

Station News

The Connecticut Agricultural Experiment Station
Volume 10 Issue 10 October 2020



All images taken by Dr. Kimberly Stoner:
Perplexing bumble bee on anise hyssop
Bumble bees on yellow coneflower
Bumble bee on mountain mint
Bumble bee on Zinnia

The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society", a motto as relevant today as it was at our founding in 1875.



CAES

The Connecticut Agricultural Experiment Station

Putting Science to Work for Society since 1875

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GRANTS RECEIVED SEPTEMBER 2020

“FDA LFFM- Continuation of human and animal food/feed programs at the CT Agricultural Experiment Station.” White, J.C. Awarded from US FDA in September 2020 for 5 years; \$3,225,000.

This proposal, entitled “FDA LFFM- Continuation of human and animal food/feed programs at the CT Agricultural Experiment Station,” is being submitted in response to FOA-PAR-20-105 Laboratory Flexible Funding Model (LFFM) (U19) Clinical Trial Not Allowed. Our proposal includes 7 different projects encompassing Food Defense, Human Food Product Testing, Animal Food Product Testing, Chemistry Capability/Capacity Development, Sample Collection, NFDSX and ORAPP Integration, and Method Development/Validation. Each Project is described in its own Component within Assist, as well as Overall and Admin core Components. The Connecticut Agricultural Experiment Station (CT AES) has a 145-year history of food safety research, including 15 years as a member of the FDA Food Emergency Response Network (FERN) Chemistry Cooperative Agreement Program (cCAP), and 8 years of funding under 4 different FDA ISO food safety CAPs. CT AES participates in a broad range of surveillance and monitoring programs to ensure the safety of food in the state. The primary goal of the current LFFM Proposal is to acquire the necessary funding to enhance the capacity and capabilities of CT human and animal food testing laboratories in support of an integrated food safety system. Specifically, CT AES will conduct sample testing in the area of chemistry and will engage in the development special projects that would support and expand that testing. This project will strengthen and improve FDA’s efforts to prevent foodborne illnesses and minimize foodborne exposures through building a nationally integrated laboratory science system. The funding will equip CT with additional resources that can be employed to build and increase sample throughput capacity within their state.

Dr. Scott C. Williams, Dr. Kirby C. Stafford III, and Dr. Megan A. Linske. “Effectiveness of Oral Delivery of the Systemic Acaricide Moxidectin to White-tailed Deer in the Management of the Pathogen Vectors *Amblyomma americanum* and *Ixodes scapularis*.” Centers for Disease Control and Prevention; BAA 75B301-20-R-67837; \$257,036; 09/2020 to 09/2023.

Tick-borne illnesses, primarily Lyme disease but also anaplasmosis, spotted fever rickettsiosis, babesiosis, tularemia, and Powassan encephalitis, continue to be public health threats and have increased exponentially over the past several decades. Deer management alone has been successful in significantly reducing tick abundances in only locations of an insular nature with limited immigration. Topical acaricide application has had limited success in management of ticks on deer while systemic treatment has had excellent success, but use is limited as lengthy withdrawal periods (45-48 days) are required before animals can be consumed, which precludes its use during and ~ 7 weeks prior to hunting season. This proof of concept study will determine if the systemic acaricide moxidectin can be orally delivered to white-tailed deer for successful control of all stages of parasitizing *Amblyomma americanum* and *Ixodes scapularis*. The USDA has recently approved a 0-day withdrawal period for moxidectin use in cattle; humans can consume milk and beef at any time after application. In addition, the FDA approved moxidectin for use in medicine for the systemic acaricidal treatment of river blindness (which is caused by a parasitic worm) in humans over 12 years old. Whole kernel corn will be coated with a commercially available formulation of moxidectin ([Cydectin® Pour-On for Beef & Dairy Cattle, 5 mg moxidectin/ml; Bayer AG, Leverkusen, Germany](#)) and fed to two white-tailed deer populations, one with a known *A. americanum* population and the other a known *I. scapularis* population. Deer will be treated during peak activity periods for adult stages of both species. Treatment effectiveness will be determined by obtaining blood samples from deer during and up to 8 weeks post-treatment to determine moxidectin levels and regressed against parasitizing tick burdens on individual animals. This strategy has potential to have a devastating impact on areawide tick abundances, thus positively impacting human health and way of life by reducing both tick abundances and incidents of tick-borne illness.

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STATION NEWS

ADMINISTRATION

DR. JASON C. WHITE participated in a meeting with DAS Construction Services staff and Christopher Williams Architects regarding the New Haven campus greenhouse project (September 1); participated in the Center for Sustainable Nanotechnology (CSN) all faculty ZOOM call (September 3); hosted the CSN monthly nanochemistry-plant working group call (September 8); participated in the monthly FDA FERN cCAP call (September 10); participated in a ZOOM call with collaborators at Louisiana State University and the University of Auckland regarding a manuscript we are preparing (September 10); hosted a kick-off meeting for a newly funded USDA NIFA competitive grant with **DR. WADE ELMER** and University of Massachusetts faculty focused on nanoscale sulfur (September 11); participated in a ZOOM call with CSN collaborators at the University of Wisconsin to discuss collaborative experiments (September 11); participated in the Department of Public Health Laboratory Preparedness monthly conference call (September 14); participated in a teleconference call with CAES and USDA APHIS staff regarding the spotted lanternfly (September 15, 25); participated in a Teams meeting with CT Department of Agriculture and CAES staff regarding the interagency sampling contract (September 16); participated in a weekly CSN all center call (September 16, 23); participated in an FDA webinar on our newly awarded Laboratory Flexible Funding Model (LFFM) grant (September 17); participated in a ZOOM call with collaborators at Johns Hopkins University regarding collaborative research (September 17); participated by ZOOM in the NanoInnovation 2020 Conference & Exhibition held in Rome, Italy, and gave a presentation entitled “Nanoscale nutrients to suppress disease and increase crop production” (150 attendees) (September 18); as an external committee member, participated remotely in the Ph.D. defense of Nathalie Hudson-Smith at the University of Minnesota (September 21); participated by ZOOM in the annual Northeast Experiment Station Directors meeting (September 22); participated in a Teams meeting with staff from the Attorney General’s Office regarding regulation of insect pests (September 22); participated in an EPA-sponsored webinar on the “Next Gen Fertilizer Challenge” (September 24); hosted the quarterly CAES Safety Committee meeting (September 28); participated by ZOOM in the annual Experiment Station Directors meeting (September 28-30); and participated by ZOOM in the annual all-hands CSN meeting and gave a presentation entitled “Nanochem-plant Work at CAES” and hosted a breakout session on plant and nanoparticle interactions (65 attendees) (September 30).

ANALYTICAL CHEMISTRY

DR. CHRISTIAN DIMKPA submitted a research proposal entitled “Harnessing tripolyphosphate as nanofertilizer: formulation with chitosan and nanoscale zinc oxide to enhance phosphorus (P) use efficiency” to the Hatch Grant and which got approved for funding. In the project, Dr. Dimkpa will explore tripolyphosphate (TPP) - that otherwise contributes to pollution of water bodies and eutrophication - as an alternative source of phosphorus for crop fertilization. The TPP will be formulated with zinc (Zn) oxide nanoparticles and functionalized by addition of chitosan, to improve phosphorus use efficiency through reducing P leaching and modulating the negative interaction between P and Zn. The product will be evaluated in wheat and soybean.

DR. BRIAN EITZER participated in a conference call of the North American Chemical Residue Workshop’s organizing committee (September 10); a conference call of the FDA Laboratory Flexible Funding Model where they discussed how this new grant program will work (September 17); the APHL Cannabis Community of Practice ZOOM call, which reviewed a previous webinar and had a round robin discussing issues in the various states (September 24); and presented a webinar during the Thermo Instrument Company user meeting entitled “Use of LC-HRMS in the Analysis of Contaminants in Foods, Feeds, and Environmental Samples” (90 live viewers, 20 on demand viewers) (September 29).

DR. CHRISTINA ROBB participated in meetings for the Eastern Analytical Symposium for which she is a board member: board meeting (September 11); 2021 program meeting (September 15), long range planning meeting (September 23); participated in an FDA FERN cCAP technical call (September 10) and an FDA LFFM call (September 17).

MS. KITTY PRAPAYOTIN-RIVEROS assisted with the production of the CAES Seminar Series - Optimizing Community Scale Surveillance Efforts for SARS CoV-2 (September 2); assisted with the production of the CAES Seminar Series - Candidate Disease Resistance Genes for *Populus trichocarpa* Revealed by Genome-wide Association Mapping and Transcriptome Analysis (September 30); participated in the Sample Analysis Data Exchange - IT Implementation Phase Meeting on WebEx to discuss the NFSDX (National Food Safety Data Exchange) phase II Sample Data Elements Mapping File (September 1, 15); and participated in the CT Weekly Office Hours for Teams with Microsoft Customer Success Manager (September 7, 21, 28).

DR. NUBIA ZUVERZA-MENA accepted an invitation to join the journal *Biomolecules* as a Topic Editor. She will be leading Special Issues, suggesting new topics, and supervising the editorial process.

ENTOMOLOGY

DR. KIRBY C. STAFFORD III participated in a conference call with members of the Northeast Regional Center of Excellence in Vector Borne Diseases on project logistics for a proposed *Haemaphysalis longicornis* overwintering study (September 2); participated in a conference call with members of the Centers for Disease Control and Prevention to discuss a new multiyear grant for host-targeted acaricide trials (September 21); hosted Dr. Christopher Kerantzas, a Yale-New Haven Hospital Microbiology Fellow (September 21-23); and on various dates, participated in calls and with **DR. GOUDARZ MOLAEI** participated in preparing the vector-borne disease component on climate change for the GC3 Public Health and Safety Working Group report.

MS. KATHERINE DUGAS gave a virtual talk via ZOOM to a group of Boy Scouts working towards their Insect Study merit badge with the Scouts engaged in a discussion about insect taxonomy and biology (10 attendees) (September 18); and with **DR. GALE RIDGE**, was interviewed about bed bugs and the misinformation and urban myths surrounding them by Brian Scott-Smith for a Coast and Country CAES Podcast (September 29).

DR. MEGAN LINSKE participated in a conference call with members of the Northeast Regional Center of Excellence in Vector Borne Diseases on project logistics for a proposed *Haemaphysalis longicornis* overwintering study (September 2); participated in a conference call with members of the Centers for Disease Control and Prevention to discuss a new multiyear grant for host-targeted acaricide trials (September 21); discussed and demonstrated Lyme disease ecology field work for Dr. Chris Kerantzas (Yale University Medical Fellow) with **DR. SCOTT WILLIAMS**, **MR. MICHAEL SHORT**, and **MRS. JAMIE CANTONI** (September 23); and assisted in vegetation surveys with **DR. SCOTT WILLIAMS** (CAES), Mr. Michael Gregonis (DEEP Wildlife Division), and Mr. Andy Hubbard (MDC Forester) at MDC's Barkhamsted Reservoir property (September 24).

DR. GALE E. RIDGE was interviewed about pollinators and pollinator pathways in Connecticut by Clare Dignan of the New Haven Register (September 3); and was interviewed about the brown marmorated stink bug by Joy Venderlink of the Cheshire Citizen and about the biology of wasps, hornets, and yellowjackets by Holly Kocet of the Pollinator Pathways newsletter (September 28).

DR. VICTORIA L. SMITH participated in a meeting of the Yale Biosafety Committee via ZOOM (21 participants) (September 17); and was interviewed regarding spotted lanternfly by WSHU radio (September 22).

DR. KIMBERLY A. STONER was interviewed by Amy Ziffer, who is writing a book on pollinator plants (September 15); presented a talk on Planting for the Bees' Needs to Monroe Girl Scouts, which was attended by 16 fifth-grade girls and 2 adults (September 21); participated in an international meeting of the COLOSS (Society for the Prevention of Honey Bee Colony Loss) Task Force on Bee Nutrition (32 participants worldwide) (September 22); and co-led a meeting of the Pollinator Committee of the Plant-Insect Ecosystem Section of the Entomological Society of America to discuss the development of a "Wildly Important Goal" for the Entomological Society to become a leading source of information on pollinators for policymakers, the media, and the public (9 participants) (September 30).

ENVIRONMENTAL SCIENCES

DR. JOSEPH PIGNATELLO participated in a virtual conference with collaborators from the University of Maryland and GeoSyntec on a collaborative project (September 16 and 23).

DR. PHILIP ARMSTRONG was interviewed about West Nile virus activity in Connecticut by Fox 61 and NBC-CT (September 9); was interviewed about EEE virus by the New London Day (September 25) and Yale Daily News (September 28); and gave an online seminar entitled "Jamestown Canyon Virus in Connecticut: Lessons Learned from 24 Years of Surveillance and Research" to the American Mosquito Control Association (September 23).

DR. DOUG BRACKNEY presented a talk entitled "Community Scale Surveillance Efforts for SARS-2 CoV" at the CAES Seminar Series (September 2); presented the same talk at the Experiment Station Associates annual meeting (September 9); and was interviewed about his role in SalivaDirect by the Chesterton Tribune (his parent's hometown newspaper).

MS. ANGELA BRANSFIELD participated in a Federal Select Agent Program's Multi-Agency Informational Meeting (September 23) and a Federal Select Agent Program's RO webinar series Inactivation Protocols, Overview and Updates (September 30).

DR. GOUDARZ MOLAEI was interviewed regarding tick activity by Fox 61 (<https://www.fox61.com/article/news/local/covid-concerns-west-nile-eee-lyme/520-f42ef336-679a-49e9-9aab-dc3b512026c2>) (September 9); by the New Haven Register (<https://www.nhregister.com/health/article/Population-of-invasive-tick-species-discovered-in-15565811.php>) (September 14); by Fox 61 (<https://www.fox61.com/article/news/local/asian-longhorn-tick-discovered-in-fairfield-county/520-d2a5a368-22c3-4bbb-bcbf-c214ed17d06e>) (September 14); by WICC600 radio (September 24); and by Rich Kirby, editor for patch media (<https://patch.com/connecticut/across-ct/asian-longhorned-ticks-are-latest-bugs-set-shop-ct>) (September 16); and also hosted Christopher Kerantzas, MD/PhD, Yale School of Medicine, to discuss research (September 21).

DR. SARA NASON participated in virtual meetings of the Benchmarking and Publications for Non-Targeted Analysis working group (September 3, 11, 24); participated in a virtual meeting with collaborators from Yale regarding a grant submission (September 9); and launched a website nontargetedanalysis.org for the Benchmarking and Publications for Nontargeted Analysis working group.

FORESTRY AND HORTICULTURE

DR. JEFFREY S. WARD was interviewed about the importance of severe weather in creating young forest habitat by Robert Miller, Danbury News-Times (September 1); administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board (September 9); met with Joe Orefice (Yale University) to discuss invasive control (September 21); participated in a conference call with state and private foresters to discuss forest management and carbon storage/sequestration (September 24); participated in a conference call for the Increasing Resiliency in Southern New England Oak Forests project (September 25); spoke on "A Short History of the Connecticut Forest" for the Long Hill Garden Club in Trumbull (26 attendees) (September 28); and gave a ZOOM presentation entitled "A Short History of the Connecticut Forest" for the Cragin Memorial Library in Colchester (24 attendees) (September 29).

DR. SUSANNA KERIÖ attended a meeting of NE1833, "Biological Improvement of Chestnut through Technologies that Address Management of the Species and its Pathogens and Pests" (September 7); and participated in Connecticut Tree Protection Examining Board oral examinations of arborist candidates (September 9).

DR. ABIGAIL A. MAYNARD talked about growing vegetables at Lockwood Farm in a video to be used in Lower School classes at Hamden Hall Country Day School (4 teachers) (September 18); and reported on Station activities at a quarterly meeting of the Council on Soil and Water Conservation via ZOOM (15 adults) (September 24).

DR. SCOTT C. WILLIAMS participated in a conference call with members of the Northeast Regional Center of Excellence in Vector Borne Diseases on project logistics for a proposed *Haemaphysalis longicornis* overwintering study (September 2); participated in a conference call with members of the Centers for Disease Control and Prevention to discuss a new multiyear grant for host-targeted acaricide trials (September 21); discussed and demonstrated Lyme disease ecology field work for Dr. Chris Kerantzas (Yale University Medical Fellow) with **DR. MEGAN LINSKE**, **MR. MICHAEL SHORT**, and **MRS. JAMIE CANTONI** (September 23); and conducted vegetation surveys with **DR. MEGAN LINSKE**, Mr. Michael Gregonis (DEEP Wildlife Division), and Mr. Andy Hubbard (MDC Forester) at MDC's Barkhamsted Reservoir property (September 24).

PLANT PATHOLOGY AND ECOLOGY

DR. WADE ELMER attended an APS Foundation Board monthly meeting via ZOOM (12 attendees) (September 16); attended the USDA NIFA plan of work briefing (51 attendees) (September 23); and attended the Center for Sustainable Nanotechnology All hands meeting via ZOOM (46 attendees) (September 29-30).

DR. YONGHAO LI participated in the National Plant Diagnostic Network Online Communication and Web Portal Committee Meeting via ZOOM (8 adults) (September 9); and participated in the Northeast Plant Diagnostic Network Regional Meeting via ZOOM (21 adults) (September 21).

DR. ROBERT E. MARRA presented, via ZOOM, a webinar, "Ecology of Forest Fungi," to the Menunkatuck chapter of the National Audubon Society (180 adults) (September 8); administered oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board (Lockwood Farm) (September 9); and was interviewed on beech leaf disease by Brendan Crowley for CT Examiner (<https://ctexaminer.com/2020/09/28/deadly-beech-leaf-disease-identified-across-connecticut-and-rhode-island/>) (September 23).

DR. LINDSAY TRIPLETT served on a federal grant panel as an expert reviewer for the EuroXanth COST Action CA16107 Wiki on Xanthomonas virulence factors; presented a virtual talk entitled "The Rice That Helped America Grow" for the Avon Library (11 attendees)

(September 15); served on the Ph.D. committee of Michigan State University graduate student, Jingyu Peng, who successfully presented and defended his dissertation virtually (September 30); and served as organizer and co-host of the Early Career Virtual Showcase of the Japan-US Seminar on Plant Pathology (four sessions with 100-120 attendees per session (September 28-29, October 5-6).

VALLEY LABORATORY

MS. ROSE HISKES co-chaired virtual Connecticut Invasive Plant Working Group symposium planning committee ZOOM meetings (September 8, 22, 29); and assembled an invasive insect display and handouts including Spotted Lanternfly information for David Irvin, DEEP Forestry, who did a talk for the Watertown Rotary Club at Hawk Ridge Winery (18 attendees).

DR. JAMES LAMONDIS was interviewed about beech leaf disease in Connecticut by Brendan Crowley for the Connecticut Examiner (September 21).

DEPARTMENTAL RESEARCH UPDATES SEPTEMBER 2020

Adeel, M., T. Farooq, **Jason C. White**, Y. Hao, and Y. Rui. 2020. Carbon-based nanomaterials suppress tobacco mosaic virus (TMV) infection and induce resistance in *Nicotiana benthamiana*. *J. Hazard. Mat.* doi.org/10.1016/j.jhazmat.2020.124167.

Abstract. Although nanomaterials (NMs) may inhibit viral pathogens, the mechanisms governing plant-virus-nanomaterial interactions remain unknown. *Nicotiana benthamiana* plants were treated with nanoscale TiO₂ and Ag, C60 fullerenes, and carbon nanotubes (CNTs) at 100-500 mg/L for a 21-d foliar exposure before inoculation with GFP-tagged tobacco mosaic virus (TMV). Plants treated with CNTs and C60 (200 mg/L) exhibited normal phenotype and viral symptomology was not evident at 5 days post infection. TiO₂ and Ag failed to suppress viral infection. RT-qPCR analysis revealed that viral coat protein transcript abundance and GFP mRNA expression were reduced 74-81% upon CNTs and C60 treatment. TEM revealed that the chloroplast ultrastructure in carbon NM-treated plants was unaffected by TMV infection. Fluorescence measurement of CNTs and C60 (200 mg/L) treated plants indicated photosynthesis equivalent to healthy controls. CNTs and C60 induced upregulation of the defense-related phytohormones abscisic acid and salicylic acid by 33-52%; the transcription of genes responsible for phytohormone biosynthesis was elevated by 94-104% in treated plants. Our findings demonstrate the protective role of carbon-based NMs, with suppression of TMV symptoms via hindered physical movement and viral replication. Given the lack of viral phytopathogen treatment options, this work represents a novel area of nano-enabled agriculture.

Camp, A. A., M. A. Batres, W. C. Williams, R. W. Koethe, **Kimberly A. Stoner**, and D. M. Lehmann. 2020. Effects of the neonicotinoid acetamiprid in pollen on *Bombus impatiens* microcolony development. *Environmental Toxicology and Chemistry* [ePpub 30 September 2020] doi.org/10.1002/etc.4886.

Abstract. Honey bees and other wild bee species including bumble bees have experienced population declines in recent decades. While many stressors are implicated in bee population declines, much attention has focused on neonicotinoid pesticides, which are widely used and known to be toxic to pollinators. One neonicotinoid, acetamiprid, has been studied very little in bumble bees, despite its use on bumble bee pollinated crops. Here we assessed the impacts of acetamiprid to the North American bumble bee *Bombus impatiens* using the microcolony model. We examined nest growth, development, and subsequent nest productivity as measured by drone production. We found that high concentrations of acetamiprid in pollen (4,520 µg/kg) significantly impacted nest growth and development, and ultimately reproduction (drone production). We found the no observable adverse effects level to be 45.2 µg/kg. Overall, acetamiprid has the potential to negatively impact reproductive endpoints for *B. impatiens*, however effects occurred at concentrations substantially higher than expected environmental concentrations. Further work is required to assess the effects of this pesticide on *B. impatiens* via alternate routes of expo-

sure, and on queenright colonies.

Cui, Wen-Li, Jin-Yue Bian, **De-Wei Li**, Jun-Wei Wang, and Lin Huang. 2020. First report of leaf blight on Chinese fir (*Cunninghamia lanceolata*) caused by *Bipolaris yamadae*. *Plant Disease* 104(9):2523. <https://doi.org/10.1094/PDIS-12-19-2685-PDN>

Abstract. Chinese fir (*Cunninghamia lanceolata* [Lamb.] Hook) is widely cultivated in China, contributing ~40% to timber production in southern China. In December 2017, a leaf blight disease was found on Chinese fir in the National Forest Park of Kunyushan (E 121° 46', N 37° 15') in Yantai, Shandong. It mainly infected Chinese fir, exhibiting brown to brownish-red with one to three dark brown bands across the leaves. It started at the tips and later covered the whole leaf. Incidence was 9.4%. Symptomatic leaves were collected and surface sterilized. Forty cuttings (~0.5 × 0.5 cm) from lesion margins were placed on 2% PDA in Petri plates and incubated at 25 ± 2°C for 7 days. Twenty-eight isolates were single spored and stored in the Forest Pathology Laboratory at Nanjing Forestry University. They were grown on PDA for 7 days and exposed to fluorescent light for another 5 days to stimulate sporulation. Conidia of each isolate were individually collected in sterile ddH₂O and used for plant inoculations (1 × 10⁵ spores/ml). Healthy 1-year-old detached leaves collected in the field and 10-month-old seedlings generated from tissue culture were surface sterilized using 75% ethanol and inoculated with 5 µl of the conidial suspension. Sterile ddH₂O was used on control leaves. Inoculated leaves and plants were kept in a moist chamber at 25 ± 2°C under a 12-h photoperiod. The experiment was repeated twice, with at least six replicates for each treatment. At 7 days postinoculation, detached leaves inoculated with isolate XXG7 showed brown necrotic lesions of 1.4 ± 0.6 cm average length. Similar necrotic lesions were observed on seedlings inoculated with XXG7. No lesions were found on plants inoculated by other fungal isolates and ddH₂O. XXG7 was reisolated from the margins of the lesions and used to fulfill Koch's postulates and for species identification. Colonies of XXG7 grown on PDA were round, with an average mycelial growth rate of 1.6 ± 0.4 cm/day. Aerial mycelium was dense, felted, and olive. The fungus produced black pigments. The vegetative hyphae were septate, branched, light brown to brown, 1.9 to 3.4 µm in width. When the colonies were exposed to fluorescent light for 3 days, conidia and conidiophores were produced. Conidiophores were solitary, brown, rarely branched, multiseptate, flexuous, and geniculate at the upper parts. Conidiophores were 66.8 to 355.6 × 3.5 to 6.7 µm, and the terminal conidiogenous cells were 6.6 to 22.3 µm long (*n* = 30). Conidia were usually long, oval, straight, smooth, brown to dark brown. Most conidia were 4- to 9-distoseptate and 27.1 to 75.4 × 12.6 to 21.3 µm (mean = 53 × 16.3 µm [*n* = 60]). These morphological characteristics were similar to *Bipolaris setariae* (Manamgoda et al. 2014; Shoemaker 1959). The taxonomy was further studied using molecular identification. The ITS region of rDNA, glyceraldehyde-3-phosphate dehydrogenase (GPD) gene, and translation elongation factor-alpha (tef-1α) gene of XXG7 were amplified with primer sets ITS1/ITS4, GDP1/DPG2, and EF1-983/EF1-2218R, respectively (Raza et al. 2019). ITS (MT032396), GPD (MT036970), and tef-1α (MT036971) sequences were deposited in GenBank. The ITS sequence showed 99.8% identity to *B. setariae* strain LC12047 (MN215632.1); GPD sequence 100% similarity to strain LC12047 (MN264068.1); and tef-1α sequence 99.9% similarity to strain LC12047 (MN263926.1). Phylogenetic analysis using concatenated sequences of ITS, GPD, and tef-1α also showed that XXG7 clustered monophyletically with strains of *B. setariae* and was supported with a high bootstrap value (73%). Based on morphological and phylogenetic data, XXG7 was identified as *B. setariae*. *B. setariae* is an important pathogen on lawn grasses, gramineous crops, and other plants (Manamgoda et al. 2014; Raza et al. 2019). This is the first report of *B. setariae* causing leaf blight on Chinese fir in China. This discovery will facilitate further studies as well as monitoring and control of the disease in the future.

Elmer, Wade H., R. De La Torre-Roche, Nubia Zuverza-Mena, Christian Dimkpa, J. Gardea-Torrese, and Jason C. White. 2020. Influence of single and combined mixtures of metal oxide nanoparticles on eggplant growth, yield, and Verticillium wilt severity. *Plant Disease* doi:10.1094/pdis-07-20-1636-re.

Abstract. Verticillium wilt, caused by *Verticillium dahliae*, is one of the major diseases of eggplants. Nanoparticles (NP) of CuO, MnO, and/or ZnO were sprayed alone onto young eggplants and in different combinations and rates and then seedlings were transplanted into soil infested with *V. dahliae* in the greenhouse and field during 2015-2018. All combinations of NP were consistently less effective than NP CuO applied alone at 500 µg/ml at enhancing disease suppression, biomass, and fruit yield. NP CuO were associated with an increase in fruit yield (17% and 33% increase) and disease suppression (28% and 22% reduction) in 2016 and 2017, respectively, when compared to untreated controls. However, this effect was negated in the greenhouse and field experiments when NP CuO was combined with MnO. Combining NP of CuO with ZnO resulted in variable effects; amendments increased growth and suppressed disease in greenhouse experiments,

but results were mixed in the field. Leaf tissue analyses from the greenhouse experiments show Cu concentration in leaves was reduced in when NP CuO was combined with other NPs even when application rate were the same amount. A simple competition for entry sites may explain why combinations of NP CuO and MnO reduced efficacy, but does not explain the lack of inhibition between Cu and Zn. NPs of CuO performed better than their larger bulk equivalent and studies on application rate found 500 µg/ml was optimal. No phytotoxicity, as determined, by leaf burning, necrotic spots or dead apical buds was noted even at the highest rates of 1,500 µg/ml.

Ma, C., J. Borgatta, B. G. Hudson, A. A. Tamijani, R. De La Torre Toche, Nubia Zuverza-Mena, Y. Shen, Wade H. Elmer, B. Xing, S. E. Mason, R. J. Hamers, and Jason C. White. 2020. Advanced material modulation of plant nutritional and phytohormone status suppresses soybean sudden death syndrome (SDS) and increases yield. *Nature Nanotechnol.* DOI:10.1038/s41565-020-00776-1.

Abstract. Customized $\text{Cu}_3(\text{PO}_4)_2$ and CuO nanosheets (NS) and commercial CuO nanoparticles (NPs), were investigated for micronutrient delivery and suppression of soybean sudden death syndrome. An ab initio thermodynamics approach modeled how material morphology and matrix effects control nutrient release. Infection reduced biomass and photosynthesis by 70.3% and 60%, respectively; foliar application of nanoscale Cu reversed this damage. Disease-induced changes in antioxidant enzyme activity and fatty acid profile were also alleviated by Cu-amendment. The transcription of two dozen defense- and health-related genes correlate nanoscale Cu-enhanced innate disease response to reduced pathogenicity and increased growth. $\text{Cu}_3(\text{PO}_4)_2$ NS exhibited greater disease suppression than CuO NPs due to greater leaf surface affinity and Cu dissolution as determined computationally and experimentally. The findings highlight the importance and tunability of NM properties such as morphology, composition, and dissolution. Early seedling foliar application of nanoscale Cu to modulate nutrition and enhance immunity offer great potential for sustainable agriculture.

Shen, Y., J. Borgatta, C. Ma, Wade Elmer, R. J. Hamers, and Jason C. White. 2020. Copper nanomaterial morphology and composition control foliar transfer through the cuticle and mediate resistance to root fungal disease in tomato (*Solanum lycopersicum*). *J. Agric. Food Chem.* doi.org/10.1021/acs.jafc.0c04546

Abstract. Two copper nanomaterials (CuO nanoparticles [NPs] and $\text{Cu}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$ nanosheets) and CuSO_4 were applied to tomato (*Solanum lycopersicum*) leaves and elemental Cu movement from the leaf surface through the cuticle and into the interior leaf tissue was monitored over 8 hours. Two forms of nanoscale Cu were used to foliar treat tomato on a weekly basis in greenhouse and field experiments in the presence of the pathogen *Fusarium oxysporum* f. sp. *lycopersici*. For CuSO_4 , Cu accumulation and retention in the cuticle was over 7-fold greater than the nanomaterials, demonstrating that nanoscale morphology and composition mediate Cu accumulation in leaf tissue. In the greenhouse, weekly foliar applications of the nanosheets and NPs increased seedling biomass by 90.9% and 93.3%, respectively, as compared to diseased and ionic Cu controls. In the field, $\text{Cu}_3(\text{PO}_4)_2 \cdot 3\text{H}_2\text{O}$ nanosheets reduced disease progress by 26.0% and significantly increased fruit yield by over 45.5% per plant relative to the other treatments in diseased soil. These findings suggest that nanoscale nutrient chemical properties can be tuned to maximize and control movement through the cuticle and that interactions at the seedling leaf biointerface can lead to season-long benefit for tomato growing in the presence of *Fusarium* spp.

JOURNAL ARTICLES APPROVED SEPTEMBER 2020

Noori, A., L. P. Bharath, and Jason C. White. Type-specific impacts of Ag on the protein profile of tomato (*Lycopersicon esculentum*). *Plant Cell, Tissue and Organ Culture*

Qu, H., C. Ma, W. Xing, L. Xue, H. Liu, Jason C. White, G. Chen, and B. Xing. Effects of copper oxide nanoparticles on willow growth, soil enzyme activity and microbial community composition in a wetland microcosm. *Environmental Science & Technology*

Rawat, S., K. Cota-Ruiz, H. Dou, V. Pullagurala, Nubia Zuverza-Mena, Jason C. White, G. Niu, N. Sharma, J. Hernandez-Viezcas, J. Peralta-Videa, and J. Gardea-Torresdey. Soil weathered CuO nanoparticles compromise foliar health and pigment production in spinach (*Spinacia oleracea*). *Environmental Science & Technology*

Seebold, K., A. Mila, S. Bost, B. Fortnum, C. Johnson, and James LaMondia. Diseases of tobacco (*Nicotiana tabacum* L). Chapter 21 in *Diseases of Field Crops Handbook*

Stafford, Kirby C., III. Emerging and exotic ticks in Connecticut. *Connecticut Wildlife*

Watkins, A. E., E. P. Fenichel, D. M. Weinberger, C. B. F. Vogels, Doug E. Brackney, A. Casanovas-Massana, M. Campbell, J. Fournier, S. Bermejo, R. Datta, the Yale IMPACT Research Team, C. S. Dela Cruz, S. F. Farhadian, A. Iwasaki, A. I. Ko, N. D. Grubaugh, and A. L. Wyllie. Pooling saliva to increase SARS-CoV-2 testing capacity. *bioRxiv*

ARTICLES OF INTEREST SEPTEMBER 2020



Memorial Bench for Dr. David “Dave” Hill, Soil Scientist and “Station Gardener” 1957-2019

Michael McHill, Rollin Hannan, and Richard Cecarelli installed the bench, rocks, and mulch. Michael McHill and Abigail Maynard planted the plants.

NEW STAFF, STUDENTS, AND VOLUNTEERS SEPTEMBER 2020

Jacquelyn La Reau has two reasons to celebrate in September. First, she successfully defended her Masters thesis entitled "Community Dynamics of Two Distinct Microbiotas of the *Aedes aegypti* Midgut During Bloodmeal Digestion" in the School of Health Sciences at Quinnipiac University. Second, Jackie will be joining the Station as a Technician I. She will be working with Drs. Blaire Steven and Quan Zeng on a USDA-funded project investigating the role of the apple blossom microbiome on fruit development and disease resistance.



Elizabeth Lin is a first-year Ph.D. student in the Department of Environmental Health Sciences at the Yale School of Public Health. Her research mainly focused on the development of a personal exposure assessment tool (the FreshAir wristband) and its application in different study settings. She has analyzed the FreshAir wristband samples collected from 6 different countries using a GC-HRMS. Elizabeth has looked at individuals' exposure to a broad range of toxic chemicals, for example, flame retardants, pesticides, polycyclic aromatic hydrocarbons, phthalates. She is delighted to have this opportunity working with Dr. Sara Nason this semester to learn extraction methods for different sample matrices, and getting exposure to the LC-MS.

Cameron Ryan, a senior at Southern Connecticut State University majoring in Biology, is working with Dr. Neil Schultes for the Fall term as a student intern.





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