

URBAN AGRICULTURE / CONTROLLED ENVIRONMENT AGRICULTURE

NEWSLETTER

SUMMER, 2025

Welcome to the latest edition of our monthly newsletter – your gateway to the future of farming.

In this edition, we spotlight the dynamic work of the Urban Agriculture Group at Kentucky State University, where innovation meets sustainability. From smart greenhouse systems to student-led research in controlled environment agriculture, our mission is to reshape urban food systems through education, technology, and community impact.

**HARVESTING INNOVATION:
THE FUTURE OF
AGRICULTURAL
TECHNOLOGIES**



**SUSTAINABLE
FARMING:
IMPROVING
FOOD SECURITY
THROUGH C.E.A**



**KENTUCKY STATE
UNIVERSITY**

THREATENED CON

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**CULTIVATING
KNOWLEDGE:**

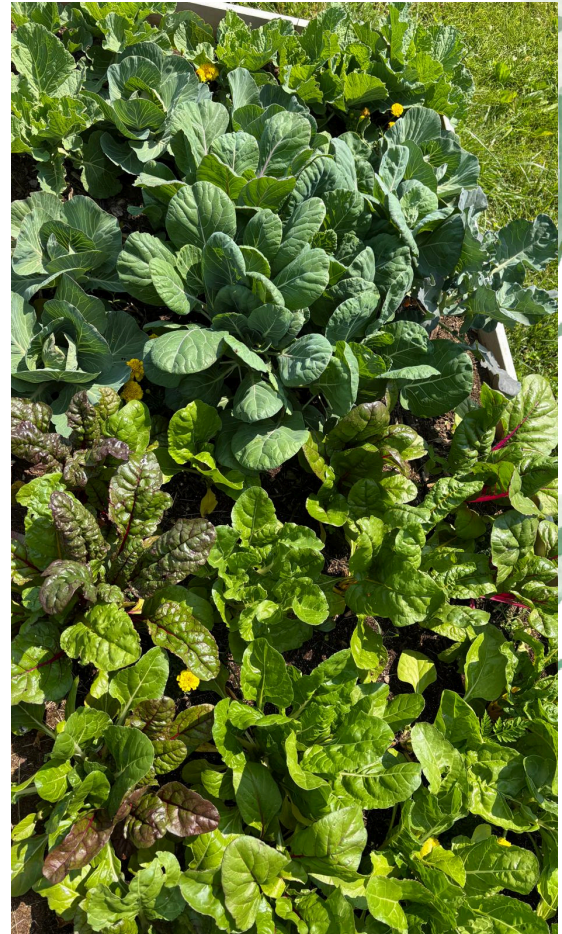
**STUDENT-
RAN FARM
CHRONICLES**

PURPOSE

The Urban Agriculture/CEA lab aims to highlight the research initiatives that have been conducted throughout the summer. Expressing our successes along with our obstacles and how we overcame them. We want to inspire the Kentucky State University community through our innovative approach towards addressing food accessibility through scientific research and educational mentorship from our team of graduate and undergraduate students.

INTRODUCTION

“Enhancing food accessibility through urban agriculture” a simple, yet meaningful message that Kentucky State University’s Urban and Controlled Environment Agriculture Lab is working earnestly to promote. For the second summer in a row a under the direction of Dr. Nzaramyimana Theoneste a team of graduate and undergraduate students have been working together on several different research projects, that will continue into the Fall semester. This summer has been especially special due to the substantial growth of the lab, which started with a group of 7 lab members (4 graduates and 3 undergraduates) now reaching a total of 20 lab members including 5 administrators, 6 graduate students, and 10 undergraduate students.



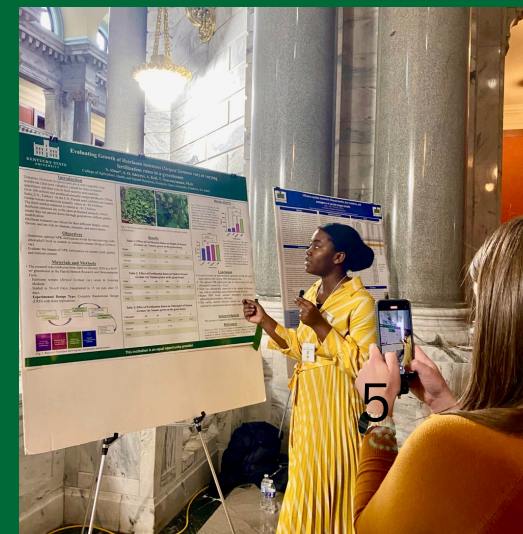
What makes this program even more remarkable is its interdisciplinary nature. Students in our lab come from diverse academic backgrounds including nursing, agribusiness, computer science, plant and environmental science, each bringing a unique perspective to the work we do. This collaborative environment fosters innovation and mirrors real-world team structures in agriculture, technology, and public health sectors. Our students work diligently together on everything ranging from nutrient monitoring and crop production to data analysis and community outreach. In this lab we demonstrate the far-reaching value of urban agriculture in academic and community contexts.

The growth of this lab is significant because it creates an environment for undergraduate students to get hands on agricultural skills and professional development skills that will be beneficial to their academic and professional careers, it also has inspired undergraduate students outside of the lab to want to know more about the school of agriculture at Kentucky State University. This summer we are conducting research projects on our Student-Ran Farm, an initiative that emphasizes urban agricultural practices via hydroponic systems, field production high tunnel usages and more. The student-Ran Farm encourages our undergraduate research assistants to take ownership in contributing to scientific research that supports food accessibility for all people. Having undergraduate students involved in farm activities on this level has been unheard of until now but the experience has been nothing short of extraordinary and innovative which we hope will encourage more student participation in the future.



“When students interested in ag see a greenhouse or a Freight Farm, they see it’s a great opportunity because they can do it too,” Nzaramyimana said. “It’s really expensive to purchase farmland. But they can own a small greenhouse in a backyard. So, we’re starting to see kids from the city joining urban ag programs.”

• **JOHN TWOR, ILLINOIS STATE MAGAZINE**



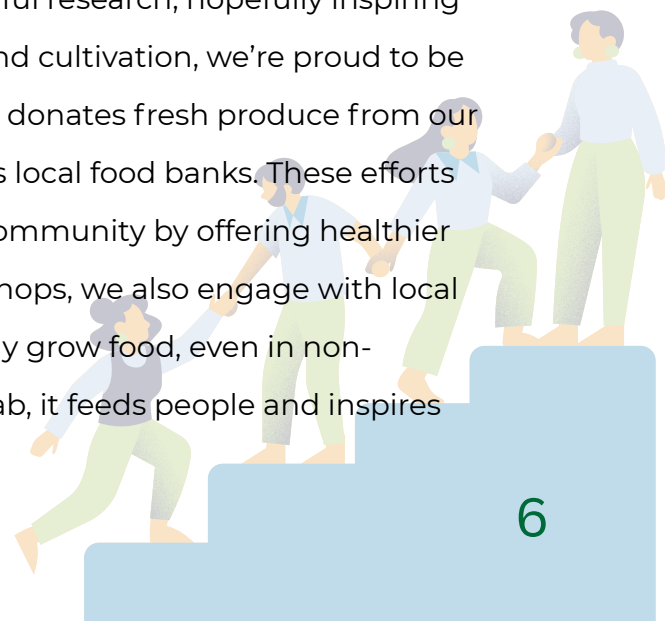
MISSION STATEMENT:

Student research assistants in the Urban Agriculture/CEA program learn about various aspects of agriculture: controlled environment agriculture, research methodology, team building, and food production. This program also supports staff and student research projects, lab activities, and course-based projects.

Under the leadership of Dr. Theoneste Nzaramyimana, the team runs a student-run farm on the Kentucky State University Harold Benson Farm field and greenhouse for food production, research, and education. Students donate fresh vegetables to the campus and community during the harvest seasons to reduce local food insecurity and promote healthy nutrition.

ABOUT THE LAB AND FARM:

Our Lab includes of both graduate and undergraduate students which creates a unique opportunity for mentorship and collaborative learning. Together we conduct experiments through hydroponics and field production, growing a variety of different crops that contribute to scientific research. Useful skills are developed daily in laboratory and outdoor environments. We also conduct workshops on scientific writing that encourage our undergraduate students to seek factsheet and research publications. Each graduate student is assigned mentees who work alongside their mentors to aid them in their individual and collective projects, giving them firsthand insights on what it means to be a graduate student conducting meaningful research; hopefully inspiring them to pursue further education. Beyond research and cultivation, we're proud to be apart of an initiative focused on food equity. Our team donates fresh produce from our student-ran farm to the campus community as well as local food banks. These efforts positively impact food insecurity in the surrounding community by offering healthier food options. Through extension programs and workshops, we also engage with local residents, sharing knowledge about how to sustainably grow food, even in non-traditional spaces. Our research isn't confined to the lab, it feeds people and inspires action.



WHAT WE ARE GROWING NOW

We are currently growing a total of 27 different crop varieties including:

Vegetables

- Broccoli
- Tomatoes
- Cucumber
- Pumpkin
- Okra
- Green peppers
- Habanero peppers
- African Eggplant
- Bush beans
- Carrots
- Potatoes
- Onion
- Cabbage

Fruits

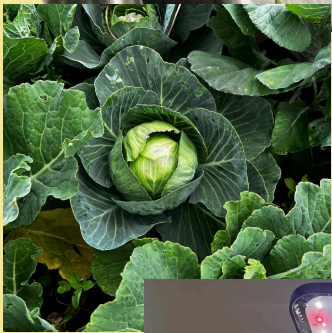
- Watermelon

Leafy greens:

- Swiss chard
- Kale
- Collards
- Micro greens
- Lettuce
- Watercress

Herbs

- Rosemary
- Mint
- Lemongrass
- Parsley



OUR PRODUCE



We have harvested nearly 6,729 pounds of fruits and vegetables on the Student-Run-Farm in 2025.

CULTIVATION METHODS:

We are producing these crops through a variety of growing methods, soil based, hydroponic and we have recently acquired high tunnels. Soil based and hydroponic agriculture are two distinct forms of crop production. Soil based farming is a traditional method where nutrients, water, and support are all provided by the natural soil available. This traditional approach relies heavily on environmental conditions, soil quality, land availability, and nutritional inputs as needed. The use of agrochemicals like fertilizers and pesticides is commonly seen in traditional farming practices to help enhance productivity. In contrast hydroponic production is a soilless method of plant production where crops grow in a nutrient rich water solution under controlled conditions like greenhouses or vertical farms. This method enables the precise control of nutrients, reduces water usage and eliminates soil-borne diseases. Hydroponics can also be practiced in diverse environments and resource limited areas. Both methods are being utilized in the lab and on the student-ran farm to promote healthy crop production while providing students with the experience of managing complex systems like deep water culture (DWC), and NFT hydroponics and soil-based high tunnels.





CHALLENGES WE FACED

EXPLORE THE REAL-LIFE HURDLES OUR
TEAM ENCOUNTERED AND HOW WE
TRANSFORMED THEM INTO VALUABLE
LEARNING EXPERIENCES.

CHALLENGES:

As a team we have tackled many real world challenges that naturally come with any kind of food production. Instead of letting them hinder us, we used these instances as learning opportunities. Overall some of our most prominent challenges included watering issues, pests, and fungal diseases. Throughout the summer we were able to collectively identify the root of these issues by documenting them and if necessary doing additional research to find solutions.

PROBLEMS/SOLUTIONS:



This recently transplanted eggplant seedling suffered from an infestation of flea beetle, a common pest in eggplants, peppers, and other nightshade. This issue causes severe damage to the plant and can stunt its growth. To fix this issue we applied neem oil on a consistent basis to repel the insects.



This image depicts Tomato Catfacing of some of our tomato plant, this is a physiological issue caused by environmental stress like overwatering. This issue causes scarring, cracking around the stem, distorted growth, and rough patches on the skin. This issue is not contagious so to fix it we removed the affected plants and adjusted watering routines to make ensure adequate watering.



This bean plant suffered a bacterial disease called Halo blight. This infection causes water soaked spots, irregular brown spots with yellow halos and potential defoliation. We found that the best course of action was to completely remove the plant and not compost to avoid the spread of the infection. Another solution to this issue we found was to incorporate crop rotation with other non legume plants (to break up the disease cycle).



RESEARCH HIGHLIGHTS

DISCOVER WHAT OUR RESEARCH
ASSOCIATES AND GRADUATE STUDENTS ARE
WORKING ON!



ALEX KOFI

is currently conducting a hydroponic experiment assessing the effects of magnesium fertilization on Kale, he is also working on a light intensity project using three diverse types of plastic mulch to determine which is most suitable for healthy growth of Habanero peppers specifically observing growth and yield.

ERIC MURWANASHYAKA

is conducting a salinity project involving Kale cultivation in both indoor and outdoor settings. Three kale varieties are being exposed to different salt concentrations to determine which varieties exhibit the greatest resistance to salinity. This research aims to support aquaponic systems and benefit coastal regions and urban areas where salt is commonly found, often leading to runoff that contaminates surrounding soils.





MARIE MERCI UWIMBABAZI

is conducting an experiment observing the Impact of Artificial LED Lights Spectra on Swiss chard Growth, Yield and Nutritional Quality Performance under Controlled Environment

NIA RAGLAND

will be conducting a comparative analysis study of two kale varieties grown hydroponically and in soil, this experiment aims to compare the Beta carotene accumulation, yield, and growth rate of kale in both systems hoping to support hydroponics as a sustainable alternative to soil-based agriculture for urban and sustainable agriculture. This study aligns with the lab's broader focus on nutrient optimization, particularly within hydroponically grown leafy greens, which are known to exhibit varied responses to fertilization and environmental controls. It contributes ongoing lab research examining how light, salinity, and nutrient delivery affect key health promoting compounds like beta-carotene in kale.





ADEKUNLE ADEYEYE

[RESEARCH ASSOCIATE]

GROWTH RESPONSES OF TWO TOMATO VARIETIES TO VARYING NPK RATES IN A CONTROLLED ENVIRONMENT BY ADEKUNLE ADEYEYE

Tomatoes may be one of the most beloved vegetables (or fruits!) in the world, but growing them efficiently in urban settings requires more than just good seeds and water; it demands precision. At Kentucky State University's Harold Benson Research and Demonstration Farm, our team set out to answer a simple but important question: How can we get the best yield from different tomato varieties in a greenhouse using the right amount of fertilizer?

We focused on two favorites among growers and food lovers:

- Jasper (Cherry type): small, sweet, and ideal for snacking and salads.
- Striped German (Heirloom type): large, colorful, and known for its rich, complex flavor.

Using a controlled greenhouse environment, we tested four levels of NPK 20:20:20 fertilizer (0, 0.66, 1.32, and 1.98 g/L) and tracked plant height, leaf chlorophyll content, and total fruit yield over the growing season. The results revealed a clear story:

- The Striped German produced over twice the yield of Jasper about 345 g per plant compared to 153 g, even though Jasper plants grew taller.
- Chlorophyll levels (a key indicator of photosynthetic health) rose steadily with more fertilizer, peaking at the higher rates.
- The most efficient rate was 1.32 g/L, which delivered high yields and healthy plants without over-fertilizing. Going beyond that level provided little additional benefit, which means growers can save money while protecting the environment.
- Fertilizer rates didn't significantly change plant height, but they made a real difference in fruit quality and quantity, especially for the Striped German variety.

WHY THIS MATTERS FOR URBAN AGRICULTURE:

Urban growers often work in limited space and rely on greenhouses, vertical farms, or container gardens. In these systems, every square foot counts, and fertilizer is a major cost. Our findings show that pairing the right tomato variety with the right fertilizer rate can help growers:

- Maximize yield in limited space.
- Reduce unnecessary fertilizer use.
- Produce fresh, high-quality tomatoes for local communities.

This research highlights the potential of Controlled Environment Agriculture (CEA) to deliver reliable and efficient food production. By fine-tuning nutrient management, we can make urban farming more sustainable, productive, and profitable.

Summary

Study assessed the growth responses of two tomato varieties (*Jasper* and *Striped German*) to different levels of NPK fertilization in a controlled environment (greenhouse).

Study Design

- ❖ Completely Randomized Design (CRD)
- ❖ Greenhouse study
- ❖ 2 Tomato varieties
- ❖ 4 levels of NPK fertilization
- ❖ 3 replications
- ❖ Growth parameters:
 - ❖ Crop yield (g), Chlorophyll Content (SPAD), and Plant Height (cm)

Tomato Varieties

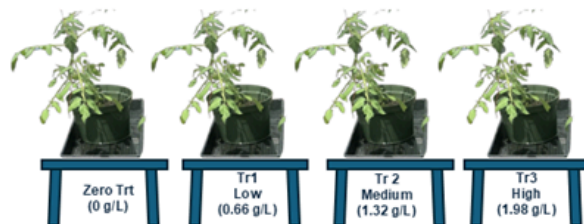


Jasper Var.

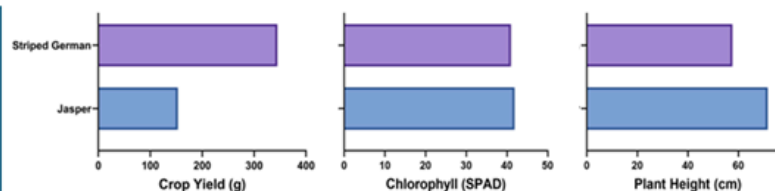


Striped German var.

NPK Fertilization



Key Results



Conclusion

- ❖ The 1.32 g/L and 1.98 g/L rates of NPK produced higher Chlorophyll and Yield for tomato.
- ❖ *Striped German* tomato varieties performed better than *Jasper* cultivars in terms of crop yield



RICHARD KABANDA

FROM THE LAB TO THE FIELD: MY JOURNEY IN RESEARCH AND URBAN AGRICULTURE

This past year has been a season of learning, growth, and discovery. My graduate research at Kentucky State University focuses on watercress and upland cress, exploring how growing conditions influence their nutrient-rich compounds like beta-carotene, chlorophyll, and glucosinolates, and vitamin C—phytonutrients with powerful benefits for human health.

This summer, I took my work to the USDA-ARS research facility in Wooster, Ohio, where I honed my lab skills under the guidance of Morris Leslie and Dr. James Altland. From preparing plant tissue and reagents to extracting phytochemicals and running advanced spectrophotometric analyses, I experienced first-hand how science fuels agricultural innovation.

Back at Kentucky State University's student-run farm, I have been equally hands-on—growing crops like tomatoes, kale, cucumbers, corn, zucchini, carrots, and Swiss chard; applying pesticides responsibly; setting up and managing drip irrigation; weeding with machinery; harvesting produce; running hydroponic systems in the greenhouse; and mentoring undergraduate students in both field and lab work.

It has not always been easy—long hours, complex experiments, and challenging weather—but it has been incredibly fulfilling. These experiences have shown me that agriculture is not just about plants—it is about people, innovation, and a commitment to feeding communities sustainably.

Beyond the farm, I had the honor of presenting my research findings at the American Society for Horticultural Science (ASHS) conference—a milestone that strengthened my confidence as a scholar.

I am grateful to KSU's Urban Agriculture Lab, particularly, my supervisor and PI, Dr. Theoneste Nzaramyimana for giving me the platform to merge scientific research with real-world farming, preparing me to make a lasting contribution to the future of food systems.



Watercress research work in a greenhouse and laboratory at USDA-ARS in Wooster, Ohio



GERMAINE AKEZA

Working at the student-run farm as a Food Safety Officer and Research Assistant has been a transformative experience, blending personal and professional growth. I gained hands-on expertise in implementing food safety protocols, ensuring Good Agriculture Practice, and maintaining high-quality produce standards. This summer, my research which is entitled "Comparative Analysis of Microgreens (Kale & Broccoli) Growth and Yield Performance on Different Substrates in Greenhouse Cultivation", also enhanced my skills in experimental design, data collection, and analysis. All these experience will enable me to contribute meaningfully to innovative, science-driven solutions in the food and Agriculture sector.



WHY IT MATTERS: THE **BIGGER** PICTURE

Urban and controlled environment agriculture plays a vital role in tackling food insecurity and building more resilient communities.

By producing food closer to where people live and reducing dependence on external weather conditions, hydroponic systems and other innovative methods empower individuals and communities to become more self-reliant. At Kentucky State University, our lab reflects this mission—preparing students not just to grow crops, but to grow solutions for a more equitable and sustainable food system.



STUDENT VOICES

WHAT ARE OUR STUDENTS SAYING?



JADE MCCARGO

My name is Jade McCargo and I'm a junior here at Kentucky State University studying agricultural business. My experience working with Dr. Theoneste urban agriculture lab has been nothing but exceptional and rewarding. From germinating, to planting, to harvesting and packaging, this has been by far one of the best experiences I have ever had. I have also been able to learn about innovative growing systems that you can use to grow different vegetables right from your kitchen.



This internship has opened my eyes to understand the critical role that urban agriculture plays in today's society. I also have been able to hear firsthand feedback from staff and students about how much they enjoyed the fresh vegetables that they were given. In addition to hands-on experience I have been able to speak to the community about what we have been doing this summer on the farm and in the lab. I have been able to create a fact sheet on a specific vegetable giving growing tips, background information, crop maintenance tips, health benefits and so on. I highly recommend this internship and experience to all interested in sustainability, agriculture, and providing fresh vegetables for your home or community and lastly professional development.

SEPHORA AFFOUE YAO



Working on the farm this summer was more than just an experience—it was a journey. Being part of the Student-Run Farm's Urban Ag team was truly rewarding. As undergraduates, we do not always get the chance to make decisions in team projects, but this time, we had the opportunity to choose what we wanted to grow and take ownership of the entire process. It's very impressive to place a tiny seed in the soil and watch it grow into something that can feed people. If more people experienced this process up close, I think many of us would become growers or farmers. .

From watering and weeding to harvesting and sharing our produce with the KSU community, every step taught me valuable lessons in patience (waiting for the plants to bear fruit), responsibility (ensuring we produced high-quality food), and how pleasant growing things is.

I am especially grateful to Dr. Theo for giving undergraduates the opportunity to lead farm activities from time to time. It gave us real-world experience and boosted our confidence. The biggest challenge for me was the weeds! I still do not understand how they grow so fast and everywhere! But despite that, the most satisfying part was tasting the results of our hard work. There is nothing more rewarding than eating what you have grown with your own hands. As a nursing student, I found an even deeper meaning in this work. Knowing the nutritional value of the food we grew and how it contributes to health made the experience feel like biology in action. I especially enjoyed harvest time, even if the cucumber leaves were itchy and the fruit loved to hide. It was still my favorite part of the process. I am also thankful to the rest of the team

ALECIA DANIELS

I am Alecia Daniels a junior majoring in Environmental Systems with a minor in marketing from Cincinnati, Ohio. This summer I had the pleasure of being an intern in Dr. Theoneste's urban agriculture lab, which was an amazing experience. I had the opportunity to learn about farm work, conducting research, and having a professional social media presence. Before this internship I have never done any type of agriculture work which has really eye opening for me and has made me appreciate my food more. I would say the biggest highlight of this summer has been watching the crops grow, watching them go through ups and downs and figuring out how to nurture them was so special to me. Even though I bel.

A big challenge that we faced was that in the beginning of the summer we had some herbs and flowers in a raised bed that were not doing so well, and we couldn't figure out why, after much deliberation and moving things around we still didn't figure out what was going on. After a while, the herbs almost magically came back to life and started thriving and have been great ever since. Watching the herbs and flowers go through that reminded me how agriculture is not always linear, and difficulties are part of the process. Overall, this summer has been nothing short of an amazing learning experience that I loved!



JAIYA MCCARGO

My experience working as an undergraduate research assistant for Dr.Theo's Urban Agriculture lab can be described in many ways but to sum it all up I would use the word, enlightening. There's so much to learn from the experience you get in Dr.Theo's lab. These experiences range from working hands on in the field, greenhouse, in the physical lab, material shopping, mentorship, networking opportunities,

public speaking, event planning, media interviews, and so much more. While I am so grateful for all of these experiences and opportunities, it would be an injustice to not recognize and highlight the cultural sharing this lab has to offer. This lab gives you a different perspective as I got to work with some of K-states international students. Learning about the different backgrounds, cultures, practices, even music tastes was such a cool part of being in this lab, aside from all the hard work the team puts in day after day! I am so thankful to Dr.Theo for this experience over this summer and I'm so thrilled I got connected to the different people in this lab.



SEBASTIAN PHILIP ASHINYO

My name is Sebastian Philip Ashinyo, A freshman at Kentucky state university majoring in computer science. My experience working with Dr. Theoneste's urban agriculture lab has been nothing short of rewarding. From planting and harvesting to packaging and community outreach, I've been able to see firsthand the value urban agriculture brings to both individuals and communities.

What excites me most is finding ways to combine technology with agriculture. With my background in computer science, I can contribute by creating tools that make farming more efficient—such as designing apps to track plant growth, building data systems to monitor crop yields, or even using sensors and automation to improve watering and lighting systems. These innovations help bridge the gap between farming and technology, making it easier for people to grow food in their homes or neighborhoods. This opportunity has opened my eyes to the critical role urban agriculture plays in today's society. I've been able to hear firsthand feedback from staff and students about how much they appreciate the fresh vegetables we've grown and shared.

In addition to the hands-on work, I've contributed to projects that connect technology with agriculture, such as developing informational resources and exploring digital ways to share knowledge about sustainability, health benefits, and crop maintenance.

I highly recommend this experience to anyone interested in sustainability, agriculture, or technology. It's an incredible opportunity to not only gain professional development but also to make a real impact by combining innovative tech solutions with the timeless need to grow healthy food for our communities.



KWABENA SARPONG

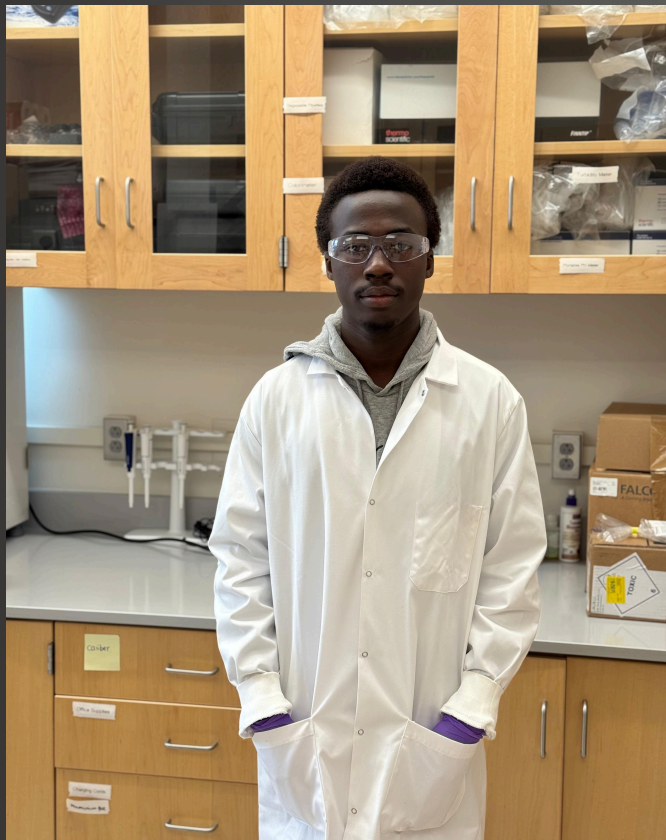


This summer has been one of the most rewarding experiences of my journey so far. Working with the Urban Agriculture / CEA team at Kentucky State University allowed me to grow both personally and professionally. From planting seeds to harvesting, packaging, and even sharing produce with the community, I've learned how much effort and care goes into producing fresh, healthy food.

Beyond the farm and lab work, I had the opportunity to collaborate with peers, share ideas, and develop leadership skills through teamwork. I also learned how agriculture and technology intersect to create sustainable solutions for the future.

One of the most impactful moments for me was seeing how our work directly benefits others — providing not just food, but also education and awareness about healthy living.

This summer has strengthened my passion for innovation and service. It showed me that with commitment and creativity, we can contribute to solving real-world challenges while building skills that will last a lifetime.



HARVEST METRICS

**SO FAR OUR TEAM HAS
HARVESTED**

2,595 + LBS

OF FRESH PRODUCE!

AS THIS NUMBER CONTINUES TO GROW OUR
PRODUCE WILL BE USED FOR DATA ANALYSIS
AND DISTRIBUTION TO THE KENTUCKY STATE
UNIVERSITY COMMUNITY AND LOCAL HOMELESS
SHELTERS!



*If you have received our produce, please
scan the QR code to give us some helpful
feedback!*

URBAN AGRICULTURE

A plant in the city does not ask whether it belongs; it simply grows. Urban agriculture teaches us that belonging is not inherited but created, through care and persistence. The garden becomes proof that even the most alien landscapes can be made into home.

