2024 Highlights

About the Nursery Research Center

The Tennessee State University Nursery Research Center, located in McMinnville, TN, provides support to the regional nursery industry through research in the areas of pathology, entomology, genetics, horticulture, sustainability, and related sciences. An economic impact study conducted several years ago determined the NRC has a $5.4 million annual economic impact on the State of Tennessee. In addition, the research outputs at the Nursery Research Center at the time were estimated to produce a $20 million annual impact to the national nursery industry.

The TSUNRC is supported by a combination of state funding, cooperative agreements, and competitive grant sources. Our faculty are highly productive, bringing in approximately $1 million in competitive grant funding per year. Our research programs address major issues challenging the nursery industry today. Current projects include improving production practices and developing management options for pests and diseases impacting Tennessee growers including those of regulatory concern such as imported fire ants (federal quarantine), Japanese beetle (harmonization program), boxwood blight (state quarantines) and the newly identified vascular streak disorder. In addition to our research impacts, we serve the industry by hosting disease and pest workshops, small farm Extension classes, Master Gardener classes, Pesticide Certification classes, and other events for local and state agencies. We also partner with our nursery stakeholder groups, Middle Tennessee Nursery Association, and the Tennessee Nursery and Landscape Association to host annual field day education events.

Dr. Karla Addesso, NRC Director

In February 2024, our long-time center Director, Dr. Nick Gawel, retired. Upon his departure, Dr. Karla Addesso inherited that role. Dr. Addesso will lead the TSUNRC in its ongoing research and extension efforts, while also maintaining her research program in ornamental entomology and chemical ecology. In the short-term, she is focused on upgrading NRC infrastructure and strengthening ties between the center, the nursery industry and Warren County.

Breeding & Genetics
Dr. Lisa Alexander

Program Goal – Conduct genetics and breeding studies in woody ornamental plants with the long-term goal of developing improved plants for the nursery industry.

Research Focus – Develop genomic resources to identify genes underlying important ornamental traits like reblooming and foliar disease resistance; collecting and evaluating native and underutilized species for nursery production potential; and producing new woody ornamentals through hybridization and mutation.

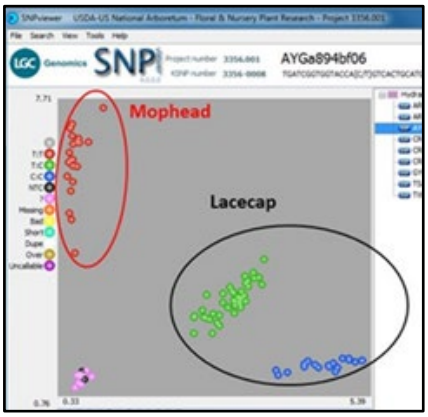
Recent Research Impacts

Oakleaf Hydrangea Conservation and Breeding

- Dr. Alexander and a team of researchers collected oakleaf hydrangea across its native range and characterized the genetic and environmental diversity. They found several populations with rare traits and planted out these populations for horticultural evaluation. Cultivars and wild-collected plants are used in a breeding program for compact, disease-resistant, heavy-flowering oakleaf hydrangeas adapted to a wide range of landscapes.

Native and Underutilized Nursery Crops

- A native witch hazel 'Sunglow' was released after an evaluation of witch hazel species and cultivars. 'Sunglow' is resistant to powdery mildew, flowers heavily in November, and can be own-rooted.
- *Osmanthus fragrans* is a popular flowering tree native to warm climates. To increase cold-hardiness, Dr. Alexander crosses *Osmanthus fragrans* with more cold-hardy species and relatives and evaluates hybrids for cold-hardiness and production value.



Hydrangea Genomic Resources

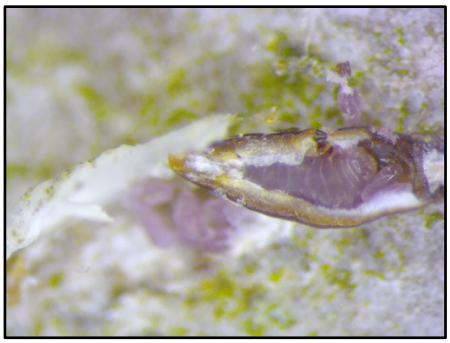
- Dr. Alexander and a team of researchers have developed genetic maps, DNA markers, and a complete genome sequence for bigleaf hydrangea.
- These tools were used to identify genes controlling inflorescence shape and double-flowering in bigleaf hydrangea and are currently being used to identify genes for reblooming, aluminum tolerance, and disease resistance.

Chemical Ecology & Entomology
Dr. Karla Addesso

Program Goal - Manage insects and mites impacting Tennessee and the national woody ornamental industry using behaviorally-based management practices.

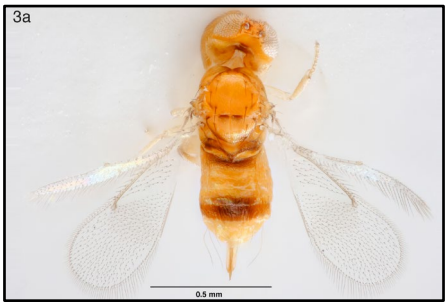
Research Focus - The Chemical Ecology Program research focuses on improved integrated pest management approaches by incorporating information on the ecology and behavior of insects into pest management decision-making.

Recent Research Impacts



Japanese Maple Scale

- Application Timing: Showed that applications of pyriproxyfen and 2% horticultural oil in March and April before crawler hatch is as effective as direct sprays in May.
- Natural Enemies: Identified three species of microscopic parasitic wasps present in middle Tennessee nurseries that feed on JMS. All three of these species are first reports in Tennessee.



Flatheaded Borers

- Systemic Drench Alternative: Identified that winter cover crop blends of crimson clover and grain (triticale, winter wheat) are as effective as systemic drenches of imidacloprid at preventing flatheaded borer attacks.
- Herbicide Damage and Borer Attacks: Found that herbicide drift on foliage and/or trunks during May flight period increased the incidence of borer damage on trees.
- Trap Development: Identified damaged maple tree odors that attract flatheaded borers. Confirmed a new trap shape for capturing flatheaded borers responsible for damage in nurseries.

Ambrosia Beetles

- Ethanol Detection Systems: Identified a hand-held ethanol detection system to evaluate the susceptibility of trees to ambrosia beetles in fields.

Dr. Addesso received the Outstanding Young Research Faculty Award from the TSU College of Agriculture (2014). She is on the governing board of the Entomological Society of America with a global membership of +7,000 entomologists (2019-present). Together with collaborators, she has procured over $18 million in extramural funding.

Entomology
Dr. Jason Oliver

Program Goal - Address insect pests impacting Tennessee and the national woody ornamental industry.

Research Focus -The Entomology Program research focus is improved integrated pest management approaches for wood-boring insects like ambrosia beetles and flatheaded borers, as well as better quarantine treatment options for regulatory pests like Japanese beetle and imported fire ant. Other pests are researched as needed in conjunction with other Otis L. Floyd Nursery Research Center (NRC) programs.

Recent Research Impacts

Imported Fire Ant (IFA)

- IFA Pathogen Detections: Solenopsis invicta virus-1 (SINV-1), SINV-2, SINV-3 and *Kneallhazia solenopsae* (Microsporidian) identified in Tennessee hybrid IFA populations for the first time. New hybrid SINV-3 virus detected (2017). New detections of SINV-4 (2022) and SINV-6 (2023).

Japanese Beetle (JB)

- Chemical Approvals: Acelepryn SC (2020) – first anthranilic diamide alternative to neonicotinoids.
- New Natural Enemies: New flesh-fly parasitoid of adult JB identified (first Sarcophagid known to parasitize JB) (2024). Fall tiphia wasp found in TN (2018). *Ovavesicula popilliae* confirmed in TN (2017).

Flatheaded Borer (FB)

- Systemic Drench Treatment: Imidacloprid was identified as most effective method to control FB for up to 3-years post drench leading to major tree loss prevention and cost reductions.
- New FB Invasives and Other FB State Records: Invasive European oak borer (2003) and *Agrilus subrobustus* (2006) confirmed in U.S. by our program. 68 new state FB species records for TN.

Dr. Oliver received the Outstanding Research Faculty Award from the TSU College of Agriculture (2010) and the Southeastern Branch of Entomological Society of America Distinguished Achievement Award in Horticultural Entomology (2017). He has served as a Research Representative on the JBHP Regulatory Treatment Review Committee since 2004. Together with collaborators, he has procured over $18.2 million in extramural funding to support multiple graduate students, interns, staff, and other TSU faculty members.

Horticulture
Dr. Jake Shreckhise

Program Goal – Develop novel and improve existing nursery management practices that increase plant propagation and production efficiency while mitigating agrichemical runoff; Characterize and evaluate woody ornamental plant germplasm to identify and select for economically important traits.

Research Focus – The Horticulture Lab is focused on evaluating the effect of root-zone-heat-mitigating cultural practices; identifying phosphorus-adsorbing amendments that can be added to nursery substrates to improve phosphorus fertilizer retention during irrigation and storm events; Developing dependable clonal propagation protocols; Evaluating California incense cedar trees from 12 climactically diverse provenances for their adaptability to eastern US climates; Assessing the effects of fertilizing bigleaf hydrangea with silicon on its tolerance to foliar diseases and abiotic stress; Comparing bigleaf hydrangea cultivars for heat tolerance and identifying the traits that contribute to heat tolerance.

Recent Research Impacts

Root-zone Temperature

- Nursery growers who have switched to using white containers have reported higher quality root systems and up to a 30% reduction in production time for certain species.
- Results of root-zone temperature research presented at grower conferences in California, Illinois, Ohio, North Carolina, and Tennessee.

Phosphorus Requirements of Woody Plants:

- Found that industry-standard controlled-release fertilizer formulation of 3:1:2 NPK provided container-grown nursery crops with excessive amounts of P.
- Reducing the P content by 33-50% (depending on species) produced plants of equal quality and size.
- As a result of this research, low-P fertilizers with 30% to 60% less P have been adopted by nurseries throughout the mid-Atlantic.

Incense Cedar Propagation

- Developed a cutting propagation protocol for an Oregon nursery that has resulted in an 85% rooting success rate for their new incense cedar cultivar

Dr. Shreckhise's research on root-zone temperature has received $400,000 in temporary base funds through the Floral and Nursery Research Initiative. His research on reducing phosphorus leaching from container substrates was awarded $20,568 from the ARS Office of Technology Transfer Pilot Initiative and a Certificate for Innovative Thinkers. Dr. Shreckhise is Chair of the Nursery Crops Professional Interest Group for the American Society for Horticultural Science and Chair-elect of the NC1186 Multistate Research Project, "Water Management and Quality for Ornamental Crop Production and Health."

Nursery Production and Sustainability
Dr. Anthony Witcher

Program Goal - Develop improved and sustainable practices for nursery crop production.

Research Focus - Address major issues in nursery crop production with an emphasis on weed management, cover crops, and alternative soil/substrate amendments.

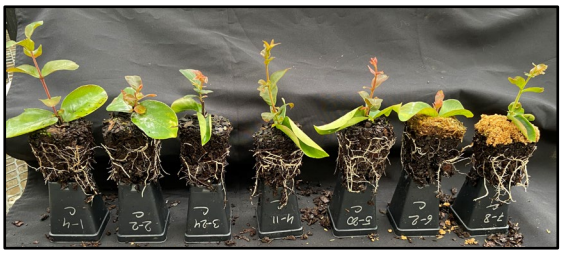
Recent Research Impacts

Weed Management

- Identified pre-emergent herbicides and mulches for use in cutting and seedling propagation in containers. Two TN growers have adopted these practices)
- Identified pre-emergent herbicides for use in field seedling production. Two TN growers have adopted these practices.

Cover Crops

- Identified several cool-season cover crops/mixes and determined optimum seeding rates for nursery middles. Several TN growers have adopted these practices.



Alternative Substrates

- Determined current fire ant and Japanese beetle insecticide treatments are effective in compost-amended substrate. This work was conducted to ensure quarantine and harmonization treatments work in substrates other than pine bark.

Dr. Witcher serves, as 2nd Vice President on the Executive Committee (International Plant Propagators' Society - Southern Region) and as a Board Member for Southern Cover Crops Council. For the IPPS Southern Region he serves on the Membership Communications Committee, Fellows Screening Committee and the Sponsorship Committee. He also Serving on the Council for Agricultural Science and Technology (CAST) Board of Representatives for the Northeastern Weed Science Society.

Plant Pathology
Dr. Fulya Baysal-Gurel

Program Goal - Developing sustainable, environmentally friendly, and economical management practices for the woody ornamental industry in Tennessee, with a concentration on plant pathology, mycology, plant disease diagnosis and management, integrated pest management, and biological control of plant diseases

Research Focus - Our program aims to develop sustainable, environmentally friendly, and economical management practices for woody ornamental diseases. Using both molecular and classical techniques, we focus on the detection, diagnosis, and management of fungal, oomycete, bacterial, and viral diseases affecting woody ornamentals in nursery production in Tennessee. In conjunction with other Nursery Research Center programs, we connect closely with growers to better understand their perceptions, knowledge, and management practices and develop more effective practices to deter and manage the diseases affecting their production.

Recent Research Impacts

Diagnostics

- Our lab has diagnosed over 3,000 woody ornamental samples since 2015, confirming 12 new diseases in Tennessee, including boxwood blight in Warren County in 2016.
- Played key role in helping the state's agricultural authorities in their efforts to manage boxwood blight.

Vascular Streak Dieback (VSD) Threat

- Conducted fungicide efficacy trials in 2022 and 2023 using redbud plants that were naturally exhibiting VSD symptoms in the field and in container-grown production settings in Tennessee.
- Currently working to isolate, detect, and identify VSD's causal agent/s; to screen fungicides to determine their effectiveness against VSD; and to screen the redbud species/cultivars to identify their tolerance/susceptibility to VSD. Our goal is to develop an integrated disease management plan to prevent or at least reduce losses due to VSD.

Other: The TSU College of Agriculture honored Dr. Baysal-Gurel with its Outstanding Early-Career Scientist Award in 2017 and its Outstanding Graduate Student Mentor Award in 2023. She and her collaborators have received a total of 85 contracts or grants that have procured over $18 million in extramural funding, which has provided full or partial support for 17 personnel and several undergraduate students over the past eight years.

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