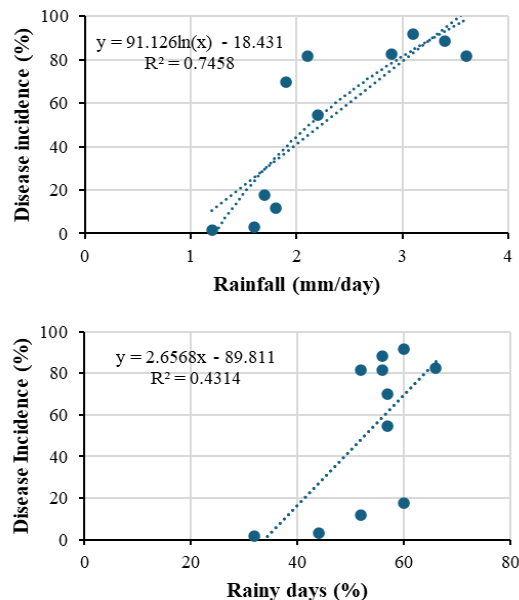


Figure 1 Boxwood blight incidence in relation to rainfall per day (top) and percent rainy day (bottom) during growing season in northern

Table 1 Summary of Pearson correlation coefficient between boxwood blight incidence and weather measurements in the USA and Germany cases (NA=not available)

Weather parameter	USA		Germany	
	Pearson	P	Pearson	P
No. of rainy days	0.27	0.0111	0.18	0.593
Percent rainy days	0.37	0.0004	0.66	0.0281
Rainy hours per day	0.19	0.0866	NA	NA
Total rainfall (mm)	0.26	0.0175	0.41	0.209
Rainfall per day	0.38	0.0004	0.83	0.0016
Rainfall per rainy day	0.26	0.0142	0.69	0.0187
Wetness period (h/day)	0.36	0.0006	NA	NA
Average daily minimum relative humidity (RH, %)	0.30	0.0047	0.14	0.6895
Mean relative humidity (%)	0.42	<.0001	-0.03	0.9321
Average daily maximum relative humidity (%)	0.23	0.0307	-0.25	0.4494
Period when RH<30% (h/day)	-0.11	0.3201	-0.21	0.5409
Period when RH<40% (h/day)	-0.15	0.1619	-0.18	0.5926
Period when RH<50% (h/day)	-0.24	0.0246	-0.07	0.8466
Period when RH≥90% (h/day)	0.48	<.0001	-0.09	0.7919
Period when RH≥95% (h/day)	0.53	<.0001	-0.08	0.8126
Period when RH=100% (h/day)	0.18	0.0996	-0.43	0.1855
Average daily minimal temperature (T, °C)	0.07	0.5007	0.60	0.0509
Mean temperature (°C)	-0.02	0.8275	0.52	0.0988
Average daily maximum temperature (°C)	-0.12	0.263	0.36	0.2796
Period when T<15°C (h/day)	-0.06	0.5591	-0.52	0.0999
Period when T≥30°C (h/day)	-0.20	0.0692	-0.05	0.8952
Period when T≥35°C (h/day)	-0.06	0.585	0.02	0.9422
Average daily minimum wind speed (m/s)	NA	NA	-0.43	0.1901
Mean wind speed (m/s)	-0.2343	0.0299	-0.47	0.1463
Average daily maximum wind speed (m/s)	-0.1129	0.3009	-0.56	0.0761

based on the current knowledge of the biology of blight disease. Specifically, a variety of secondary weather measurements were generated to better gauge the impacts of extreme temperature, relative humidity, and wind speed, in addition to the trial/seasonal means. These included: 1) average daily minimum and maximum temperatures, relative humidities and wind speeds that might have suppressed the blight development, and 2) periods of low and high temperatures (<15, ≥30 and 35°C) and relative humidities (<30, 40 and 50%, ≥90 and 95%, and 100%) that might have further suppressed or promoted the blight progression (**Table 1**). When summarizing the rainfall data, the duration of the trial/growing season was also taken into consideration. Specifically, percent rainy days, average rainy hours per day, rainfall per day and per rainy day were included, in addition to total rainfall and rainy days of the trial/growing season.

As shown by the Pearson correlation coefficient (**Table 1**), only 3 of the 25 original and secondary weather measurements considered, percent rainy days, rainfall per day and per rainy day, consistently had a close relationship to the boxwood blight rating in both USA and Germany cases.

Comparatively, rainfall per day appeared a better measurement than rainfall per rainy day ($P < 0.0016$ vs. < 0.0142). This close relationship between the blight development and rainfall is exemplified by the data of the Germany cases (**Figure 1**). The significance of rain in the boxwood blight field epidemiology was not unexpected, as water splash is the primary means of local spread for the blight pathogen. Therefore, rainfall is critical to the blight pathogen's dispersal, in addition to the reproduction, germination, and infection steps of the disease cycle.

Additional weather measurements showed a close relationship to boxwood blight development in the USA case but none in the Germany case (**Table 1**). These additional measurements included number of rainy days ($P = 0.0111$), wetness period ($P = 0.0006$), average daily minimum RH ($P = 0.0047$), mean RH ($P < 0.0001$), average daily maximum RH ($P = 0.0307$), period when RH $< 50\%$ ($P = 0.0246$), $\geq 90\%$ and 95% ($P < 0.0001$) and mean wind speed ($P = 0.0299$). Further analyses are required to resolve the differences between the USA and Germany cases and identify other weather factors than rainfall per day and percent rainy days in boxwood blight development.

EXTENSION HIGHLIGHTS

The BBIG team members were out sharing information at industry gatherings this quarter. Most notably, we were featured on the program at Cultivate '24, the industry's midsummer trade and educational show in Columbus, OH in mid-July as well as at the Farwest Show in Portland, OR at the end of August. In Columbus, Nina Shishkoff presented on "Box Cultivars, Climate and Disease Control". In Portland Jerry Weiland spoke on how production decisions influence risks for boxwood blight outbreaks. Luisa Santamaria was also featured at the Farwest Show, conducting a seminar session in Spanish that covered advances in boxwood monitoring techniques; she also spoke in English at the Nursery Science Summit, presenting "Growing Awareness: Enhancing Plant Health in Nurseries Through Education". Jay Pscheidt spoke on how smart spraying grapes leads to new boxwood blight management. Margery Daughtrey presented on boxwood blight and other significant nursery crop diseases at two educational field days on Long Island at Cornell's LI Horticultural Research & Extension Center—to horticultural interns from the region on July 16 and at the Plant Science Day on July 18. One of our key 'multiplier' audiences was targeted by Chuan Hong, who gave a presentation on "Boxwood Blight and Other Signature Programs" at the Virginia Master Gardener College in June.

In addition to these live audience presentations that reached many boxwood stakeholders across the country, on July 25, Xiaoping Li presented a seminar online for an international audience: "Tiny But Mighty: Unlocking the Microbiome Potential to Enhance Boxwood Resilience to Disease & Environmental Stress". This was likely the first introduction of many in the green industry to the concept of plant microbiomes and how their study may improve future disease management in revolutionary ways.

Meanwhile, the content and organization of the website at boxwoodhealth.org has been improved through the efforts of Chuan Hong and our collaborators at the Horticultural Research Institute of AmericanHort, Chuan Hong also reached out to an important audience for boxwood blight information with an article - "BBIG – the Boxwood Blight Buster"- in the August issue of Arborist News.

PROJECT MEETING BRIEF

Three monthly Project Leadership Team Meetings were held on June 15, July 17, and August 14, respectively. In addition to planning for the monthly digests, quarterly newsletter and meetings, the Leadership Team discussed and decided to add to the BBIG outreach website two new tabs – Box Tree Moth and Spanish to meet the emerging needs for information on respective topics. The Box Tree Moth tab is active, while content is being developed for the Spanish tab. Also discussed during these meetings were topics for the BBIG Boxwood Webinars with boxwood microbiome by Dr. Xiaoping Li aired on July 25, and next topics identified, although yet to be finalized depending upon the speaker availability. An additional topic of importance was the preparation of the 2024 BBIG Annual Report.

The BBIG Project Directors and Associates held their 16th quarterly project-wide meeting via Teams on August 21, 2024. The meeting started with an invited presentation entitled 'Boxwood blight field epidemiology and forecasting', by Chuan Hong of Virginia Tech, followed by research and extension updates

by Project Directors and/or their associates. Also discussed was project management and annual report. One major change in project management is that Karen Snover-Clift of Cornell University is the new Editor-in-Chief of BBIG monthly digest – Monthly, and quarterly magazine – BBIG Newsletter, starting in August 2024. As done in previous project years, two versions of the 2024 BBIG Annual Report are being prepared with one documenting project activities, accomplishments, and impacts in full detail for the Advisory Panel and stakeholders, and the other – a streamlined version – for the sponsor, the USDA National Institute of Food and Agriculture – Specialty Crop Research Initiative, both due at the end of the 4th project year – August 31, 2024.

BBIG families including Project Directors, Associates, and Collaborators gathered in Memphis, TN during the 2024 Plant Health – Annual Meeting of the American Phytopathological Society, celebrating what has been accomplished together over the past 4 years and charting strategies forward.

ANNOUNCEMENTS



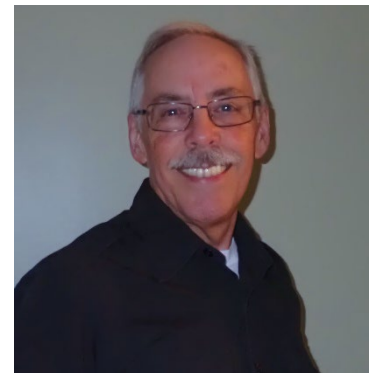
Claire Carter, a recent graduate with a B.S. in Earth and Environmental Science from Virginia Wesleyan University, has broad interests and experience. In 2022, she worked as a horticultural assistant for Norfolk Botanical Gardens in the spring and as an intern at Myrtle Beach State Park nature center for the summer. She also worked as a student trainee for the Chemical Fate & Transport Division at the EPA in summer 2023.

Claire joined the BBIG Team as a Lab and Field Aide at Virginia Tech's Hampton Roads Agricultural Research and Extension Center in March 2024. She has since helped with graduate and post-doc research, project management tasks, lab routines, and the maintenance of research plants. Meanwhile, she has gained a variety of microbiological and horticultural skills as well as lab management, research process, and coordination.

Mike Likins is a well-versed applied plant scientist. He was the State Plant Pathologist for the Commonwealth of Virginia for 12 years from 1990 to 2002. During this period, he also served as the State Endangered Species Coordinator (for plants & insects) for 1½ years, and as supervisor of the Beneficial Insect Rearing Laboratory for 3 years. Mike joined the Virginia Cooperative Extension at Chesterfield Co., Virginia in 2002. He served as the Ag & Natural Resource Extension Agent/Unit Coordinator/County Director, and as a Director for the local Soil & Water Conservation District until his retirement in 2020. Mike was re-employed as the Laboratory Specialist and Plant Pathologist for the county until the end of 2023.

Mike's extensive relationship with boxwood blight began in 2013 when he diagnosed the first positive case in the landscape in Virginia. Until his last retirement, Mike served as a regional expert by diagnosing diseases and educating landscape contractors, area Extension Agents, Master Gardeners and residents on boxwood blight.

Currently, Mike is a Research Associate with Dr. Hong, evaluating the efficacy of a non-rotational program of a novel fungicide as a soil drench and as a foliar application for the management of boxwood blight in landscape settings in the Richmond area.



RECENT PUBLICATIONS

Refereed Journal Articles

1. Ghimire, B., Pendyala, B., Patras, A., and Baysal-Gurel, F. 2024. Evaluating UV-C sensitivity of *Calonectria pseudonaviculata* in model buffer solution using UV-C light emitting-diode system. Plant Disease Open access at <https://doi.org/10.1094/PDIS-03-24-0618-SC>

2. Li, X. P., Weiland, J. E., Ohkura, M., Luster, D. G., Daughtrey, M. L., Gouker, F. E., Chen, G., Kong, P., and Hong, C. X. 2024. Cultivars and production environments shape shoot endophyte profiles of boxwood with different blight resistance. *PhytoFrontiers* Open access at <https://doi.org/10.1094/PHYTOFR-03-24-0023-R>.
3. Khaliq, I., Brand, T., Daughtrey, M., Kong, P., and Hong, C. X. 2024. Investigating weather variables driving boxwood blight epidemics: insights from field trials with *Buxus sempervirens* ‘Suffruticosa’ in northern Germany between 2006 and 2020. *Plant Pathology* [Open access at https://doi.org/10.1111/ppa.13969](https://doi.org/10.1111/ppa.13969).

Newsletter and Trade Journal Articles

1. Hong, C. X. 2024. Boxwood blight buster. *Arborist News* (August issue):26-28.

RECENT PRESENTATIONS

Professional Conference Presentations, Seminars and Webinars

1. Daughtrey, M., Luster, D., Calabro, J., Gray, J., Hall, C., Weiland, J., Baysal-Gurel, F., Gouker, F., Kong, P., Crouch, J., LaMondia, Pscheidt, J., Santamaria, L., Shishkoff, N., Snover-Clift, K., Westrick, N., and Hong, C. X. 2024. Fighting a good fight against invasive pathogens through the Boxwood Blight Insight Group. The 20th International Plant Protection Congress, Athens, Greece, July 1 to 5.
2. Jennings, C., Ghimire, B., and Baysal-Gurel, F. 2024. Control of boxwood blight using fungicides and biorational products. *Plant Health* 2024, Memphis, TN. July 27 to 30.
3. Kong, P., and Hong, C. X. 2024. *Burkholderia* sp. SSG – a safe and powerful broad-spectrum biocontrol agent and biofertilizer. The 20th International Plant Protection Congress, Athens, Greece, July 1 to 5.
4. Shishkoff, N. 2024. Differences in boxwood blight symptom expression at different times and in different boxwood cultivars. *Plant Health* 24, Memphis, TN, July 29.

Extension/Outreach Programs and Presentations

1. Daughtrey, M. L. 2024. Diseases of boxwood and other nursery crops. Intern Field Day, Long Island Horticultural Research & Extension Center, Cornell University, Riverhead, NY. July 16.
2. Daughtrey, M, L. Identifying and managing diseases and insect problems of greenhouse and nursery ornamentals. Online. Eason Horticultural Resources. July 11.
3. Daughtrey, M. L. 2024. Diseases of Ornamental Plants. Plant Science Day, Long Island Horticultural Research & Extension Center, Cornell University, Riverhead, NY. July 18.
4. Hong, C. X. 2024. Boxwood blight and other signature programs. Statewide Annual Master Gardener College. June 7.
5. Li, X. P. 2024. Tiny but mighty - unlocking the microbiome potential to enhance boxwood resilience to diseases and environmental stresses. BBIG Boxwood Seminar Series. July 25.
6. Li, X. P., and Hong, C. X. 2024. Understanding the impacts of fertilization and irrigation on boxwood microbiome and crop health. 2024 Field Day of the Virginia Nursery and Landscape Association. Virginia Beach, VA. July 25.
7. Shishkoff, N. 2024. Boxwood blight – box cultivars, climate, and disease control. Cultivate’24. Columbus, OH. July 14.

PROJECT DIRECTORS

Chuan Hong (Project Leader), Virginia Tech, Virginia Beach, VA
 Margery Daughtrey (Extension Leader), Cornell University, Riverhead, NY
 Douglas Luster (Research Leader), USDA, ARS, Foreign Disease & Weed Science Research, Ft. Detrick, MD
 Charles Hall, Texas A&M University, College Station, TX
 Jerry Weiland, USDA, ARS, Horticultural Crops Disease and Pest Management Unit, Corvallis, OR
 Fulya Baysal-Gurel, Tennessee State University, McMinnville, TN

Fred Gouker, USDA, ARS, Floral & Nursery Plants Research, Beltsville, MD
Ping Kong, Virginia Tech, Virginia Beach, VA
Jo Anne Crouch, USDA, ARS, Foreign Disease & Weed Science Research, Ft. Detrick, MD
James LaMondia, Connecticut Agricultural Experiment Station, Windsor, CT
Jay Pscheidt, Oregon State University, Corvallis, OR
Luisa Santamaria, Oregon State University, Aurora, OR
Nina Shishkoff, USDA, ARS, Foreign Disease & Weed Science Research, Ft. Detrick, MD
Karen Snover-Clift, Cornell University, Ithaca, NY

ADVISORY PANEL & LIAISON TO AMERICANHORT

Jill Calabro (Chair), Sr Product Development Manager, Valent USA Corporation, Walnut Creek, CA
Lynn Batdorf, Boxwood Cultivar Registration Authority, International Society for Horticultural Science
Frank Collier, Owner, Pleasant Cove Nursery, Rock Island, TN
Michael Gaines, President, CW Arborists, Ltd., Sagaponack, NY
Laura Gladwin, Plant Health Manager, Everde Growers, Forest Grove, OR
John Keller, Planning & Research Vice President, Monrovia – Grow Beautifully in CA, CT, GA, OR
Bennett Saunders, General Manager, Saunders Genetics, LLC., Piney River, VA
Richard Schnall, Vice President, Rosedale Nurseries, Inc., Hawthorne, NY
Casey Sclar, H.O. Smith Endowed Director, The Arboretum at Penn State, State College, PA
Mark Sellew, Owner, Prides Corner Farms, Lebanon, CT
Jennifer Gray (Liaison to AmericanHort), Administrator, Horticultural Research Institute, Washington, DC

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