

SUMMER 2023

# THE MAGAZINE OF *SPES*

SCHOOL OF PLANT AND ENVIRONMENTAL SCIENCES

Nutrient Film Technique



COLLEGE OF AGRICULTURE AND LIFE SCIENCES  
SCHOOL OF PLANT AND  
ENVIRONMENTAL SCIENCES  
VIRGINIA TECH.



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<b>HAHN HORTICULTURE GARDEN UNVEILS LONG-RANG PLAN FOR EXPANSION</b>  More event spaces and new gardens are among the improvements planned as part of a donor-driven \$4 million fundraising effort to enhance the garden as a regional destination.	<b>BRINGING THE OUTDOORS INDOORS: HOW CONTROLLED ENVIRONMENT AGRICULTURE IS CHANGING THE INDUSTRY</b>  Researchers are elevating Virginia Tech as a leader in controlled environment agriculture, while helping to attract global leaders to the commonwealth.	<b>VIRGINIA TECH RESEARCHERS FIGHT FIRE BLIGHT’S PLIGHT ON APPLE PRODUCTION</b>  Two USDA grants are funding novel approaches to manage the spread of this deadly disease that decimates crops across the commonwealth and beyond.	<b>THREE HOKIES HONORED WITH FIRST-EVER SPES ALUMNI AWARDS</b>  Awards were given in three categories: recent undergraduate, impact in the global community, and career achievement.			



Students in the *World Crops: Food and Culture* class prepare dishes for their final presentations.



Andrew Gnatowski '23 was the first student to graduate majoring in Ecological Restoration.

The major was first introduced in Spring 2021.

The curriculum for the major was designed in conjunction with the Society for Ecological Restoration's Certified Ecological Restoration Practitioner Program.



## CELEBRATING FIVE YEARS OF SPES



July 1<sup>st</sup> marks the five-year anniversary of the School of Plant and Environmental Sciences. It was formed in 2018 by bringing together three departments: Crop and Soil Environmental Sciences, Horticulture, and Plant Pathology, Physiology, and Weed Science.

When we started the integration process, we knew there would be challenges bringing together three departments with a greater than 350-year collective history. But none of us imagined we would be dealing with a global pandemic. While COVID-19 did present challenges, it was not able to stop the growing momentum that has led to considerable progress on upgrading facilities, introducing new undergraduate majors, creating two research centers, and hiring new faculty to help lead us into the future.

## TEACHING

SPES added nine new tenure-track faculty positions at the Blacksburg campus and five at Agricultural Research and Extension Centers across the commonwealth. SPES also added an instructor and collegiate faculty member to focus on undergraduate education.

To make sure students have the proper facilities to learn, the school upgraded eight teaching spaces, including classrooms, laboratories, and learning sandboxes. SPES added 11 new courses to the curriculum over the last five years with the number of credit hours taught increasing by 25 percent. Cannabis – Science, Industry and Culture is a popular course for both majors and non-majors. This spring, nearly 1,000 students enrolled in the course.

Two new majors were added to the school's curriculum. Ecological Restoration is the process of guiding the recovery of degraded or destroyed ecosystems. Students in the major engage in a structured program of learning that moves from introductory courses in the biological and physical sciences to courses in soil science, ecology, geology, plant science, and ecological restoration. The curriculum was designed in conjunction with the Society for Ecological Restoration's Certified Ecological Restoration Practitioner In-Training Program.

The Integrated Agriculture Technologies major prepares students for work in the applied sciences using advanced technologies to improve plant productivity and environmental protection. Students learn to work with drones, robots, environmental sensors, and data analytics to improve the sustainability of field crops and horticultural systems.

Since the formation of the school, we have awarded more than 75 Ph.D.'s, 50 master's, and hundreds of bachelor's degrees.

## RESEARCH

SPES continues to increase its research efforts in several areas including invasive species, plant genomics and crop breeding, and soil health and management. This variety in research area and expertise reflects the diverse nature of agriculture and environmental protection in the commonwealth.

During the school's short history, our research faculty have produced nearly 1,000 publications with graduate students and post-doctoral advisees well represented as authors and contributors. More than 50 percent of the grants applied for were awarded. During the last half-decade, nearly 500 grants were received by the school, totaling nearly \$37 million. Internal grant funding continues to grow as well from sources including the John Lee Pratt Foundation, the Powell River Project, the Institute for Critical Technology and Applied Sciences, and the Fralin Life Sciences Institute. Since 2018, SPES has been awarded \$2.2 million from these sources.

To accommodate the research teams, seven research labs have been renovated and two new centers created. The first is the Agricultural Technologies Innovation Center. The center was designed to bring together faculty working in the area of agricultural and environmental technologies. Having them together in a single location increases interaction, promotes creativity, increases efficiencies, and promotes creative collisions, leading to technological advancements and new intellectual property.

The school has also partnered with the Institute for Advanced Learning and Research in Danville, Virginia and the Seafood Agricultural and Extension Center to create the Controlled Environmental Agriculture Innovation Center. The unique partnership better connects SPES to stakeholders, increases visibility for the school in the commonwealth, and elevated Virginia Tech as a major CEA center in the United States. The creation of the center allows SPES to become involved in economic development in Virginia, leading to the creation of hundreds of jobs as new employers move into the commonwealth.

## EXTENSION

SPES has 40 faculty members with an Extension appointment. Areas of focus vary widely, leading to unique programmatic opportunities and collaborations within the school, college, and Virginia Cooperative Extension. Focus areas include cover crops, home gardening, plant pathology, soil fertility, and turfgrass. SPES faculty have produced 260 documents for Virginia Cooperative Extension in the last five years. Even through the pandemic, total direct and indirect contacts with the public and stakeholders increased.

The Virginia Tech Turfgrass Team is a unique partnership between SPES and the Virginia Turfgrass Foundation. The team, with funds raised by the Virginia Turfgrass Association, has applied research facilities throughout the commonwealth to develop and test new grasses and a wide variety of innovative management strategies.

The Virginia Master Gardener Program provides communities with locally identified programs, including answers to individual questions via hotlines and plant clinics and educational programs to meet targeted needs. Nearly 90 percent of our Extension faculty contribute to the Master Gardener program each year.

The Virginia Agriculture Expo is the largest agricultural field day event in the commonwealth. It is a cooperative program among more than a dozen SPES faculty and the Virginia Soybean Association, Small Grains Association, Corn Board, and Virginia Farm Bureau. The event features on-site applied research plots and variety trials managed by Extension specialists, equipment displays, and a trade show. It attracts more than 1,500 stakeholders annually.

These are just a few examples of the many successes we have seen over the last five years. With the pandemic now behind us, over the next five years the school will continue to grow as we provide a top-rate education for our students, conduct research to improve agricultural productivity and soil and water health while reducing negative impacts on the environment, and continue to provide science-based information to our stakeholders and community.

Michael Evans  
Director & Professor

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## GRADUATE STUDENTS ON VIRGINIA TECH TURFGRASS TEAM PARTICIPATE IN UNIQUE INDUSTRY OUTREACH PROGRAM

Graduate students in the School of Plant and Environmental Sciences took part in the W.S. Connelly Innovative Research Contest, financially supported by Kevin and Patrick Connelly, chief financial officer and chief executive officer, respectively, of Landscape Supply Inc.

The oral presentation contest is a moderated, timed scientific presentation like students routinely give at academic society meetings. This contest is different as students are tasked with successfully communicating to an audience comprised of industry professionals instead of scientific peers.

The contest was originally held as part of the conference education program for the Mid-Atlantic Turfgrass Expo. The pandemic moved the conference educational programming to a virtual format for several years. Not wanting to lose momentum with its success, it was incorporated into the Landscape Supply two-day virtual fertilizer and pesticide applicator recertification program. The program was presented in February to more than 1,000 participants from several states.

A panel of industry judges was pre-selected for each day's program. The students had 20-minutes to present their topics to kick off each day's event. Point values were assigned on the basis of: presentation timing, the presentation of the material in a logical, ordered sequence, the quality of the visual aids, student speaking method, and student ability to answer audience questions.

Travis Roberson, advised by Assistant Professor David McCall, won the first-place prize of \$500 for his presentation, "Impact of spring dead spot on field performance and athlete safety."

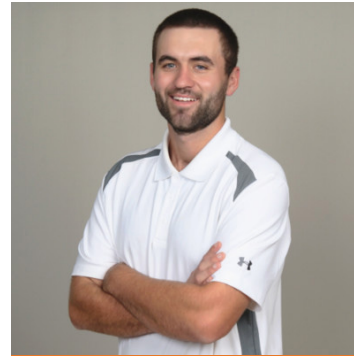
John Peppers, advised by Professor Shawn Askew, won second-place and a \$400 prize for his presentation on "Goosegrass and Poa management as influenced by plant growth regulators."

Shannon Bradley, advised by Assistant Professor Alejandro Del Pozo, won third-place and a prize of \$300 for her presentation on "Remote detection of annual bluegrass weevil."

Caleb Henderson, advised by McCall, won the first-ever People's Choice Award and a prize of \$500. His presentation was "Targeted pesticide applications using GPS sprayers and pest mapping."

The judges decided that all of the presentations were award worthy, so \$200 prizes were given to the other participants: Navdeep Godara, Daewon Koo, and Aaron Tucker.

Reaction from event participants was, "This was the best recertification program I have ever participated in and the students are the primary reason."



Travis Roberson



John Peppers



Shannon Bradley

## NATIONAL COLLEGIATE LANDSCAPE COMPETITION TEAM FINISHES IN TOP 10 AT NATIONAL COMPETITION

The Virginia Tech National Collegiate Landscape Competition Team placed 10<sup>th</sup> at this year's competition. The event was hosted by Mississippi State University in Starkville.

The National Collegiate Landscape Competition is a conference and career fair for students, allowing them to meet industry professionals and interview for internships and careers.

The centerpiece of the conference is a 31-event student competition where they compete in events including interior, exterior, and 3D landscape design, robotics and technology, tractor loader backhoe operation, and construction cost estimating.

The team had several individual events with top 10 finishes, including:

- Trevor Hunter, Connor Osborne, and Makenzie Shifflett finished fourth in landscape plant installation;
- Chase Mallory was fifth in compact excavator operation;
- Tyler Croson and Wyatt Wade were fifth in irrigation troubleshooting;
- Hannah Chambers was sixth in interior landscape design;
- Sylar McDade was seventh in plant problem diagnosis;
- Theodore Testa was ninth in turf and weed identification, and;
- Ava Lambert was tenth in annual and perennial identification.

As part of the event, scholarships are awarded to participants. This year, six students won a total of \$8,000.

This year, 529 students from 46 colleges and universities took part.





## VIRGINIA TECH COMPETES IN 2023 NATIONAL SOIL JUDGING CHAMPIONSHIP



2023 Soil Judging Team. (From left) Jillian Burgan, Bernie Frantz, Grace Bartlett, Joe Paterson, C.J. Rufe, Zach Gesa, Tessa Naughton-Rockwell, Liz Eroshenko, Clara Betts, Will Ubben, Madison Norris, Matthew Smith, Kate Johnson, and Peter Arnold

The Virginia Tech Soil Judging Team finished ninth out of 23 teams at the 2023 National Collegiate Soils Contest, sponsored by the Soil Science Society of America.

Students spent four practice days describing soils derived from ancient and modern alluvium, eolian sands, and residuum from several types of unusual bedrock.

“This contest was very challenging because of the very subtle differences in colors and textures between the soil horizons,” said John Galbraith, a professor in the School of Plant and Environmental Sciences. “The soils were not strongly developed, so subtle differences made big differences in the soil classification.”

They braved cool, windy days before the weather finally cleared up for the two competition days.

“The students learned about wind-blown parent materials and witnessed wind erosion in action, reminding them of the dust bowl days in that region,” Galbraith said. “The semi-arid vegetation and land uses, seen on the drive to and from the contest, will help the students to better understand instructional lectures in their environmental science and ecology classes.”

The contest was hosted by Oklahoma State University near Woodward, Oklahoma.

“Overall, the preparation in Blacksburg and the contest week experiences were a tremendous learning opportunity for everyone involved,” Galbraith said.

## HORTICULTURE CLUB AND HAHN GARDEN HELD ANNUAL PLANT SALE

Hundreds of people visited the Blacksburg campus for the Horticulture Club at Virginia Tech and Hahn Horticulture Garden’s annual Plant Sale.

A variety of annuals and perennials, as well as trees and shrubs, filled two greenhouses and a portion of the garden for the three-day event.

Managing the plant sale gives the student plant sale chairs real-world experience in managing a large event. The student leaders ordered plants, coordinated delivery, established pricing, maintained inventory, interacted with customers, and managed the collection of payments. Planning the sale is a large endeavor that requires months of planning and preparation.

Historically, the plant sale provides the garden with 5 to 10 percent of its annual operating budget.

The horticulture club activities include educational trips, scholarships, a spring banquet, and a donation to the National Collegiate Landscape Competition Team. This year, the club awarded \$6,000 in scholarships to club members at the spring banquet. Scholarships are awarded based on volunteer hours and meeting attendance.



## CROPS TEACHING LAB RENOVATIONS

The Crops Teaching Lab in Smyth Hall received a makeover. The lab was equipped with additional storage and new furniture. The desks and chairs can be rearranged to allow for group work in small or large settings.



Photos provided  
by Ozzie Abaye.



## THE ART AND SCIENCE OF CREATING NEW PLANTS

Students in the Plant Propagation course, taught by Instructor Josh Kardos, got a hands-on lesson in apple grafting.

Guest lecturer Jon Vest '92, MPA '99, a senior Extension agent for Virginia Cooperative Extension in Floyd County, led the laboratory discussion and demonstration.

Students grafted a scion, a small piece of stem with only two buds, onto a root stock that has resistance to disease or insects, and a dwarfing characteristic.

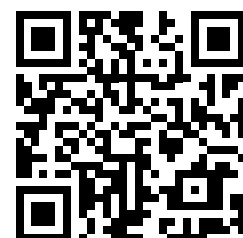
“Grafting enables us in a commercial orchard to plant smaller trees at a higher volume,” Vest said. “It also helps us reduce our pesticide usage and the overall application rates we would normally use in 30 or 40 foot trees.”



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## PREPARING THE GREENHOUSE FOR THE PLANT SALE

Students in the Ornamental Plant Production and Marketing class, taught by Instructor Josh Kardos, prepared the greenhouse for the annual Horticulture Club spring plant sale.

Throughout the semester, students grew plants for the sale and were responsible for all aspects of production from setting up the greenhouse, to potting and maintenance, and adjusting greenhouse conditions.

During the class, students planned for production, explored the industry, discussed wholesale growing, retail and online sales, and performed financial analysis to evaluate the profitability of the plants they grew.





so any class focused on helping endangered or impaired ecosystems in the town is very appealing and important to me.”

Throughout the week, students learned about the projects taking place at the creek, invasive vegetation management, site preparation techniques, and vegetation restoration techniques. They also discussed collaborating with stakeholders, challenges to restoration, how to assess negative impacts of restoration, and possible conflicts.

They also took part in some of the restoration effort, working in diverse teams while interacting with professional contract crews. Throughout the week they planted bare root seedlings and installed shelters, inspected the plants, and installed live stakes.

“My favorite part of the course was getting to learn about bare-root seedling planting methods, as well as the many enlightening discussions on various topics,” Coddington said. “This course helped prepare me for my future career by providing me with ample opportunities to apply myself in restoration work. It also helped emulate what a job in the field is like on a weekly basis.”

“I was impressed with the 17 students,” Saxton said. “They were very engaged. It actually gave me a lot of hope for the future generation of natural resource professionals and restoration ecologists because of how engaged they were and interested in learning with an open mind.”

The students were also tasked with creating a restoration plan for a degraded site found in the real-world. They presented their projects at the end of the semester. The hope is those will receive funding in the future.

“Ecological restoration is likely the fastest growing sector in the natural resource field,” Saxton said. “In my opinion, it is a matter of survival that we invest more here and we are advancing the science and implementation of ecological restoration because we have a lot of impacts as humans on the planet and our population is growing. We want a resilient planet to pass on to future generations.”

## NEW COURSE GIVES STUDENTS HANDS-ON EXPERIENCE IN ECOLOGICAL RESTORATION

BY PATRICK MCKEE

PHOTOS SUBMITTED BY TOM SAXTON & LEIGHTON REID

Stroubles Creek, which runs through the Virginia Tech campus, has been listed as federally impaired for more than two decades. The Virginia Department of Environmental Quality says one of the top reasons is its lack of riparian restoration buffer, a strip of vegetation that improves water quality by filtering pollutants, absorbing stormwater runoff and lowering surface water temperatures.

In an effort to teach students about ecological restoration and give them hands-on experience, the School of Plant and Environmental Sciences created a new course, taught for the first time in 2023: Ecological Restoration Field Practicum.

The course, which took place during spring break, was co-taught by Assistant Professor Leighton Reid and Tom Saxton, who earned his bachelor’s degree in natural resource conservation and forestry from Virginia Tech in 2014. Students were given hands-on experience in designing, implementing, and monitoring complex ecological restoration projects

“I’ve been working on Stroubles Creek restoration since I was a senior,” Saxton said. “I’ve had a vision since the start in 2014 to have a more dedicated student course so they could see all of these projects we have going on and be a part of it.”

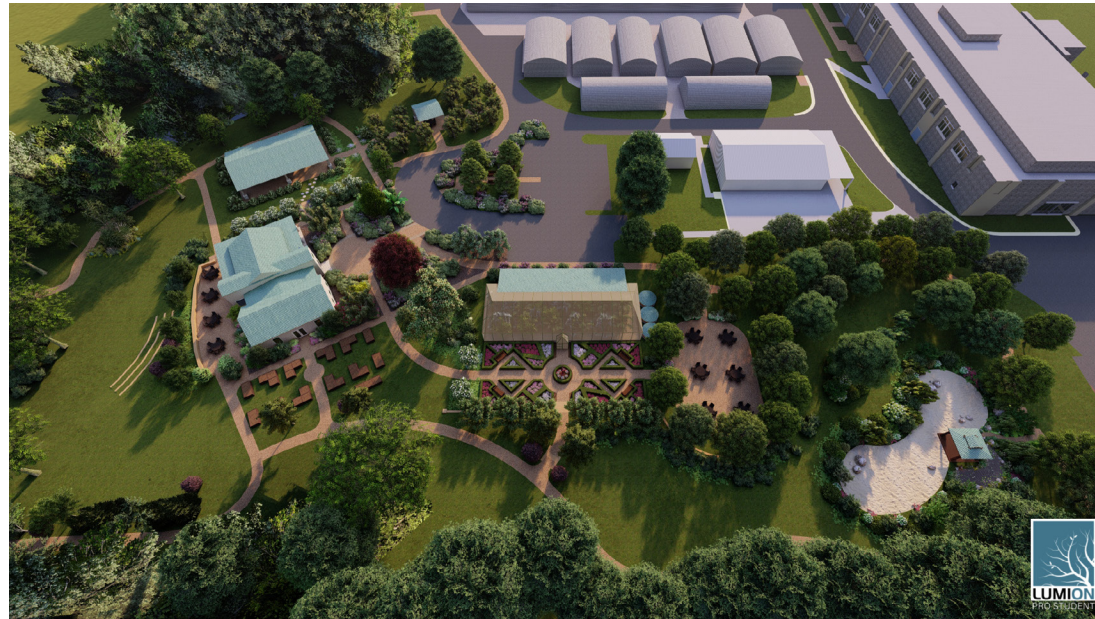
Henry Coddington, a junior majoring in Ecological Restoration, found this course appealing because of the field experience. “I wanted to take part in this course because it pertains heavily to my major, and I have always preferred practical, hands-on teaching methods to lectures,” Coddington said. “I am from Blacksburg,





# HAHN HORTICULTURE GARDEN UNVEILS LONG-RANGE EXPANSION PLAN

BY MARYA BARLOW



Virginia Tech’s Hahn Horticulture Garden has completed a new \$4 million planning study outlining potential growth and expansion for the six-acre public teaching and display garden, a popular destination on the Blacksburg campus.

Elements proposed in the study, driven by gifts, would significantly upgrade the Hahn Horticulture Garden’s amenities for holding events and vastly expand its array of gardens and sustainability

features. Highlights proposed in the study include a spacious open-air marquee structure, a Japanese-style zen garden, a glass house, a formal garden, water-conserving rain gardens, and multiple spaces for teaching, learning, and relaxing.

Hahn Horticulture Garden Director Scott Douglas said the goal of the planning study is to recommend ways to elevate the garden as a regional attraction and to capitalize on its allure to host more revenue-producing events, such as weddings, conferences, and reunions.

“Items identified in the study help us better utilize our 6-acre footprint,” Douglas said. “It allows people to stay longer, see more things, and be exposed to different styles of gardens. I’m hoping this will make us more of a destination.”

Open 365 days a year from dawn until dusk, the Hahn Horticulture Garden is western Virginia’s largest public garden and serves students and the community as a hands-on learning resource for gardening, landscaping, and environmental awareness. It operates entirely on donations and public generosity.

“People assume that because we are on Virginia Tech’s Blacksburg campus, we are in the university’s budget,” Douglas said. “We are an independent operator, so we are heavily dependent on people renting this place, making donations, and attending the Garden Gala in June. We are looking for donors to help us make the long-range plan a reality.”

Douglas said event rentals cover more than 50 percent of the garden’s operating costs. To increase that potential, the garden is proceeding with design and construction of a 2,800-square-foot open-air marquee structure to be built on the lawn next to the Peggy Lee Hahn Garden Pavilion. The wood framed structure, designed by Hill Studio in Roanoke, will have a concrete floor, wood columns with Hokie Stone bases, and a dramatic green metal roof that matches the neighboring pavilion. It will meet the demand for a large open-air covered event space while eliminating the need for tent rentals that damage the lawn.

The marquee is the first project slated for completion. Douglas said his hope is to break ground as early as November so it can be completed for the 2024 wedding season and Hahn Horticulture Garden’s 40th anniversary.

To complement the marquee structure, the study proposes a caterer hut with a roof and concrete floor that would be placed

between the new building and the parking area, enabling a convenient, sheltered workspace for event caterers. When not in use, the hut would offer a shaded, dry location for students and visitors.

A new “glass house” is also proposed to display a variety of tropical plants and orchids and house temperature-sensitive plants over the winter and seed-starting each spring. The glass house would function as a unique space for smaller rental events.

The study additionally proposes the introduction of a formal garden to feature clipped boxwood hedges and a variety of flowering plants to expose students and the public to a highly managed and controlled landscape style that is distinctly different from other spaces in the Hahn Garden.

Also under consideration is a Japanese-style zen garden with an open-air tea house surrounded by a raked stone garden and bordered by a small pond. The garden would introduce an international style and provide a peaceful space for relaxation and meditation.

Other improvements proposed in the planning study include:

- A prominent Hokie Stone entry gate at the garden’s main entrance on Washington Street.
- Directional signs to the Hahn Horticulture Garden from Route 460 and additional directional campus signage to guide visitors to the garden.
- Rain gardens to capture building runoff, highlight water conservation, and demonstrate a bog area.
- A plant collection database presented on a searchable map interface so students and visitors can locate and learn about the wide variety of plants in the garden.
- Landscape lighting to increase the overall safety of the garden for night events.
- A home gardening demonstration area featuring a collection of raised garden beds and a composting area.
- A shade garden with pathways, rhododendrons, a seating area, and a sculpture.
- A sidewalk along Garden Lane to provide a safe walkway from the greenhouse parking spaces to the pavilion.
- New accessible pedestrian pathways throughout the property.

The growth plans create more opportunities for students in the College of Agriculture and Life Sciences’ School of Plant and Environmental Sciences and Agricultural Technology program, who intern, work, volunteer, and take classes in the gardens throughout the year. Douglas said students will have a role in the installation and maintenance of many of the projects outlined in the study, from planting and pruning to building ponds and walkways.

“We’ve been so grateful to our community and volunteers who have supported the garden over the last 40 years,” Douglas said. “We look forward to involving them in the next chapter of growth to make the Hahn Garden the premier venue to visit, learn, relax, gather, and celebrate.”

To learn more about how to support the Hahn Horticulture Garden, please contact Emily Wong at ewong03@vt.edu or visit <https://hahngarden.vt.edu/support.html>.



Rendering of the proposed covered patio.





# BRINGING THE OUTDOORS INDOORS: How CONTROLLED ENVIRONMENT AGRICULTURE IS CHANGING THE INDUSTRY

BY: PATRICK MCKEE

With the population of the world expected to reach 10 billion by 2050, there is growing concern surrounding how to feed everyone. According to the Food and Agriculture Organization of the United Nations, farmers will need to increase food production by 70 percent to meet the need. Couple that with consumer demand for locally farmed foods that are fresher and more environmentally friendly, the controlled environment agriculture (CEA) industry is expected to grow in the coming decades.

Controlled environment agriculture is a technology-based approach to food production under targeted environmental conditions that aims to optimize plant growth and yield while minimizing resource use and environmental impacts. “It is sometimes defined as being everything from a high tunnel to, what is considered the highest technology level, vertical farms,” explained Kaylee South, an assistant professor in the School of Plant and Environmental Sciences.

The indoor environment shields crops from extreme weather by controlling conditions with heaters and coolers, ventilators, humidifiers and dehumidifiers, and CO<sub>2</sub> enrichment. In vertical farming, LED growing lights are used with hydroponic or aquaponic systems providing water and nutrients. There is less need for pesticides and 70 to 90 percent less water is required.



Controlled environment agriculture is a solution to the rapid loss of arable and fertile agricultural land. According to Maximize Market Research, around 4 million hectares — 10 million acres — of land become unusable due to erosion and degradation of soil annually with another 4 to 5 million hectares — 10 to 12 million acres — converted to commercial use for highways, factories, and roads.

To bring researchers together to advance the industry, the Controlled Environment Agriculture Innovation Center was formed at the Institute for Advanced Learning and Research (IALR) in Danville, Virginia. The center is a partnership between IALR, the Virginia Tech School of Plant and Environmental Sciences, and the Virginia Seafood Agricultural Research and Extension Center, and is part of the SmartFarm Innovation Network.



“I met with Mike Evans (director of the School of Plant and Environmental Sciences and co-director of the center) to let him know what IALR does,” said Scott Lowman, vice president of applied research at IALR and co-director of the Controlled Environment Agriculture Innovation Center. “We are not academic research and we are not a business. We play in between.”

The Institute has a greenhouse complex along with resources in biology, technology, and chemistry. Pair that with the school’s experience and resources, and “It really made sense,” Lowman said.

South is one of several researchers at Virginia Tech and the Institute who is studying ways to advance the CEA industry by improving crops in both vertical farms and greenhouses. “One project is working with beneficial bacteria to improve plant growth within controlled environment systems, looking mainly at hydroponics, on crops that range in fruiting and also traditional leafy greens and herbs as well.”

Researchers in the center are also exploring beneficial bacteria to promote plant growth in greenhouse and indoor vertical farm hydroponic production systems, plant pathogen control, and applied research that is beneficial to farmers. In addition, they are researching best practices for using technology to monitor and improve crop production in controlled environments, such as tomato production in indoor vertical farm systems.

They recently finished a project that looked at different fertilizer concentrations and how those affect the plant yield and sugar content in strawberries.



Robert Chretien and Amy Turner harvest microgreens in the CEA Innovation Center vertical farming lab. Photo by Patrick McKee for Virginia Tech.

reason they did that was they knew they could rely on us for support,” Lowman said.

Plenty, an indoor vertical farmer, also brought jobs to the commonwealth, building a \$300 million complex outside of Richmond. “That caught the attention at the highest level in Richmond,” Lowman said.



Scott Lowman, picture provided by the Institute for Advanced Learning and Research.

### GROWING INDUSTRY

In 2021, controlled environment agriculture in the United States was valued at \$74 billion, according to Maximize Market Research. It is expected to more than double to \$157 billion by the end of the decade.

Several companies have moved to Virginia due, in part, to the work at the CEA Innovation Center. “As Virginia continues to attract global CEA companies, the demand will increase for trained employees to fill these positions,” said Michael Evans, director of the School of Plant and Environmental Sciences and co-director of the CEA Innovation Center.

“About the time we were discussing the creation of the center, we were also in talks, as part of economic development, with AeroFarms to locate to Virginia,” Lowman said.

AeroFarms built the world’s largest aeroponics farm in southern Virginia, just miles from the center. “Part of the

In April, Virginia Governor Glenn Youngkin toured the CEA Innovation Center to learn about the research taking place, the collaboration with industry, and the steps being taken to train the workforce. His goal is for Virginia to be the number one destination for CEA companies in the country and the world. “We need to be driving industry innovation to continuously move the marker forward,” Youngkin said during a news conference in Raphine, Virginia. “One great example is the partnership between Virginia Tech and the Institute for Advanced Learning and Research in Danville. The work that is going on there is extraordinary.”

At that news conference at the Shenandoah Valley Agricultural Research and Extension Center, the governor signed legislation to aid the Controlled Environment Agriculture industry. The new legislation expands the agricultural sales tax exemption to include items used to produce market-ready agricultural products.



really fosters an environment for sharing ideas and new business opportunities,” said Indoor Ag-Con CEO Brian Sullivan.

### LOOKING TO THE FUTURE

“CEA offers a lot of really good opportunities,” South said. “For several reasons, the future looks really interesting.”

“The more immediate future is tomatoes, smaller, dwarf strawberries, things of that nature,” Lowman said. “In the more distant future, it could be plants with custom nutritional levels with certain vitamins. It could even be human pharmaceuticals, so imagine a plant producing something that humans need to live.”

“I think students, who may not have thought about agriculture, will be attracted to entering the field because of CEA,” South said. “I see CEA playing a major role in the future.”



Michael Evans, SPES Director and Assistant Professor Kaylee South discuss on-going research at the Controlled Environment Agriculture Innovation Center with Virginia Governor Glenn Youngkin. Photo provided by the Institute for Advanced Learning and Research.

The center and its growing influence in the region helped to attract a major conference to the east coast. Indoor Ag-Con has held a trade event for a decade in Las Vegas. Looking to expand to the east coast, the CEA Innovation Center and the Institute were a perfect fit. “This conference offers an exciting opportunity to bring people together for exchanging new and diverse ideas to help move the industry forward and into exciting directions,” South said.

Last year, more than 200 people from 28 states, Puerto Rico, and Canada attended the two-day event. “Both organizations see tremendous value in growing an event like this that brings business and academia audiences together at an incredible research facility setting that



# VIRGINIA TECH RESEARCHERS FIGHT FIRE BLIGHT’S PLIGHT ON APPLE PRODUCTION

BY MARY HARDBARGER

As the old English proverb goes, “An apple a day keeps the doctor away.”

It’s long been known that apples offer multiple health benefits. Rich in fiber and antioxidants, they are linked to a lower risk of many chronic conditions, including diabetes, heart disease, and cancer.

Apples help protect human health, but what is being done to protect the health of this delicious and nutritious fruit?

Researchers at the Alson H. Smith Jr. Agricultural and Extension Research Center, a Virginia Tech facility well-known for its contributions to the commercial fruit industry, are studying methods to fight fire blight, a contagious and often deadly disease that affects apples and other fruits.



In the past 15 years, more frequent warm and wet weather during the spring has sparked epidemics of fire blight, causing losses of up to \$22 million per year in apple and pear crops. Particularly impacted regions include the mid-Atlantic, northeast, and Pacific northwest.

With funding from two grants from the United States Department of Agriculture estimated at a total of more than \$360,000, Srdjan Acimovic, an assistant professor in the College of Agriculture and Life Sciences’ School of Plant and Environmental Sciences, is developing effective treatments of fire blight. More specifically, fire blight bacterium *Erwinia amylovora* in fire blight cankers. Cankers are infected dead zones on wood bark and cause up to 50 percent of orchard acreage loss.

“This project will provide growers with critically-needed, next-generation control options for all fire blight phases – cankers, blossom blight, and shoot blight,” Acimovic said.

## STOPPING THE SPREAD

Fire blight, like so many diseases that affect plants and humans, is complicated. Discovered in the early 1800s, it is the first-ever described plant pathogen in the history of plant pathology. The disease remains a challenge for today’s researchers because of many factors, including climate change, the way fruit trees are now commonly planted, and because of the disease’s ability to spread quickly, and often, secretly.

Historically, growers planted fruit trees far apart on large acreages of land. Trees would grow tall and sprawling and require a ladder and a lot of labor to harvest. Today, most growers plant high density trees, or smaller trees planted closer together.

“The reason why they do this is because it’s lucrative, and they can produce much more fruit per acre,” Acimovic said. “But at the same time, this allows fire blight to spread more easily. Flowers eventually develop on the trees, and that’s where the entry point for fire blight is.”

Fire blight thrives in warm, wet conditions and starts appearing during the correlating spring months. The continual mix of rain and sun infects the flower, resulting in bloom blight.

The infection doesn’t stop there. It spreads into the shoots - shoot blight- and eventually into the tissue and trunk of the plant, causing cankers. Cankers harbor deadly bacteria that can hibernate during the winter months, a process called overwintering, and spread in the spring. They can, and often do, lead to the death of trees, resulting in profit loss and a fear that other trees will, too, be infected.

Acimovic has seen first-hand fire blight’s devastation. He is stationed at the Alson H. Smith Jr. Agricultural Research and Extension Center in Winchester, Virginia, where many of the facility’s apple trees have succumbed to the disease.

“It looks like someone has taken a blow torch to them,” he said.

Traditional treatment of fire blight begins in the spring. Growers spray the trees with copper-based pesticides as a general sanitation measure. The spray may disinfect the surface of the branches and cankers, but bacteria can remain dormant inside.

And that’s where Acimovic’s research begins.

“No matter how well the growers prune the orchards to take cankers out, there will always be enough cankers remaining in the orchard to allow the bacterium to overwinter and potentially infect again the flowers in the spring,” he said. “What I want to do with this research is develop some management options that target the bacterium inside of the skin and address this stage that has been very poorly investigated in the past.”

To support this research, the United States Department of Agriculture awarded Acimovic, principal investigator, and his team of researchers a \$75,000 USDA Specialty Crop Block Grant and a \$287,000 USDA-NIFA Crop Protection and Pest Management Grant.

The grants will fund two similar projects with goals to develop effective dormant copper spray treatments in mix with bark penetrating oils for eradication of fire blight bacterium *Erwinia amylovora* in fire blight cankers, evaluate spray programs with different plant activators that prevent shoot blight and fire blight cankers, and test newly-designed antimicrobial enzymes that degrade biofilm of *E. amylovora* to control blossom and shoot blight.

Acimovic is using a very advanced and novel approach to learn more about the bacteria that harbors inside the cankers, the focus of his research to combat fire blight.

The technology is called Droplet Digital PCR (preliminary chain reaction). Its more common counterpart is Digital PCR. Both tools help amplify, or detect, if a pathogen is present. Similar technology was used to detect COVID-19 and its different variants.

In fire blight’s case, DNA is taken from sample of a canker and processed through PCR machines. With Digital PCR, a chip inside the machine captures these small molecules of DNA. If the fire blight pathogen is present, the machine reads blue. Yellow means negative. The machine can also quantify the pathogen, or how much of the bacteria is present.

Droplet Digital PRC is similar but superior technology, Acimovic said. Microscopic droplets of oil mix with the DNA of the plant. Should a pathogen be detected, the droplet emits fluorescent light. This method can amplify the pathogen even more than Digital PCR, leading to higher yields of accuracy.

“This is the latest technology, and we have made many more advances with this research in my lab,” Acimovic said. “We are excited to continue this revolutionary study that we hope will soon benefit our industry partners and stakeholders across the commonwealth.”



## SPES HONORS OUTSTANDING FACULTY AND STAFF

The School of Plant and Environmental Sciences handed out several awards during its spring picnic in April. Awards were given to faculty members in the areas of research, teaching, and Extension, and research and administrative staff. The research awards are given to those who have demonstrated: an excellent publication record, grant and fellowship record, national and international awards or recognition, citations, and student training.

### SHAWN ASKEW OUTSTANDING APPLIED RESEARCH FACULTY

Shawn Askew has published more than 500 scientific abstracts, 100 peer-reviewed publications, and more than 300 Extension articles. During the past five years he has received more than \$1.4 million in research support. Askew has served as president of the Northeastern Weed Science Society (NEWSS) and was named Fellow of the NEWSS in 2023. His nominator said, “It is his commitment to his students and his colleagues that he is most noted for as a mentor, peer, and friend.”



### DAVID HAAK OUTSTANDING BASIC RESEARCH FACULTY

David Haak has published 28 peer-reviewed papers since 2017 and has been cited more than 6,900 times. He has been invited to present his research more than a dozen times. He has graduated five Ph.D. students and one M.S. student, and trained two post-doctoral associates. Haak was recently awarded the Stebbins Award for outstanding publication in Phylogenomics. His nominator said, “His publication record, funding history, and impactful training of future scientists are commendable, particularly in light of his generosity, humility, and inclusiveness as a colleague.”



### RORY MAGUIRE OUTSTANDING EXTENSION FACULTY

Rory Maguire’s research and Extension program has produced a host of best management practices in water quality protection and nutrient use efficiency that have been implemented by both Virginia and Mid-Atlantic farmers. He also serves as supervisor of the Virginia Tech Soil Testing Lab which handles more than 50,000 samples annually. Since 2018, he has generated more than \$1.3 million of research support, published 14 peer-reviewed articles, and five peer-reviewed Extension articles. The Outstanding Extension Faculty Award is given to a faculty member who demonstrates a commitment to exemplary engagement with stakeholders, productivity and outputs, and evidence of impact demonstrating positive personal and societal change.



### JOSH KARDOS OUTSTANDING TEACHING FACULTY

Josh Kardos teaches six horticulture courses, examining a wide-range of subjects. His classes are noted as cutting-edge opportunities for students that offer tremendous value and potential for growers both economically and increasing food sources to address the needs of urban population centers. Kardos’ experiences in plant breeding, plant grafting, program management, and as the manager of the Virginia Tech Specialty Crops Research Program provide him a unique perspective and expertise in training the next generation of students for green-industry careers. The Outstanding Teaching Faculty Award is given to those who demonstrate: a commitment to enhancing the educational environment, highest standards of instruction, implementation of new forms and technologies of teaching, and continual evaluation of effectiveness.

### SABRINA ALLEN OUTSTANDING ADMINISTRATIVE STAFF

Sabrina Allen serves at the Fiscal Specialist and has been with the school since it launched in 2018. Over her 30-year career at the university, she has served in most fiscal roles including reconciling, purchasing, payroll, and several human resources roles. Her nominator says, “Sabrina has always distinguished herself as a team player, both with her peers on the SPES fiscal administrative team, but also on behalf of the faculty, staff, and students.” The Outstanding Administrative Staff Award is given to those who demonstrate professionalism and enthusiasm, a willingness to help others, commitment to professional development, and willingness to accept new job responsibilities.



### KEVIN BAMBER OUTSTANDING RESEARCH STAFF

Kevin Bamber routinely volunteers to help others. He manages several administrative tasks that aid the school, such as Glade Road fuel accounting and departmental vehicles. Graduate students he encounters describe him as one of the best aspects of their lab, saying “Working with him is a true joy.” Bamber is known for providing birthday cakes for those he works with at the Glade Road facility, claiming, “everyone should have a cake on their birthday.” Over the past decade, he has purchased more than 100 cakes. The Outstanding Research Staff Award is given to a research staff member who has demonstrated outstanding contribution, professionalism, and enthusiasm, boosts morale of colleagues, is committed to helping others, and professional development.





Wynse Brooks (at left) and Judy Fielder (at right) retired from the School of Plant and Environmental Sciences in April. Brooks was a senior research associate in the Small Grains Breeding and Genetics program. He retired after 30 years at Virginia Tech. Fielder was a member of the Human Resources team in the administrative office. She was with the university for 44 years.

NEWEST MEMBERS OF THE SPES TEAM



**ANDREA RENSHAW**  
Laboratory & Research Specialist, Small Grains Breeding Program

- M.S. Agriculture and Life Sciences, Environmental Science Concentration, Virginia Tech
- B.S. Biology: Ecology, Evolution, and Organismal Biology, West Liberty University

Renshaw has worked at Virginia Tech for a few years. She is currently a Lab and Research Specialist/Administrative Assistant with the Virginia Tech Small Grains Breeding Program, assisting with laboratory, greenhouse, agriculture, and administrative duties for the program. Renshaw has previous experience in ecological and conservation studies, microbiology, bioremediation, education, and laboratory management.



**DAPHNE WILLIAMS**  
Horticulturist, Hahn Horticulture Garden

- B.S., Horticulture, Virginia Tech

Williams has spent many years in the green industry in many different roles including public and private gardening, retail nursery, residential and commercial landscaping, and community outreach.

With a passion for design concepts, nature, gardening, and building lasting relationships with people, Williams looks forward to the opportunity to continue to strengthen her skill sets in the green industry as well as her relationships with the community.

Originally from Newport, Virginia, she currently lives on a farm in Pembroke, Virginia. She feels fortunate and grateful to be able to work at her alma mater where she is able to remain creative, interact with plants and people on a daily basis, and invest in the future of Horticulture at Virginia Tech. Go Hokies!

ALUMNI SPOTLIGHT

THREE HOKIES HONORED WITH FIRST-EVER SPES ALUMNI AWARDS

The School of Plant and Environmental Sciences at Virginia Tech held its first-ever Alumni Awards Celebration, honoring three outstanding Hokies. Two of them were also recognized by the College of Agriculture and Life Sciences (CALS).

ANDREW MILLER '16, M.S. '18  
SPES OUTSTANDING RECENT UNDERGRADUATE ALUMNI AWARD

Miller is the director of the Brentsville Turf Program at Brentsville District High School in Nokesville, Virginia. In this role, he mentors young individuals in the trade of turfgrass management, advocates for students interested in starting a career in the turf industry, teaches students through hands-on learning with commercial-grade equipment, and prepares students for the workplace with firsthand work experience.

Miller was also awarded the CALS Outstanding Recent Undergraduate Alumni Award.



(From left) Andrew Miller, Kate Fiedler, and Richard Harkess Photo by Patrick McKee for Virginia Tech.

KATE FIEDLER Ph.D. '14  
SPES OUTSTANDING ALUMNI IN THE GLOBAL COMMUNITY AWARD

Fiedler is currently a foreign services trainee with U.S. Department of Agriculture-Animal and Plant Health Inspection Service. Upon completion of the 10-month program, she will achieve the title of deputy agricultural attaché, a diplomatic foreign service role based at the United States Embassy in Tokyo. Within this role, Fiedler will be responsible for agricultural trade negotiations, capacity building of local trade partners, and acting as a plant pathology expert for local and regional incursion of pests.

Fiedler was also awarded the CALS Outstanding Alumni in the Global Community Award.

RICHARD HARKESS Ph.D. '93  
SPES CAREER ACHIEVEMENT AWARD

Harkess is a professor in the Department of Plant and Soil Sciences at Mississippi State University in Starkville. His research, focused largely on ornamental plant material production, has a major impact on the graduate program, with 25 students completing the program. He has received nearly \$2.3 million in grants, leading to the publication of 64 peer-reviewed manuscripts. Harkess teaches three courses per year, coordinates undergraduate programs in the department, and coordinates enrollment in the ACCEPtS courses, a grant-funded course sharing alliance with four universities.



## STUDENT SPOTLIGHT

### SPES RECOGNIZES OUTSTANDING GRADUATE STUDENTS

#### VIPIN KUMAR OUTSTANDING M.S. STUDENT

Kumar is currently working on evaluating different herbicides for termination of cover crops and control of volunteer mustard in corn. He is also studying the influence of cover crops on insect-pest infestations in agronomic crops. From his thesis research, Kumar has published one review article, has one original research article that was recently accepted, and another currently in review. Kumar has given eight oral and poster presentations and received second place awards for three of his posters. He received a first place prize in herbicide symptomology at the Northeast Weed Science Society student weed contest. Kumar is advised by Assistant Professor Vijay Singh at the Eastern Shore Agricultural Research and Extension Center.



#### SAPANA POKHREL OUTSTANDING PH.D. STUDENT, APPLIED RESEARCH

Pokhrel is evaluating how conservation management systems, such as cover crops and no-till, influence nitrogen management. From her dissertation research, she has published two peer-reviewed Extension publications. Since she joined Professor Rory Maguire's program, Pokhrel has given 10 poster and oral presentations, many of which reflect her research in applied situations, including conducting nutrient management training for the Virginia certification exam, presenting her research to the Virginia Innovative Farmers Roundtable, the Virginia Soil Health Coalition, and the Master Gardener College.



#### PARUL SHARMA OUTSTANDING PH.D. STUDENT, BASIC RESEARCH

Sharma is working on improving pathogen identification and characterization using long-read sequencing methods. While in the Vinatzer lab, Sharma has contributed to four peer-reviewed research articles as co-author, published one article as one of three equally contributing first authors, and another article as the sole first author. While at Virginia Tech, Sharma has received three first-place awards for her oral and poster presentations at the Potomac Division Meeting of the American Phytopathological Society, SPES Research Symposium, and the Virginia Tech Graduate Student Association Research Symposium. Sharma is advised by Professor Boris Vinatzer.



### TWO UNDERGRADUATE STUDENTS AWARDED OUTSTANDING SPES SENIOR AWARD

#### JILLIAN BURGAN MAJOR: ENVIRONMENTAL SCIENCE MINOR: GIS AND WETLAND SCIENCE

Burgan was a member of the Virginia Tech Soil Judging Team, which placed second in the regional competition in 2022. She has also worked in Bryan Brown's lab where she conducted research into ephemeral waterways and aquatic community restructuring after dry events. The results were presented at the Dennis Dean Undergraduate Research Symposium.



#### TEX TESSA NAUGHTON-ROCKWELL MAJOR: CROP AND SOIL SCIENCE MINOR: GLOBAL FOOD SECURITY

Naughton-Rockwell was a member of the Soil Judging Team, which won first place in the regional and national competitions in 2021 and 2022. Naughton-Rockwell also worked with the Global Agriculture Productivity Initiative and performed research with the Conservation Agriculture Adoption Project in Ecuador.



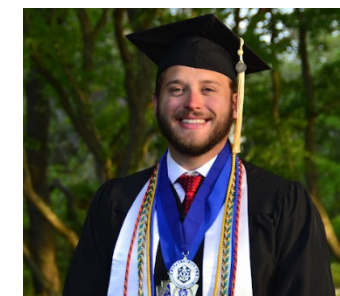
### SPES STUDENTS RECOGNIZED BY THE COLLEGE OF AGRICULTURE AND LIFE SCIENCES



#### CALS OUTSTANDING AMBASSADOR AWARD MADISON NORRIS



#### CALS CHAMPION AWARD JORDAN LONG



#### CALS OUTSTANDING CLUB LEADERSHIP AWARD BERNIE FRANTZ

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Pabitra Aryal  
Kshitiz Dhakal  
Suzanne Laliberte  
Qi Li  
Sapana Pokhrel

M.S.

David Bellangue  
Soni Ghimire  
Raven Larcom  
Amelia Loeb  
Anna Tharpe

Bachelor’s

CROP AND SOIL SCIENCES

Jonathan Ames  
Peter Arnold  
Bernie Frantz  
Sarah Graham  
Spencer Kent  
Tex Tessa Naughton-Rockwell  
Elizabeth Vaught

ENVIRONMENTAL SCIENCE

Clara Banks  
Camille Basilio  
Kristina Blanton  
Lindsay Borg  
Isabel Brown  
Jillian Burgan  
Asia Chhour  
Andres Cunningham Valdes  
Nathan Duda  
Zoe Froehlich  
Jack Hanley  
Wylie Hicklin  
Kathryn Johnson  
Ryan Keverline  
Erin Kim  
Austyn Kirby  
Zachary Koerber  
Gareth Krise  
Haoyu Li  
Piper Macnicol  
Lesley Merkel  
Jillian Mullen  
Madison Norris  
Jakob Sanne  
Natsumi Shimoda  
Adam Stoltz  
Sarah Superata  
Paige Sutherlin  
Thomas Teklu  
John Whilesmith

ENVIRONMENTAL HORTICULTURE

Ian Aimonetti  
Patrick Atwell  
Christopher Austin  
Arianna Ballas  
Ty Bloomer  
Joseph Carlin  
Bailey Connors  
Cosette Cusson  
Trevor Hunter  
Joy Kuzma  
Kelsi Landel  
Grace Layman  
Jordan Long  
Skylar McDade  
Carli Molella  
Grayson Moyer  
George Psacharopoulos  
Morgan Sensabaugh  
Liam Williams  
Joel Wilson

ECOLOGICAL RESTORATION

Andrew Gnatowski

LANDSCAPE CONTRACTING

Connor Osborne  
Kylie Thomas

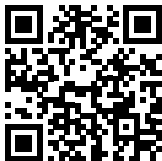
UPCOMING EVENTS

CALS ALUMNI ORGANIZATION SOCIAL

August 2  
Virginia Beach

50TH ANNUAL TURFGRASS FIELD DAY

August 28-29  
Blacksburg, Va.



CALS ALUMNI ORGANIZATION TAILGATE

September 9th  
Blacksburg, Va.

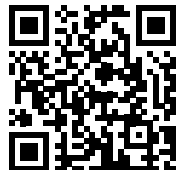


September 19-20  
Institute for Advanced Learning  
and Research  
Danville, Va.  
ceasummit.com



Homecoming 2023

October 9th-15th  
Blacksburg, Va.



Make a difference for future generations of Hokies.

Support students, faculty, and programs in the School of Plant and Environmental Sciences.

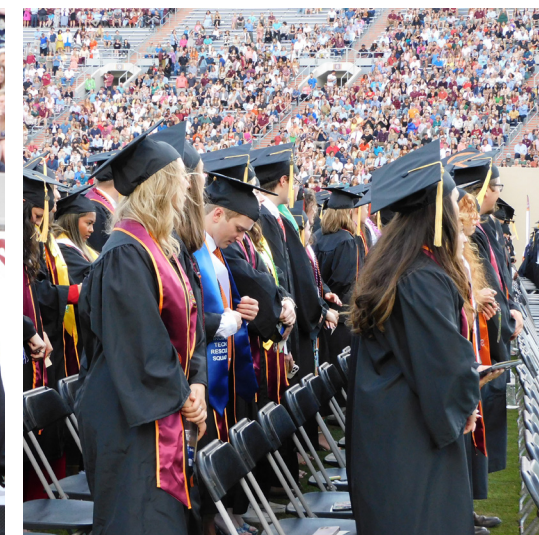
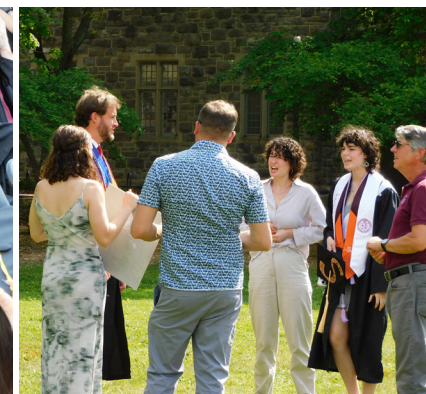
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# CONGRATULATIONS TO THE CLASS OF 2023

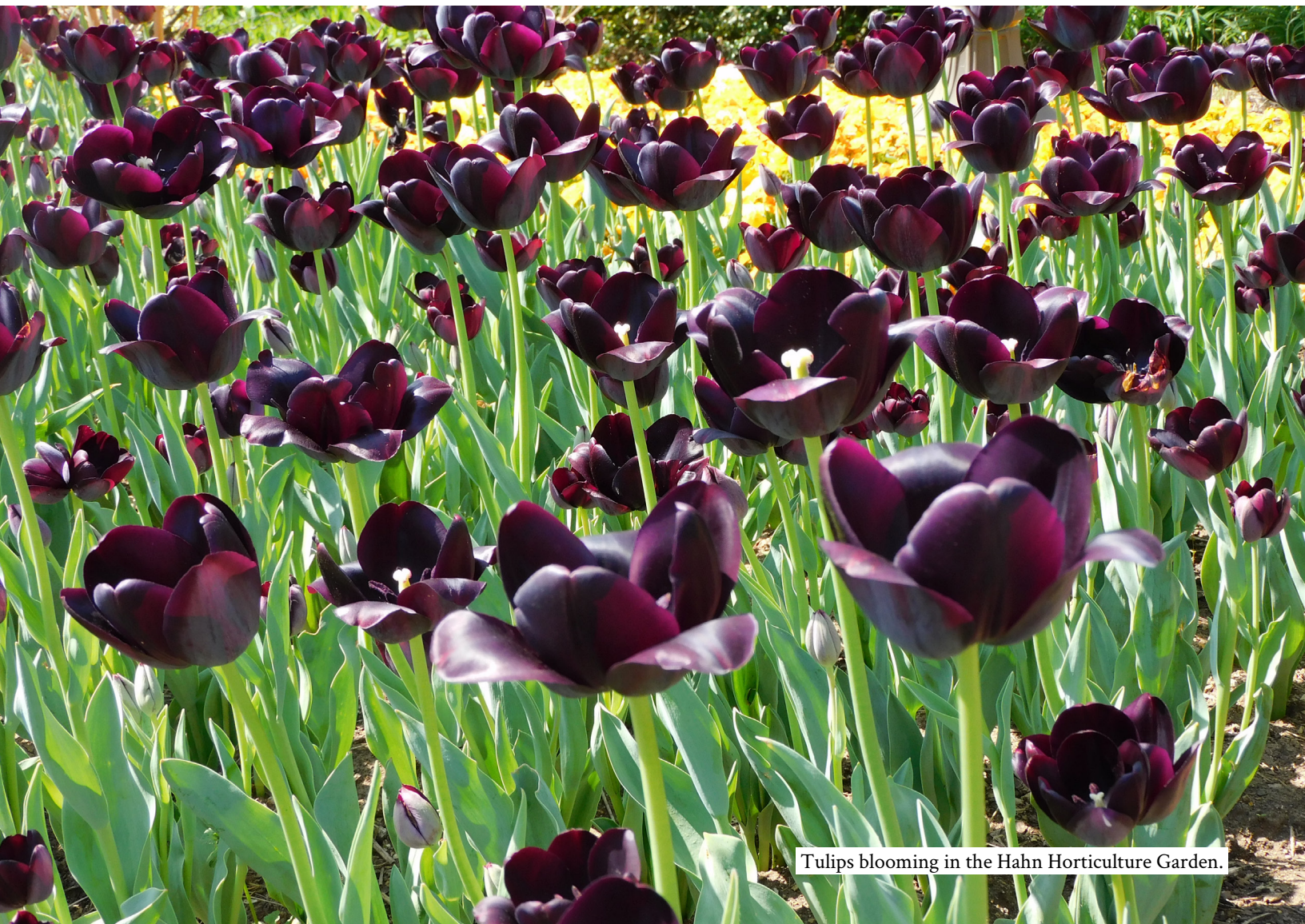






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VIRGINIA TECH.

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Tulips blooming in the Hahn Horticulture Garden.