Station News

The Connecticut Agricultural Experiment Station
Volume 14 Issue 7 | July 2024

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

This Issue

ADMINISTRATION

JASON C. WHITE, PH.D. met by Teams with the University of Connecticut Technology Commercialization Services group to discuss CAES intellectual property (June 3); participated in a Zoom call with collaborators at Carnegie Mellon University and the University of California Riverside to discuss an Engineering Research Center proposal (June 3, 10); along with **Nubia Zuverza-Mena, Ph.D., and Mandeep Kaur, Ph.D.** participated in a Zoom meeting with collaborators at Rutgers University to discuss a joint USDA grant (June 3, 24); travelled to the University of Connecticut with 26 CAES scientific staff and visitors to have a day-long symposium with faculty at the Institute of Material Science (June 4); participated in the weekly NSF Center for Sustainable Nanotechnology (CSN) all hands call (June 5, 12, 19); travelled to Washington DC to give an invited presentation entitled "Nano-enabled agriculture: A path to global food security in a changing climate" to the National Academies of Sciences, Engineering, and Medicine's Committee on the Quadrennial Review of the National Nanotechnology Initiative (June 5-7); hosted the monthly CSN Nanochem-Plant working group Zoom call (June 5); along with **Nubia Zuverza-Mena, Ph.D.** and **Trung Bui, Ph.D.,** participated in a Zoom meeting with collaborators at Yale University and the University of Minnesota for a joint NIEHS grant (June 11); along with **CHRISTIAN DIMKPA, PH.D. and Hina Ashraf, Ph.D.,** hosted a Zoom call with collaborators at Johns Hopkins University and Stonybrook University to discuss progress on a joint USDA nanoscale phosphorus project (June 11); met by Zoom with 12-15 Molecular Diagnostics to discuss collaborative work (June 12); met by Zoom with the USDA NIFA Closer to Zero working group (June 12); met by Zoom with a University of Maryland Baltimore County graduate student interested in CAES nanotechnology and agriculture research (June 12); along with **Chaoyi Deng, Ph.D.,** met by Zoom with collaborators at the University of Wisconsin to discuss a joint publication on copper sulfide (June 13); hosted the CAES Board of Control Finance Committee meeting (June 14); met with collaborators at Columbia University to discuss a joint USDA Closer-to-Zero research project (June 14, 18); along with **CHRISTIAN DIMKPA, PH.D.** met by Teams with a reporter to discuss the state of CT Cannabis and Hemp programs (June 17); met by Zoom with UMass Amherst Professor Jaime Pinero and a graduate student to discuss collaborative research (June 17); along with **Nubia Zuverza-Mena, Ph.D. and Mila Pavlicevic, Ph.D.** met with collaborators at the University of Texas El Paso and the University of Rhode Island to discuss progress on a collaborative USDA grant (June 20); attended and served as a Co-Chair for the 2024 Nanoscale Science and Engineering for Agriculture and Food Systems Gordon Research Conference at Southern New Hampshire University (June 23-28); and participated in the proposal defense of a PhD student at the New Jersey Institute of Technology (June 28).

PUBLICATIONS:

1. Cao, X., Luo, X., Wang, C., Yue, L., **White, J. C.**, Wang, Z., Xing, B. (2024). Nano- and microplastics increase the occurrence of bacterial wilt in tomato (*Solanum lycopersicum*). *ACS Nano.* DOI: 10.1021/acsnano.4c05875.

Abstract: Concern over nano- and microplastic contamination of terrestrial ecosystems has been increasing. However, little is known about the effect of nano- and microplastics on the response of terrestrial ecosystems already under biotic stress. Here, nano- and microplastics at 150–500 mg·kg–1 were exposed to tomatoes (Solanum lycopersicum L.), and the results

demonstrate that the presence of nano- and microplastics increased the occurrence of bacterial wilt caused by Ralstonia solanacearum in tomatoes as a function of contaminant concentration, surface modification, and size. Our work shows that nanoplastics (30 nm, 250 mg·kg–1) increased the disease incidence by 2.19-fold. The disease severities in amino- and carboxyl-modified nanoplastic treatments were 30.4 and 21.7% higher than that in unmodified nanoplastic treatment, respectively. The severity of disease under the influence of different-sized nano- and microplastic treatments followed the order 30 > 100 nm > 1 > 50 µm. Mechanistically, nanoplastics disrupted the structure of the tomato rhizosphere soil bacterial community and suppressed the induced systemic resistance in tomato; nanoplastics in planta decreased the salicylic acid and jasmonic acid content in tomatoes, thus inhibiting systemic acquired resistance; and microplastics increased the soil water retention, leading to increased pathogen abundance in the rhizosphere. Additionally, the leachates from nano- and microplastics had no effect on disease occurrence or the growth of tomatoes. Our findings highlight a potential risk of nano- and microplastic contamination to agriculture sustainability and food security.

2. Channab, B.-E., El Idissiab, A., **White, J. C.**, Zahouily, M. (2024). MOF ZIF-8, carboxymethylcellulose and polyvinyl alcohol bio-nanocomposite controlled-release phosphorus fertilizer: Improved P management and tomato growth. *Chem. Eng. J.* DOI: 10.1016/j.cej.2024.153610.

Abstract: This study focuses on the synthesis, characterization and application of bio-nanocomposite films using a mixture of carboxymethyl cellulose (CMC) and polyvinyl alcohol (PVA) integrated with zeolitic imidazolate type 8 (ZIF-8) nanoparticles (NPs). This advanced bio-nanocomposites were then used as a coating for triple superphosphate (TSP) fertilizers, and their impact on tomato plant growth was evaluated. The successful integration of ZIF-8 into the composite matrix was determined by distinct changes in Fourier transform infrared (FTIR) spectra, indicating significant structural modifications. Morphological analyses by scanning electron microscopy (SEM) highlight changes in the surface characteristics of the CMC/PVA films. In addition, energy dispersive X-ray (EDX) analysis validates the elemental composition of the resulting nanocomposite. The precision-coated TSP fertilizers shows a significant improvement in mechanical strength, demonstrated by greater crush resistance, as well as a controlled release of phosphorus over time. The coated TSP fertilizers also demonstrated positive effects on various growth parameters of tomato plants. This work highlights the important role of advanced coating fertilizers in promoting sustainable and efficient agricultural practices, making a significant contribution to the wider context of developing innovative agrochemical solutions.

3. Huang, F., Chen, L., Zhou, Y., Huang, J., Wu, F, Hu, Q., Chang, N., White, J. C., Qiu, T., Zeng, Y., He, H., Fang, L. (2024). Exogenous selenium promotes cadmium reduction and selenium enrichment in rice: Evidence, mechanisms, and perspectives. *J. Haz. Mat*. DOI: 10.1016/j.jhazmat.2024.135043.

Abstract: Cadmium (Cd) accumulation in rice is a global environmental issue that poses a potential threat to human health due to its subsequent transfer to food chain. Selenium (Se), an essential element, can reduce rice Cd uptake and alleviate Cd toxicity. However, the effects and mechanisms on rice performance in Cd-contaminated soil remain largely unknown globally. Here, a global meta-analysis was conducted to evaluate the comprehensive effect and mechanism of Se supply on rice growth and Cd accumulation. Our results showed Se amendment with a greater potential to promote rice growth in Cd-contaminated soil. Meanwhile, Se supply decreased rice Cd accumulation by 16.1% (11.2 to 20.6%) for root, 24.6% (19.9 to 29.1%) for shoot, and 37.3% (33.4 to 40.9%) for grain, respectively. The grain Cd reduction was associated with Se dose and Cd pollution level but not Se type and application method. We explored the potential mechanisms of Se mediated-effects in-

cluding increasing Cd distribution in the cell walls, regulating the relative gene expression (OSLCT1, OSHMA2, and OSHMA3), and decreasing soil available Cd concentrations. Importantly, Se supply promoted Se enrichment in rice and alleviated the oxidative damage by stimulating photosynthesis and activating antioxidant enzymes. Furthermore, Se supply reduced health risks posed by Cd in rice grains, especially in slightly Cd-contaminated soil. Our findings suggest that Se supply is a promising strategy for simultaneous Cd reduction and Se enrichment in rice.

4. Zhou, J., **Wang, Y.**, **Zuverza-Mena, N.**, **Dimkpa, C.**, **White, J. C.** (2024). Copper-based materials as an effective strategy for improving drought resistance in soybean (Glycine max) at the reproductive stage. *ACS Agric. Sci. Technol*. DOI: 10.1021/acsagscitech.4c00193.

Abstract: Drought is among the most damaging climatic hazards affecting crop productivity and nutritional quality. Here, we investigated the influence of Cu-based materials at mitigating drought stress in soybean (Glycine max) during the reproductive stage in order to elucidate effects on productivity. Commercial copper oxide (CuO) nanoparticles (NPs), in-house synthesized copper sulfide (CuS) NPs, and copper sulfate (CuSO4) were foliar applied at 10 mg Cu/L daily for one week to soybean that were exposed to water deficit at the onset of flowering, and plants were harvested 5 days after exposure. Drought inhibited flower production by 27% compared to the non-drought treatment. Notably, both CuS NPs and ionic Cu mitigated the drought-induced inhibition of flower production, showing a 41.7% and 33.3% improvement. CuS NPs exhibited the most positive impact on restoring shoot biomass, pod biomass, and shoot moisture content, increasing values by 53%, 96%, and 10%, respectively, compared to the drought control plants. The Cu-based materials maintained photosynthetic parameters under drought and modulated oxidative damage by enhancing reactive oxygen species (ROS)-scavenging enzyme activities. Furthermore, CuO NPs treatment increased shoot and pod Cu level by 624% and 54%, respectively, compared to the drought control plants. Taken together, these findings suggest that Cu-based materials modulate plant protective mechanisms against drought stress during the flowering stage, offering a potentially important nano-enabled strategy to promote biofortified climate resilient crops.

5. Shang, H., Li, C., Cai, Z., Hao, Y., Cao, Y., Xu, X., **White, J. C.**, Ma, C., Xing, B. (2024). Biosynthesized selenium nanoparticles as an effective tool to combat soil metal stresses in rice (*Oryza sativa* L.). *ACS Nano* DOI: 10.1021/acsnano.4c04215.

Abstract: Nanotechnology has demonstrated significant potential to improve agricultural production and increase crop tolerance to abiotic stress, including exposure to heavy metals. The present study investigated the mechanisms by which aloe vera extract gel-biosynthesized (AVGE) selenium nanoparticles (Se NPs) alleviated cadmium (Cd)-induced toxicity to rice (Oryza sativa L.). Upon exposure to AVGE Se NPs at 15 mg Se/L, the fresh root biomass was significantly increased by 100.7% and 19.5% as compared to Cd control and conventional Se NPs; additionally, AVGE Se NPs further elevated the root weight by 28.7% over the untreated control. Upon exposure to bare and AVGE Se NPs, the fraction of acid-soluble Cd was significantly reduced by 7.11% and 4.01%; conversely, no significant reduction was found with the ionic Se treatment. Transcriptional analyses highlighted that AVGE Se NPs activated stress signaling and defense related pathways, including glutathione metabolism, phenylpropanoid biosynthesis and plant hormone signal transduction. Specifically, exposure to AVGE Se NPs upregulated the expression of genes associated with the biosynthesis of glutathione peroxidases (GPx) and gibberellin (GA) by 0.14- and 4.79-fold as compared to the Cd-alone treatment, respectively, and 1.79-and 3.29-fold relative to the untreated control, respectively. Importantly, AVGE Se NPs restored the composition of the endophyte community and recruit of beneficial species under Cd exposure; for example, the relative abundance of Azospirillum was significantly increased in roots, shoots and the rhizosphere soil by 0.73-, 4.58- and 0.37-fold, respectively, relative to the Cd-alone treatment. Collectively, these findings highlight the signifi-

the relative abundance of Azospirillum was significantly increased in roots, shoots and the rhizosphere soil by 0.73-, 4.58- and 0.37-fold, respectively, relative to the Cd-alone treatment. Collectively, these findings highlight the significant potential of AVGE Se NPs to enhance plant growth and minimize the Cd-induced toxicity in rice, and provides a promising nano-enabled strategy to enhance food safety upon crop cultivation in contaminated agricultural soils.

6. Alarcon, H. V., Mohl, J., Chong, G., Betancourt, A., Wang, Y., Leng, W., White, J. C., Brune, D., Xu, J. (2024). Evidence for autotrophic growth of purple sulfur bacteria using pyrite as electron and sulfur source. *Appl. Environ. Microbiol*. DOI: 10.1128/aem.00863-24.

Abstract: Purple sulfur bacteria (PSB), which are capable of anoxygenic photosynthesis via oxidizing reduced sulfur compounds, have been around for billions of years. While being recognized as key drivers of the sulfur cycle in a range of anoxic environments, PSB may be underestimated for their full metabolic capability and flexibility. Here we report successful autotrophic growth of Allochromatium vinosum using solid-phase pyrite (FeS2) as the sole sulfur and electron-donor source. We confirmed different growth patterns of the pyrite-amended cell cultures ("py") compared to their positive controls (containing Na2S·H2O) in terms of doubling time and concentration profiles of dissolved sulfide, sulfate, and iron species. Comparative analysis of transcriptomic sequencing data revealed major and extensive upregulation in genes related to cytochromes that are likely key constituents of electron transport chains in "py". By contrast, almost all genes encoding light-harvesting complex subunits (i.e., puf and puc clusters) and bacteriochlorophylls were significantly downregulated, although those related to carotenoid biosynthesis were not. In terms of sulfur metabolism, genes encoding the periplasmic flavocytochrome c sulfide dehydrogenase (Fcc) and membrane-bound sulfide: quinone oxidoreductases (Sqr) were dramatically upregulated; while expression of most genes in the sox cluster were slightly upregulated or unchanged, those related to cytoplasmic proteins (i.e., dsr and apr clusters) are extensively suppressed. Other top differentially expressed genes include those encoding flagellar/pilin proteins (+), metal efflux proteins (+), outer membrane receptors for ferrienterochelin (-), ribulose-bisphosphate carboxylase (-), and most [NiFe] hydrogenases (+). In "py", we also observed upregulation of key genes related to ferredoxins, iron trafficking proteins, and 4Fe-4S binding proteins but overall downregulation related to FeS assembly proteins. Transmission electron microscopic and X-ray photoelectron spectroscopic analyses of the pyrite substrate in the cell cultures confirmed presence of S0 and polysulfide. All results strongly point to altered pathways in both photosynthesis and sulfur metabolism for the pyrite-supported cell cultures. The findings of this work directly impact our understanding of PSB's metabolic capability, especially their extracellular electron transfer mechanisms, and further, may provide new insight into the early-Earth biological-geological coevolution, as well as artificial photosynthesis as well as bioelectronics designs.

CAES Staff on a visit to University of Connecticut Institute of Material Science (and UConn Dairy Bar)

ANALYTICAL CHEMISTRY

Drs. CHRISTIAN DIMKPA, Yi Wang, Chaoyi Deng, and Jingyi Zhou, along with Director, **Jason White, Ph.D.**, attended the Gordon Research Conference at the Southern New Hampshire University between June 23 and 28. **DR. DIMKPA** presented a poster entitled Nano-enabled Hybrid Phosphorus Platforms for Increasing Phosphorus Use Efficiency. **Yi Wang, Ph.D.** presented a poster on Nanoscale Sulfur for Plant Nutrition, Disease Suppression, and Food Safety; **Chaoyi Deng, Ph.D.** presented a poster on Nanoscale CuO Coating Controls Attachment To and Absorption Across the Leaf Biointerface; and **Jingyi Zhou, Ph.D.** presented a poster entitled Copper-based materials as an effective strategy for improving drought resistance in soybean (*Glycine max*) at the reproductive stage.

NUBIA ZUVERZA-MENA, PH.D. attended the National Institutes of Health Tribal Advisory Committee (NIH-TAC) meeting and presented the talk “Hemp phytoremediation and degradation of PFAS: A trial at the former Loring Air Force Base”, Durham, NC (June 26-28).

NEW STUDENTS, STAFF, AND VOLUNTEERS:

Bei Liu, Ph.D. is an Associate Research Professor at Southern University of Science and Technology, China. She obtained her Ph.D. from Beijing Normal University in 2017 and conducted postdoctoral research at SUStech from 2020 to 2022. Her research focuses on the environmental interfacial chemistry and studies interfacial processes affecting the behavior of nanomaterials and organic molecules in terrestrial and aquatic environments. During her doctoral studies, she conducted academic exchanges at the University of Wisconsin-Madison in the United States. To date, she has published over 20 papers as the first or corresponding author in renowned environmental journals. She has independently led projects funded by the Postdoctoral Science Foundation and the National Natural Science Foundation of China (NSFC) for young scholars and has also participated in several general projects of the NSFC and key projects in Shenzhen. From July to September 2024, she is visiting the CAES, where she will engage in research on agricultural nanotechnology.

PUBLICATIONS:

1. Zhou J., **Wang Y.**, **Zuverza-Mena, N.**, **Dimkpa, C.O.**, **White, J.C.** (2024). Copper-based materials as an effective strategy for improving drought resistance in soybean (*Glycine max*) at the reproductive stage. ACS Agricultural Science and Technology, DOI: 10.1021/acsagscitech.4c00193

Abstract: Drought is among the most damaging climatic hazards affecting crop productivity and nutritional quality. Here, we investigated the influence of Cu-based materials at mitigating drought stress in soybeans (Glycine max) during the reproductive stage in order to elucidate effects on productivity. Commercial copper oxide (CuO) nanoparticles (NPs), in-house synthesized copper sulfide (CuS) NPs, and copper sulfate (CuSO4) were foliar applied at 10 mg Cu/L daily for 1 week to soybean that were exposed to water deficit at the onset of flowering, and plants were harvested 5 days after exposure. Drought inhibited flower production by 27% compared to the nondrought treatment. Notably, both CuS NPs and ionic Cu mitigated the drought-induced inhibition of flower production, showing 41.7 and 33.3% improvement. CuS NPs exhibited the most positive impact on restoring shoot biomass, pod biomass, and shoot moisture content, increasing values by 53, 96, and 10%, respectively, compared to the drought control plants. The Cu-based materials maintained photosynthetic parameters under drought conditions and modulated oxidative damage by enhancing reactive oxygen species-scavenging enzyme activities. Furthermore, CuO NP treatment increased shoot and pod Cu levels by 624 and 54%, respectively, compared to the drought control plants. Taken together, these findings suggest that Cu-based materials modulate plant protective mechanisms against drought stress during the flowering stage, offering a potentially important nanoenabled strategy to promote biofortified climate resilient crops.

2. Irewale, A.T., **Dimkpa, C.,** Agunbiade, F.O., Oyetunde, O.A., Elemike, E.E., Oguzie, E.E. (2024). Unlocking sustainable agricultural development in Africa via bio-nanofertilizer application - challenges, opportunities, and prospects. Scientific African. DOI: 10.1016/j.sciaf.2024.e02276

CAES
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STATION NEWS

Abstract: A combination of rapid population growth, climate change, and environmental degradation have placed immense pressure on global food sources and increased food security concerns especially in developing economies like those of African countries. Notably, efforts to produce food for the rising human population have continued to burden arable lands across the globe, necessitating heavy use of chemical fertilizers to increase crop yield. While the widespread use of conventional fertilizers has indeed enhanced crop productivity, its sustainability is threatened by rapid soil degradation and rising environmental concerns resulting from chemical compound accumulation across several ecosystems. The invention of nanotechnology, which is the synthesis and manipulation of materials at the nanometer (1 to 100 nm) range, promises potential solutions to these agricultural sustainability challenges. Specifically, theoretical, and experimental research on nanofertilizers have highlighted significant potential for their employment in sustainable farming practices. The current review examines the benefits conferred by the delivery of nutrients to plants at the nanoscale, outlining the progress, challenges, and opportunities for adopting this emerging technology by African countries, and highlighting future perspectives and areas of possible collaborations globally.

ENTOMOLOGY

PHILIP ARMSTRONG, PH.D. interviewed by WTIC about the start of statewide mosquito monitoring program and findings from last year (June 3); interviewed by Hearst Media about the detection of West Nile virus in mosquitoes (June 26).

ANGELA BRANSFIELD participated in a CAES DEI meeting (June 4); and participated via Zoom in Yale University's Biosafety Committee meeting (June 20).

JAMIE CANTONI participated in the International Festival of Arts and Ideas as a tour guide, introducing the participants to the Station's grounds and escorting them around the Station to several key scientist speakers (15 attendees) (June 28).

KELSEY E. FISHER, PH.D. presented "Conservation and restoration recommendations that align with monarch butterfly behavior and biological needs" for the Connecticut Butterfly Association (May 8; 45 attendees).

MEGAN LINSKE, PH.D. participated in a preliminary survey of tick diversity on Yale University-owned Horse Island with Dr. Scott Williams (Department of Environmental Sciences and Forestry) and Drs. Mary Beth Decker and Benjamin Chan (Yale University) (June 4); participated in a meeting with collaborators from BanfieldBio, Inc. and North Carolina State University to discuss blacklegged tick repellency trials and the upcoming field season (June 11 & 25); participated in the CDC-funded Northeast Center for Excellence in Vector Borne Diseases and Training and Evaluation Center Leadership Committee meeting (June 18); participated in a call with staff from the Centers for Disease Control and Prevention's Division of Vector-Borne Diseases on progress made on a funded integrated tick management and seasonal spray projects (June 20).

GOUDARZ MOLAEI, PH.D. attended the Longhorned Tick (*Haemaphysalis longicornis*) Stakeholders' monthly meeting and reported on the activity of this tick species in Connecticut (June 3); met and discussed with Dr. Maria Diuk-Wasser of Columbia University a joint research project on *Culex pipiens* and West Nile virus in New York (June 3); was interviewed by Boston Globe about climate change and tick-borne diseases (June 17); and participated in a nationwide tick blitz organized by USDA to map the distribution of the longhorned tick in the United States; tick surveys were conducted in multiple sites in eight Connecticut counties (June 17–27).

GALE E. RIDGE, PH.D. was interviewed by Alleah Red WFSB Channel 3 News about the recently introduced Joro spider (June 5); interviewed by Shanice Rhule, CT public radio about the Joro spider and native spiders found in Connecticut (June 5); interviewed by Kevin Gaiss, NBC News about the Joro spider (June 6); live interviewed on WTIC radio about the Joro spider (May 7th); live interviewed on the Chaz and AJ radio show about the Joro spider as well as presented a talk of field and farm safety for newly hired staff (June 10); presented a talk on jumping worms to the Tolland Garden Club (35 attendees) (June 20); and talked about the function of the Insect Information Office to two tour groups from the International Festival of Arts and Ideas (~20 visitors) (June 28).

CLAIRE RUTLEDGE, PH.D. gave a talk about Spotted Wing Drosophila to the Connecti-

cut Pomological Society (50 attendees) (June 11) at Holmberg's Orchard in Gales Ferry; held individual trainings for citizen scientists in Mansfield (June 27), Old Lyme (June 28), and East Hartford (June 29); article for which she was interviewed in April titled 'To Foil a Deadly Pest, Scientists Aim for a Beetle-Resistant Ash Tree' by Elizabeth Kolbert was published in Yale Environment 360 (June 25). https://e360.yale.edu/features/ash-tree-borers-breeding-wasps

JOHN SHEPARD discussed the Mosquito Trapping and Arbovirus Surveillance Program and evaluated trap placement locations with members of the Preventive Medicine Unit on the US Naval Submarine Base in Groton (June 10); was interviewed about the identification of the first West Nile virus positive mosquitoes in CT for 2024 and tips to prevent mosquito bites and reduce mosquitoes around the home by Matt McFarland from WFSB TV 3 (June 27) and WTNH TV 8 (June 28).

KIRBY C. STAFFORD III, PH.D. presented a talk on ticks and tick bite prevention at the Wittemore Library in Naugatuck, CT (30 attendees) (June 12).

KIMBERLY STONER, PH.D. participated in the Steering Committee of the Working Lands Alliance by Zoom. 20 people participating (June11); presented a talk, "Pollinator Habitat and Biodiversity," to the South Windsor Pollinator Pathway. Wapping Community Church, South Windsor (25 attendees) (June 11); presented talk, "CT Environmental Rights Amendment," to the Non-profit Accountability Group by Zoom (17 attendees) (June 17); interviewed by WFSB, Channel 3, on minimizing the risk of West Nile virus, ticks, and poison ivy and the value of native plants for pollinators and other wildlife (June 27).

TRACY ZARRILLO, Casey Johnson, David Mantack, Connor Grace, Aidan Castricone, and Emma Tondre were interviewed and photographed at Dovehill Farm in Moosup, CT by Lauren Owens Lambert of Smithsonian Magazine (June 3); hosted a visit from Victor DeMasi who came to review specimens in the CAES insect collection (June 6); provided taxonomic expertise for the Hymenoptera team at the 2024 Rhode Island BioBlitz held at the Norman Bird Sanctuary in Newport, Rhode Island (June 7-8); participated in a meadow establishment project created by Peter Picone of CT-DEEP called "Taking Action for Habitat by Working Hands On: Sowing Native Seeds and Creating Native Meadows" (June 11).

PUBLICATIONS:

1. Huston, C. E., Tsao, L. H., **Brackney, D. E.**, and Pyle, A. (2024) The West Nile virus genome harbors essential riboregulatory elements with conserved and host-specific functional roles. *Proc Natl Acad Sci U S A.* 121 (29) e2312080121. DOI: 10.1073/pnas.2312080121

Abstract: West Nile virus (WNV) is an arthropod-borne, positive-sense RNA virus that poses an increasing global threat due to warming climates and lack of effective therapeutics. Like other enzootic viruses, little is known about how host context affects the structure of the full-length RNA genome. Here, we report a complete secondary structure of the entire WNV genome within infected mammalian and arthropod cell lines. Our analysis affords structural insights into multiple, conserved aspects of flaviviral biology. We show that the WNV genome folds with minimal host dependence, and we prioritize well-folded regions for functional vali-

dation using structural homology between hosts as a guide. Using structure-disrupting, antisense locked nucleic acids, we then demonstrate that the WNV genome contains riboregulatory structures with conserved and host-specific functional roles. These results reveal promising RNA drug targets within flaviviral genomes, and they highlight the therapeutic potential of ASO-LNAs as both WNV-specific and pan-flaviviral therapeutic agents.

ENVIRONMENTAL SCIENCE & FORESTRY

SCOTT WILLIAMS, PH.D. spent the morning tick sampling the Yale University-owned Horse Island in the Thimbles with Yale Ecology and Evolutionary Biology Department's Research Scientist Dr. Mary Beth Decker and Associate Research Scientist Dr. Benjamin Chan (June 4); participated in a Zoom call with staff from CDC Division of Vector-Borne Diseases, University of Massachusetts, University of Rhode Island, Penn State University, State of Massachusetts, MaineHealth, Michigan State University, Texas A&M University, Tufts University, and Genesis Laboratories about tick management strategies involving white-tailed deer (June 5); participated in a collaborative Zoom call with members of the Banfield Biologic NIH SBIR-funded tick repellent fabric team (June 11); gave invited lecture to the lunch wellness seminar for Conning Insurance Asset Management titled "Tick Management in Residential Areas" (75 attendees) (June 13); participated in the first quarterly Forest Health meeting with **Eli Ward, Ph.D.** and DEEP Forestry Division Director Chris Martin as well as DEEP foresters Shelia Hoefle, Dan Peracchio, Will Hochholzer, Andrea Urbano, and former CAES seasonal employee Nick Zito (June 17); participated in the leadership meeting of the Northeast Center for Excellence in Vector-Borne Disease's Training and Evaluation Center (June 18); participated in a Zoom call with staff from the CDC Division of Vector-Borne Diseases on progress made on a funded integrated tick management project (June 20); participated in a collaborative Zoom call with members of the BanfieldBio, Inc. NIH SBIR-funded tick repellent fabric team (June 25); participated in a meeting with members of BanfieldBio, Inc. about a grant funding opportunity evaluating a novel tick trap (June 26); interviewed by Abby Weiss from the Connecticut Insider on tick ecology and the current status of ticks in Connecticut (June 27).

JOSEPH P. BARSKY participated in a Forest Ecosystem Monitoring Cooperative field calibration exercise in Montpelier, VT (June 5); participated in an aerial survey "Fly-in" training sponsored by the USDA-Forest Service Forest Health Assessment and Applied Sciences Team in Albany, NY (June 11-12); as Chair-Elect, participated in the New England Society of American Foresters Board of Directors Meeting (June 16).

GREGORY BUGBEE presented invited talk on "Composting" at the Church of Christ Congregational in Newington (June 2); gave invited talk on "Hydrilla in the Connecticut River" at a United States Army Corps of Engineers public meeting at the Middletown Town Hall (June 4); participated in the quarterly meeting of the Northeast Aquatic Nuisance Species Panel (June 13); spoke on hydrilla in the Connecticut River at a press conference hosted by Senator Richard Blumenthal at Riverside Park in Hartford (June 26); gave an invited talk on "Hydrilla in the Connecticut River" at a United States Army Corps of Engineers public meeting at the East Haddam Town Hall (June 27); with **Jeremiah Foley, PH.D** gave an Invasive Aquatic Plant Workshop to the Bantam Lake Protective Association at the Morris Town Hall (June 29); with **Jeremiah Foley, PH.D**, **Summer Stebbins**, and **Riley Doherty** met via video conference with the United States Army Corps of Engineers to discuss the CT River Hydril-

la Project (June 5, 12, 26).

JEREMIAH FOLEY, IV, PH.D. nominated **Summer Stebbins** to the US Department of the Interior's Invasive Species Advisory Committee (June 6); participated in a collaborative Zoom call with Dr. Peter Raymond, Professor of Biogeochemistry at Yale University School of the Environment on sampling methods for methane oxidation in freshwater systems (June 11); presented an invited lecture titled "Ripple of Invasion: The Spread and Impact of Aquatic Invasive Species" to Big Pond Association in Otis, MA (50 attendees) (June 15); served as an invited panelist for the Connecticut River Museum symposium titled "Solutions From Source to Sound – How Experts and Leaders Build a Healthier River" (70 attendees) (June 23); with **Greg Bugbee,** participated in a press conference with Senator Richard Blumenthal and State Representative Christine Palm announcing $5 million in funding for the treatment of hydrilla in the Connecticut River (June 26); presented a invited aquatic plant identification workshop to the Bantam Lake Association (30 attendees) (June 29).

SUSANNA KERIÖ, D.SC. met with Consulting Arborist John Gluse at Bartlett Tree Care to present a mycorrhizal inoculation street tree site in Hamden (June 3); administered the arborist exams at Lockwood Farm (June 5); met with Susan Fiedler, Matt Verry, and Madeline Schad from the CT Department of Transportation to discuss collaboration on urban tree research (June 6); was re-elected as the Secretary for the Connecticut Urban Forest Council (June 6); presented two talks at the International Union of Forest Research Organizations World Congress in Stockholm, Sweden titled "Mycorrhizal Inoculation: Promoting Tree Health and Survival in a Changing Climate" (200 attendees) (June 25) and "Impact of Neighborhood-Scale Urban Site Factors and Soil Conditions on Urban Tree Health" (70 attendees) (June 27).

ITAMAR SHABTAI, PH.D. met with collaborators from Cornell University to discuss an ongoing project at the Department of Energy's Environmental Molecular Sciences Laboratory (EMSL) (June 7); met with EMSL staff scientists to discuss the project (June 12); met with a collaborator from the Technical University of Munich to coordinate a visit to CAES and discuss grant proposals (June 12); discussed a BARD-ISUS grant proposal with a collaborator from the Hebrew University of Jerusalem, Israel (June 20); and met with a collaborator from Purdue University to discuss a USDA-NIFA grant proposal (June 20).

SUMMER STEBBINS joined the UConn Invasive Plant Certificate Advisory Board and attended the inaugural virtual board meeting. (June 24).

ELISABETH WARD, PH.D. met with Danica Doroski, Ph.D. (State Urban Forester, CT DEEP Forestry Division) and Annie Mixswell (Tree Warden, City of New Haven) to select sites for a project assessing management practices to improve urban forest resiliency to Beech Leaf Disease in New Haven parks (June 7); met with Helen Poulos, Ph.D. (Assistant Professor in Forest Ecology, Wesleyan University) and three Wesleyan undergrads to discuss the effects of Beech Leaf Disease on tree growth and mortality at Meshomasic State Forest along with **Jeffrey Ward, Ph.D.** (June 14); co-led first joint CAES-DEEP Forest Health meeting with Senior Staff from the Forestry Division (Chris Martin, Will Hochholzer, Andrea Urbano, Nick Zito, and Dan Peracchio) along with **SCOTT C. WILLIAMS, PH.D.** (June 17); was interviewed by The New York Botanical Garden for a blog post featuring *Journal of Ecology* article on plant mycorrhizal effects on soil carbon and nitrogen in forests (June 17); met with Connor Hogan (Director, McLean Game Refuge) and his four field assistants to discuss the effects of ash tree mortality from Emerald Ash Borer on long-term forest dynamics (June 26); conducted aerial forest health surveys across Connecticut in collaboration with the USDA Forest Service along with **Tia Blevins, Joseph P. Barsky**, and **Jeffrey Fengler** (June 25-28).

JEFFREY WARD, PH.D. (Emeritus) lead a "Forestry in Practice" walk discussing how forest management influences wildlife and carbon sequestration at White Memorial Foundation (WMF) in Goshen with Mike Berry, WMF Forester (19 attendees) (May 4); participated in a meeting of the Great Mountain Forest Trustees in Norfolk (May 18); spoke on impact of diseases and insects on forest dynamics for Connecticut Forest and Park Association's Master Woodlands Managers Partner's in Naugatuck (21 attendees) (June 1); lectured on "Deer browse and the biodiversity crisis" for the Greenwich Land Trust (24 attendees) (June 6); was interviewed about forest dynamics by Darcy Dennett (Firefly Filmworks) for a documentary about Peoples State Forest (June 10); spoke with Great Mountain interns on forest management with an emphasis on regeneration (4 attendees) (June 13).

LEIGH WHITTINGHILL, PH.D. presented collaborative research poster titled “Cut-and-come-again lettuce production: lessons learned from research in three different urban production systems” at the Urban Food Systems Symposium in Columbus, OH (June 11); attended the quarterly meeting of the Connecticut Council on Soil and Water Conservation and gave CAES updates (June 20); presented talk titled “Urban Agriculture Research Collaborations with Common Ground and Yale Farm” to summer interns of Common Ground High School and Yale Farm (12 attendees) (June 26).

CHARLIE (YINGXUE) YU, PH.D. conveyed a session titled “Role of Clays in Contaminant Fate and Transport” and presented talk “Transport of Biodegradable Nanoplastics Affected by Weathering and Proteins in Unsaturated Porous Media” at the 61st Annual Meeting of The Clay Minerals Society (50 attendees) (June 3–7); attended an online workshop “High Resolution Characterization of Mineral-Associated Organic Matte” from Environmental Molecular Sciences Laboratory (June 26).

GRANTS AWARDED:

Eli Ward, Ph.D. and **Susanna Keriö, D.SC.** received $136,833 from the USDA Forest Service through the Bipartisan Infrastructure Law Invasive Species High-Priority Regional Project competitive grant program for a project titled “Rapid forest assessment to monitor the effects of beech leaf disease to inform management.”

Jeremiah Foley, PH.D (Co-Investigator) and Kelly Aho, Ph.D., (PI - Michigan State University) were awarded an NSF RAPID grant "Hydrilla and carbon cycling: leveraging an ecosystem-scale herbicide application to investigate feedbacks between invasive plants and greenhouse gas emissions" ($36,885 to CAES, $196,466 in total).

PUBLICATIONS:

1. Polussa, A., **Ward, E. B.**, Bradford, M. A., and Oliverio, A. M. (2024). A common ericoid shrub modulates the diversity and structure of fungal communities across an arbuscular to ectomycorrhizal tree dominance gradient. *FEMS Microbiology Ecology.* DOI: 10.1093/femsec/fiae092

Abstract: Differences between arbuscular (AM) and ectomycorrhizal (EcM) trees strongly influence forest ecosystem processes, in part through their impact on saprotrophic fungal communities. Ericoid mycorrhizal (ErM) shrubs likely also impact saprotrophic communities given that they can shape nutrient cycling by slowing decomposition rates and intensifying nitrogen limitation. We investigated the depth distributions of saprotrophic and EcM fungal communities in paired subplots with and without a common understory ErM shrub, mountain laurel (*Kalmia latifolia* L.), across an AM to EcM tree dominance gradient in a temperate forest by analyzing soils from the organic, upper mineral (0-10 cm), and lower mineral (cumulative depth of 30 cm) horizons. The presence of *K. latifolia* was strongly associated with the taxonomic and functional composition of saprotrophic and ectomycorrhizal communities. Saprotrophic richness was consistently lower in the Oa horizon when this ErM shrub species was present. However, in AM tree dominated plots, the presence of the ErM shrub was associated with a higher relative abundance of saprotrophs. Given that EcM trees suppress both the diversity and relative abundance of saprotrophic communities, our results suggest that separate consideration of ErM shrubs and EcM trees may be necessary when assessing the impacts of plant mycorrhizal associations on belowground communities.

2. Chen, Z., Wang, C., and **Pignatello, J. J.** (2024). Rapid and convenient potentiometric method for determining fluorosulfate, a byproduct of the fumigant and greenhouse gas sulfuryl fluoride, *ACS Omega*, DOI: 10.1021/acsomega.4c02629

Abstract: Fluorosulfate ion (FSO_3^-) is a hydrolysis product of sulfuryl fluoride (SO_2F_2), which is widely used to fumigate buildings, soil, construction materials, and post-harvest commodities, and is a potent greenhouse gas. It is a potential marker for biological exposure to SO_2F_2 and for monitoring the progress of reactions used to scrub SO_2F_2 from fumigation vent gases. Here, we report a simple and inexpensive potentiometric method for determining FSO_3^- using a commercial nitrate-selective electrode and discuss its application. The method is suitable for solutions between 0.0025 mM and 660 mM FSO_3^- at initial pH between 5 and 9. Halide interference depends on its molar ratio to FSO_3^- and follows the sequence, $F^- < Cl^- < Br^- << I^-$. Halide interference can be eliminated by adding silver sulfate. Interference by bicarbonate can be eliminated by H_2SO_4 pre-treatment, and interference by phosphate or pyrophosphate by $MgSO_4$ addition. Sulfate does not interfere, as it does in ion chromatography. Satisfactory method detection limits for FSO_3^- in spiked aqueous extracts of 11 fruits were obtained. The method accurately quantified the yield of FSO_3^- relative to that of F^- in base hydrolysis of SO_2F_2. This study demonstrates that the developed method is highly selective, convenient, and sensitive, and thus can be of great value in practice.

3. Seenthia, N. I., Bylaska, E. J., **Pignatello, J. J.**, Tratnyek, P. G., Beal, S. A. and Xu, W. (2024). Experimental and computational study of pyrogenic carbonaceous matter facilitated hydrolysis of 2,4-Dinitroanisole (DNAN). *Environ. Sci. Technol.* DOI: 10.1021/acs.est.4c01069

Abstract: This study investigated the reaction pathway of 2,4-dinitroanisole (DNAN) on the pyrogenic carbonaceous matter (PCM) to assess the scope and mechanism of PCM facilitated surface hydrolysis. DNAN degradation was observed at pH 11.5 and 25 °C with a model PCM, graphite, whereas no significant decay occurred without graphite. Experiments were performed at pH 11.5 due to the lack of DNAN decay at pH below 11.0, which was consistent with previous studies. Graphite exhibited a 1.78-fold enhancement toward DNAN decay at 65 °C and pH 11.5 relative to homogeneous solution by lowering the activation energy for DNAN hydrolysis by 54.3 ± 3.9%. This is supported by our results from the computational modeling using Car−Parrinello simulations by ab initio molecular dynamics/molecular mechanics (AIMD/MM) and DFT free energy simulations, which suggest that PCM effectively lowered the reaction barriers by approximately 8 kcal mol−1 compared to a homogeneous solution. Quaternary ammonium (QA)-modified activated carbon performed the best among several PCMs by reducing DNAN half-life from 185 to 2.5 days at pH 11.5 and 25 °C while maintaining its reactivity over 10 consecutive additions of DNAN. We propose that PCM can affect the thermodynamics and kinetics of hydrolysis reactions by confining the reaction species near PCM surfaces, thus making them less accessible to solvent molecules and creating an environment with a weaker dielectric constant that favors nucleophilic substitution reactions. Nitrite formation during DNAN decay confirmed a denitration pathway, whereas demethylation, the preferred pathway in homogeneous solution, produces 2,4-dinitrophenol (DNP). Denitration catalyzed by PCM is advantageous to demethylation because nitrite is less toxic than DNAN and DNP. These findings provide critical insights for reactive adsorbent design that has broad implications for catalyst design and pollutant abatement.

NEW STUDENTS, STAFF, AND VOLUNTEERS:

Jessica Brown, Ph.D. joined the Department of Environmental Science and Forestry as a Postdoctoral Agricultural Scientist. Jessica came to the Station after receiving her BS and Ph.D. degrees from Penn State University where she investigated host-parasite interactions in small mammals for her dissertation research. Jessica enjoys going to concerts, reading, and snowboarding. You can find **Dr. Brown** on the second floor of Slate where she will be working with **DRS. WILLIAMS** and **Linske** as a new member of the Center for Vector Biology and Zoonotic Diseases working on various aspects of integrated tick management, specifically effectiveness of the systemic acaricidal treatment of both deer and mice in interrupting pathogen transmission and tick life cycles.

Christian Filteau is a Plant Health Fellow working with **Elisa-**

beth Ward, Ph.D. on a project assessing long-term changes in tree growth and mortality in response to Beech Leaf Disease. Christian is a Junior at the University of New Hampshire majoring in biology and minoring in molecular biology. Christian is interested in forestry and hopes that this internship will give him research experience that will help him pursue future career paths in natural resource management.

Elizabeth Gerbi is a Plant Health Fellow under **Leigh Whittinghill, Ph.D.** Elizabeth is studying biology at Mount Holyoke College and is focusing on ecology and environmental health. She is doing research in an invasion ecology lab and does water quality monitoring for agricultural runoff. In her very limited free time, she likes running, hiking, and reading.

Kehinde Omisakin is a research-for-credit intern under **Leigh Whittinghill, Ph.D.** He is currently a graduate student at University of New Haven studying environmental science. Kehinde is from Nigeria and had his undergraduate degree in Soil Science. He joined CAES in June and likes listening to hip-hop music, watching movies, and bike riding.

Sofia Shubin is a rising senior at Southern Connecticut State University studying biology and chemistry. She started at CAES in 2022 as a Plant Health Fellow and has returned as a seasonal employee working with **Leigh Whittinghill, Ph.D.** In her free time, Sofia loves singing choral and jazz music, hiking, cooking, and spending time with her pets.

Maddie Watts is a recent graduate from Lehigh University with a B.A. in Earth and Environmental Science and Environmental Studies. During her undergraduate years, Maddie was involved in research under her advisor, focusing on peatland moisture in Alaska and its correlation with wildfire variability. Looking ahead, Maddie is contemplating pursuing a master's degree in ecology, agriculture, or GIS as she continues to explore her career in environmental research. In her free time, she enjoys reading, hiking, and exploring her new home in New Haven. She is working with **Jeremiah Foley, Ph.D.** in the Office of Aquatic Invasive Species this summer.

PLANT PATHOLOGY AND ECOLOGY

LINDSAY TRIPLETT, PH.D. met with graduate program coordinators at the University of New Haven to discuss formal hosting of graduate students (3 adults) (June 4); co-coordinated and led 5 activities for the 2024 Plant Health Fellows REEU program: Orientation and Safety Training (June 10), planting a group field plot (June 17), a Field Trip to Enko Chem (June 20), a Zoom career panel with graduate students (June 24), and a science communication workshop (10 adults) (June 24); coordinated the tour for the International Festival of Arts and Ideas and presented a talk titled "CAES Then and Now" to attendees (26 adults) (June 28).

WASHINGTON DA SILVA, PH.D. participated in the committee meeting for the graduate student, Uday Kumar from the University of Maryland (6 people via Zoom) (June 3); attended the Gordon Research Conference in Manchester NH and presented a poster entitled "Tunable release of dsRNA molecules into plants from sustainable nanocarriers: A novel management tool for viral pathogens" (over 100 adults) (June 23-28).

YONGHAO LI, PH.D. participated in the National Plant Diagnostic Network Online Communication & Web Portal Committee meeting via Zoom (7 adults) (June 12); participated in the Northeast Plant Diagnostic Network monthly meeting via Zoom (18 adults) (June 13); with MS. Felicia Millett, introduced plant disease diagnosis and seed testing in PDIO to the group of International Festival of Arts and Ideas during the Station tour (26 adults) (June 28).

ROBERT MARRA, PH.D. led a field seminar on forest health and pathogens, with Dr. Jeff Ward, Dr. Talbot Trotter, and Jerry Milne (DEEP), for the Connecticut Forests and Parks Association's Master Woodland Managers certification program (24 adults) (June 1); administered the arborist certification oral exam ("TPX") (6 adults) (June 5); was interviewed about beech leaf disease by Marguerite Holloway, of Columbia School of Journalism (June 25); was interviewed about beech leaf disease by Brady Dennis of the Washington Post (June 26).

FELICIA MILLETT participated in the NPDN Professional Development Committee monthly meeting (10 adults) (June 4); participated in the NEPDN monthly meeting (18 adults) (June 13); participated in the NPDN Proficiency Committee monthly meeting (8 adults) (June 18); and hosted the seed testing lab tour stop during the Arts and Ideas Fest Tour (25 adults) (June 28).

RAQUEL ROCHA, PH.D. and her research group presented CAES research initiatives to control soilborne pathogens during the Station tour at the International Festival of Arts and Ideas (26 adults) (June 28).

QUAN ZENG, PH.D. participated the First World Congress on Antimicrobial Resistance (AMR) Incidence in Plants and participated in panel discussions in future steps of mitigation methods of AMRs (20 adults) (June 6); participated in committee meeting and preliminary exam of a PhD candidate student of University of Wisconsin-Milwaukee (7 adults) (June 10), visited Northwest University of China for exploring potential collaboration in novel pesticide discovery (June 18).

PUBLICATIONS:

1. Lowry, G. V., Giraldo, J. P., Steinmetz, N. F., Avellan, A., Demirer, G. S., Ristroph, K. D., Wang, G. J., Hendren, C. O., Alabi, C. A., Caparco, A., **da Silva, W.**, González-Gamboa, I., Grieger, K. D., Jeon, S.-J., Khodakovskaya, M. V., Kohay, H., Kumar, V., **Muthuramalingam, R.,** Poffenbarger, H., Santra, S., Tilton, R. D. & **White, J. C.** (2024). Towards Realizing Nano-enabled Precision Delivery in Plants. Nature Nanotechnology.

DOI: https://www.nature.com/articles/s41565-024-01667-5

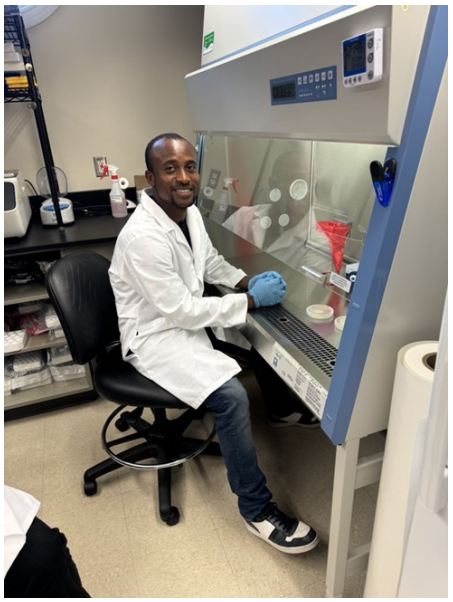
Abstract: Nanocarriers (NCs) that can precisely deliver active agents, nutrients and genetic materials into plants will make crop agriculture more resilient to climate change and sustainable. As a research field, nano-agriculture is still developing, with significant scientific and societal barriers to overcome. In this Review, we argue that lessons can be learned from mammalian nanomedicine. In particular, it may be possible to enhance efficiency and efficacy by improving our understanding of how NC properties affect their interactions with plant surfaces and biomolecules, and their ability to carry and deliver cargo to specific locations. New tools are required to rapidly assess NC–plant interactions and to explore and verify the range of viable targeting approaches in plants. Elucidating these interactions can lead to the creation of computer-generated in silico models (digital twins) to predict the impact of different NC and plant properties, biological responses, and environmental conditions on the efficiency and efficacy of nanotechnology approaches. Finally, we highlight the need for nano-agriculture researchers and social scientists to converge in order to develop sustainable, safe and socially acceptable NCs.

GRANTS AWARDED:

Washington da Silva, Ph.D. received a research grant from the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), a Brazilian Federal Agency for Support and Evaluation of Graduate Education, to host students from Brazil in his lab at CAES for training in molecular biology.

NEW STUDENTS, STAFF, AND VOLUNTEERS:

The Rocha Lab has welcomed **Tobi Okunade**, a second-year master's student in Environmental Science from the University of New Haven. Tobi will be working on a collaborative project involving the research groups of Raquel Rocha, Ph.D. and Lindsay Triplett, Ph.D. The project will focus on evaluating several bacterial strains isolated from Connecticut's soil for their potential antagonistic activity against Fusarium wilt and root-knot nematodes that infect vegetables.



The 2024 Plant Health Fellows on a tour of Enko Chem in Mystic, CT, on June 20. L-R: Michael Luethy, Enko Science Fellow, Elizabeth Gerbi, Cole Wilson, Christian Filteau, Katelyn Ouzts, Johanna Sampedro, Emma Donahey, and Madeline and Elisabeth Shin. Not pictured: Andy Medina and Alexandra Vitug.

VALLEY LABORATORY

JATINDER S AULAKH, PH.D. attended the Connecticut Christmas Tree growers' twilight meeting and talked about identification and management of weeds in Christmas trees at Hemlock Hill Tree Farm – 304 Parker Avenue, Meriden, CT (60 attendees) (June 5).

RICHARD COWLES, PH.D. discussed insect, disease and horticultural practices in growing Christmas trees at the Twilight Meeting of the Connecticut Christmas Tree Growers' Association, Meriden (60 attendees) (June 5). He discussed "Tick and fly management" with the Reindeer Owners and Breeders Association via Zoom, (20 attendees) (June 12).

MICHELLE SALVAS participated in the course "Identification of Plant-Parasitic Nematodes" given at the National Plant Protection Organization, Wageningen, The Netherlands (June 24-28).

JOURNAL ARTICLES APPROVED JUNE 2024

Bagger, M. S., Hagadorn, K. A., Misencik, M. J., Arent, S., McMillan, J. R., and **Gloria-Soria, A.** Filarial parasite infection prevalence in field-caught mosquitoes from Connecticut, USA. *Journal of Medical Entomology*.

Christudoss, A. C., Sah, K. K., Vikram, R., Giri, S., Viswanathan, D., **Dimkpa, C. O.**, Mukherjee, A. Tailoring the synthesis route to enhance the biosafety of reduced graphene oxide: results from cyto-genotoxicity assessment in a plant model, Allium cepa L. *Environmental Science: Nano*.

Deng, C., **Wang, Y.**, Castillo, C., Zhao, Y., Xu, W., Lian, J., Rodrigues-Otero, K., Brown, H., Cota-Ruiz, K., **Elmer, W.H.**, **Dimkpa, C.O.**, Giraldo, J.P., Hernandez, R., **Wang, Y.**, **White, J.C.** Nanoscale iron (Fe3O4) surface charge controls Fusarium suppression and nutrient accumulation in tomato (*Solanum lycopersicum L.*). *ACS Sustainable Chemistry and Engineering*.

Feculak, M, Loureiro, S., **White, J. C.**, Wu, K. C-W., Sheteiwy, M. S., Gao, Y., Oleszczuk, P., Josko, I. Engineered nanoparticle transformations: Rethinking toxicity in water. *Nano Today*.

Irewale, A. T., **Dimkpa, C. O.**, Elemike, E. E., Oguzie, E. E. Water Hyacinth: Prospects for Nanobiochar and Biofertilizer Development. *Heliyon*.

Irewale, A.T., **Dimkpa, C. O.**, Agunbiade, F.O., Oyetunde, O.A., Elemike, E.E., Oguzie, E.E. Unlocking sustainable agricultural development in Africa via bio-nanofertilizer application - challenges, opportunities, and prospects. Scientific African.

Irewale, A.T., Elemike, E. E., **Dimkpa, C. O.**, Oguzie, E. E. Green nano-innovations: current practices and tools for sustainable, smartand precision agriculture. *Annals of Agricultural Science.*

Jiao, Y., Yu, F., Xu, M., Wu, S., Jia, C., Zhou, C., He, J., Cheng, C., **White, J.C.**, Song, Q., Zhu, X., Smith, P., van Groenigen, K.J., Yan, X., Zhang, J., Xia, L., **Wang, Y.**, Yang, J., Zhu, X. Biomass flash graphene for sustainable crop production. *Nature Nanotechnology*.

Johnson, K. I., Das, R., Ilacas, G., Chang, H-Y., Sharma, P. R., **Dimkpa, C. O.**, Hsiao, B. S. A circular solution to enhance the food-water nexus by nanocellulose technologies for ammonium recovery and reuse. *Sustainability Science and Technology*.

Shabtai, I. A., Hafner, B. D., Schweizer, S. A., Höschen, C., Possinger, A., Lehmann, J., Bauerle, T. e Root exudates simultaneously form and disrupt soil organo-mineral associations. *Nature Communications*.

Sindhu, K., Goyal, V., Kumari, K., Avtar, R., **Dimkpa, C.O.**, Shweta Mehrotra, S. Physiological and biochemical underpinnings drive yield enhancement in Indian mustard (Brassica juncea) by silicon under field conditions. *Silicon*.

Tao, R., Cui, M., Li, Y., Wang, J., He, W., Zhao, Y., Shen, Y., Feng, Y., **White, J.C.** Nanoscale biochar to optimize fertilizer quality during waste composting: Regulation of the microbial community. *ACS Nano.*

Wan, Y., Ju, Y., **Li, D.- W.**, and Zhu, L.-H. Pathogenicity and biological characteristics of

Botryosphaeria dothidea causing branch blight of Salix babylonica. *Crop Protection*.

Wan, Y., **Li, D.- W.**, Si, Y.-Z., Sun, J.-W., Ding, X., Huang, L., and Zhu, L.-H. High diversity and divergence time of Diaporthe species causing leaf blight on Acer palmatum in China. *Fungal Diversity*.

Ward, E. B., Ashton, M. S., Wikle, J. L., Duguid, M. C., Bradford, M. A. Local controls modify the effects of timber harvesting on surface soil carbon and nitrogen dynamics. *Forest Ecology and Management*.

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The Connecticut Agricultural Experiment Station

Main Laboratories
123 Huntington Street
New Haven, CT 06511-2016
Phone: 203-974-8500

Lockwood Farm
890 Evergreen Avenue
Hamden, CT 06518-2361
Phone: 203-974-8618

Griswold Research Center
190 Sheldon Road
Griswold, CT 06351-3627
Phone: 860-376-0365

Valley Laboratory
153 Cook Hill Road
Windsor, CT 06095-0248
Phone: 860-683-4977

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Station News was prepared and edited by Dr. Jason White, Ms. Vickie Bomba-Lewandoski, and Mrs. Natalie Rivera.

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