SCRI: PIP-CAP NEWSLETTER

Volume 1: Issue 2
Spring 2024

STUDENT INTERNSHIPS WITH OUR INDUSTRY PARTNERS

IMPACT OF CO_2 CONCENTRATIONS AND PHOTOPERIOD ON RUNNERING

PLANT EVALUATIONS IN CALIFORNIA AND NEW YORK

PIP CAP
PRECISE INDOOR PROPAGATION
COORDINATED AGRICULTURE PROJECT

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IN THIS ISSUE

The SCRI PIP-CAP group visiting the California Strawberry Center at CalPoly State University, San Luis Obispo, California.

A strawberry plant growing indoors at Plenty, Inc., in WY.

Strawberry propagation under the completley indoor system in Raleigh NC

Flagging plants for fruit collection at Cornell University, Ithaca, NY.

DIRECTOR'S LETTER

Dear friends and colleagues,

In academia we are trading in relevance and trust. And with the public's trust in science decreasing at an alarming rate, questions about the relevancy of academia become warranted - and are very worrisome.

In 2023, roughly a quarter (27%) of Americans had little to no confidence in scientists to act in the public best interests. 37% of Americans think more governmental oversight of curricula is needed. This decline of public confidence in higher education can already be felt in political efforts to limit tenure, academic freedom or even funding.

The reasons for these problems are multiple. Mis- and disinformation leading to science rejection on a large scale play certainly a significant role. However, I want to follow Jane Lubchenco, Professor of Marine Ecology at OSU, who in 1997 already proposed a 'social contract' for academia in the light of the emerging global challenges: "New fundamental research, faster and more effective transmission of new and existing knowledge to policy- and decision-makers, and better communication of this knowledge to the public will all be required to meet this challenge".

In other words: Academia has some homework to do. We all can - and need - to become better at ***Communication***. And as an addendum to the 1997 work I would submit the correct approach is not talking *to* the public, but learning *from* and discussing *with* the public.

As an Extension Specialist, this concept has been my mantra from the very beginning. We in academia entered a contract to serve the public in return for public funds. And what makes me proud is that this project represents this approach. In this issue we find examples of how we start developing tools for a better future by learning from and listening to the people we serve. We learned so much when the California industry welcomed us in 2022, or when our students went on internships with industry in 2023. And we are about to answer fundamental research questions in CEA systems as well as on plant performance in the field.

Lubchenco mandated a "fast and effective transmission" of research into practice. That is a daunting task for any research team, and includes many steps and many skill sets. But I think we are on a good way in this project. Thanks to all of you, the most amazing team of people one can wish for. And that makes me very happy.

Dr. Mark Hoffmann
Project Director

A JOURNEY TO LEARN

Article by Mark Hoffmann
Department of Horticulture Science
N.C. State University, Raleigh, NC

A strawberry fruit that will be soon picked and sold at grocery store from Naturipe in Salinas, CA.

Interdisciplinary is a key feature of the SCRI PIP-CAP project. Therefore, it was important for me as the director to ensure all of us had conversations with the main stakeholders, especially in California. California has by far the largest footprint in the American strawberry industry, and arguably even world-wide. So it was crucial for our team to understand this industry better. The objective of this visit was particularly to understand growing and strawberry nursery practices in CA, what particular threats are, and what industry members' visions for the future are.

From June 27 to July 1, 2022, the PIP-CAP team was visiting strawberry operations across CA. We visited the Strawberry Center at CalPoly SLO, collaborators, industry and packing houses in Watsonville, CA, high elevation nurseries in Macdoel, low-elevation nurseries in Manteca and strawberry indoor production in the Bay area.

The opportunity for students and researchers alike to talk and learn directly from the CA industry was invaluable. We've learned how impressively integrated nursery and growing practices are in CA, learned about the major threats like labor demand and fumigant availability, the investment into automation and had plenty of discussions about the potential future of strawberry production in CA.

It would be an understatement to say that we learned a lot. And at any stop, no matter how busy people were, we were more than welcomed. To this day I am more than grateful to the industry in CA to host us, and to give us all the benefits of a doubt. Now, two years later, as this project begins to yield results, we continue this dialogue that we started back in 2022.

High-elevation nursery in Macdoel, CA.

Strawberries at different stages of development at the Cal Poly Strawberry Center, SLO.

Group walking through rows of strawberries.

2023 SUMMER INTERNSHIPS

Article by Lizeth Vigil
Department of Horticulture Science
N.C. State University, Raleigh, NC

For one week in the summer of 2023, 6 students from across the country participated in the first PIP-CAP Student Summer Internship program.This program consisted of students selecting an industry partner to spend one week learning more about the industry and gaining valuable hands-on experience. Participating industries included Driscoll's, a global leader in blueberry, strawberry, raspberry and blackberry production located in Watsonville, California. Plant Sciences, an industry leader in plant breeding and propagation in strawberry, raspberry, blackberry, blueberry and artichoke, headquartered in Watsonville, California. And Plenty, a large vertical farming company leading the industry in controlled environments located in Laramie, Wyoming.

Samantha Simard, a master student at Cal Poly University interned at Driscoll's. Working with Dr. Bhupendra Acharya, Dr. Thien Ho, and Dr. Kelly Ivors, Samantha visited grazing fields and furthered her knowledge on fusarium wilt resistance screening. Samantha advanced her understanding in nursery plant health, molecular clean stock research specifically Taqman qPCR and blackberry virus trial. Samantha was also able to visit a tabletop strawberry ranch. Samantha's takeaways from this internship were her exposure to the private berry industry, networking with leading scientists and researchers associates, education on new diagnostic assays, and received valuable input and collaboration regarding her graduate work.

Raspberry leaves with rust under a microscope.

Ava Forystek, a master student at Cornell University, visited Plant Science (PSI). During her time there and working under Mike Nelson, Ava shadowed in and toured many sections of PSI including; breeding trials, woody propagation, tissue culture lab, plant pathology lab, and more. She met with partnering companies and learned about collaborations with PSI while assisting with lab work in various labs involving many aspects of berry research. Lastly, Ava attended the 2023 Cal Poly Strawberry Field Day with PSI. Ava was able to gain valuable insight and relevance to her own research at Cornell. Ava spent time in industrial labs that focus on the same crops (strawberry and rubus) and topics as her own lab at Cornell. She shadowed in a tissue culture lab, learning skills to help with her own projects and spoke with plant breeders, horticulturalists, and plant pathologists about parallels between her work and interests to gain new perspectives. Ava's overall experience at Plant Science enabled her to learn new techniques in phenotyping, tissue culture, pest monitoring, and propagation that are applicable to her work. She gained experience in industry, allowing her to understand the differences and similarities to academia. She made valuable and meaningful connections and learned about current research and aspects of strawberry production at Cal Poly Strawberry Field Day.

Different methods of propagation being investigated.

Xi Luo, a Post-Doc at the University of Maryland visited Plenty and focused on the genetics aspects of strawberries. During her time there, Xi met with teams of operations, post harvesting, sensory, breeding and new crops.

Tissue-cultured strawberry plants grown in vessels under light treatment.

She met and discussed with the photobiology team on their RNA-seq project. Xi's week at Plenty was a very valuable experience. Xi was exposed to industry and learned about real-world needs, challenges and complexities. She built professional networks which will help her future research toward addressing more practical questions.

Michael Palmer, a PhD student at North Carolina State University visited Plenty. Working with Morgan Frankel and Casey Shawver, Michael exchanged ideas on flower mapping and refined his technique. He designed and executed the first phase of pollen viability experiment and discussed powdery mildew control strategies. Michael had immediate and long-term benefits. Michael's immediate benefits included flower mapping refinement which informed his own data collection in his current PhD work. This internship also helped keep his experimental design skill sharp. As for his long term benefits, Michael gained experience at a company doing very relevant work in his field. He networked with people in the same industry and confirmed his passion to pursue a career in industry.

Samson Humphrey, a master student at NC State also visited Plenty. Also working under Morgan Frankel and Adam Tripp, Samson joined the data science meetings and was shown an in-depth data management system. This insight allowed Samason to see how Plenty manages huge datasets of hundreds of thousands (probably millions) of plants. Data management isn't typically formally taught to horticulturalists but is absolutely vital for good research. Interning at Plenty changed how Samson planned and organized his own data management for his experiments. Additionally, Samson got an in-depth tour of the facility and learned more about what scientists do at Plenty. Working with Morgan Frankel was invaluable. Morgan, who leads the strawberry propagation at Plenty, coordinated the week-long internship and hopes to continue the partnership with NC State.

Moein Moosavi-Nezhad, a PhD student at NC State also visited Plenty. He joined the "plant physiology" team and worked closely with the lead scientist of this team, Dr. Bishow Poudel. For Moein, the greatest takeaway from this internship is the difference in the environment of a job in the industry versus a job in academia as he has had years of experience studying and working in academia since 2011 but limited experience in industry. They also went over plant-light interactions and possible lighting modifications to change crops' behavior.

A successful internship would not have been possible without the partnership and participation of Plenty, Plant Sciences and Driscoll's. With the huge success, the PIP-CAP team is looking forward to organizing a summer internship for summer 2024.

Did you know?

We can produce between 50 and 100 runner tips within 60 days from a single mother plant in a controlled environment.

Stolons and daughter plants of strawberry cultivar 'Albion'.

PHYTOTRON: CO_2 TRIALS

Article and photography by Sam Humphrey
Department of Horticulture Science
N.C. State University, Raleigh, NC

Inside one chamber midway through the experiment. Mother plants under high- and low-light subtreatments, and labeled daughter plants cascading underneath.

At North Carolina State University, you will find a building called Phytotron, full of large, controlled environment plant growth chambers. Several of these chambers are being used for Samson Humphrey's master's research project on strawberry propagation. Sam works alongside Dr. Ricardo Hernández and PhD student Moein Moosavi on the PIP-CAP physiology team to test different environmental conditions on strawberry plants (such as different light intensity, light quality, photoperiod, and CO_2 treatment conditions) to determine which conditions grow as many daughter plants as possible. The goal of this work is to use these environmental cues to manipulate the plants to grow as many high-quality daughter plants as possible, using minimal inputs.

Sam grew strawberry plants in three chambers, each with a different CO_2 concentration: either 500, 850, or 1200 µmol mol^{-1}. Each chamber was split down the middle to create a low light intensity (250 µmol m^{-2} s^{-1}, (DLI: 14.4 mol m^{-2} d^{-1} or a high light intensity (500 µmol m^{-2} s^{-1}, DLI: 28.8 mol m^{-2} d^{-1}) subtreatment. In the first repetition of this experiment, Sam used Fronteras and Monterey mother plants. Throughout this experiment, Sam has tracked the temperature, relative humidity, CO_2 concentration, and volumetric water content of the substrate.

Walking into one of these strawberry chambers feels almost like a strawberry jungle: A canopy of mother plants produces a cascade of hundreds of daughters, with stolons intertwined as they loosely dangle. Every day, Sam reaches above the plants and crawls below the benches to track daughter development. With the daughter naming system, he logs each new daughter that develops, and digitally maps its position within the stolon network. This daily development data will allow him to run analyses on the rate of daughter development and stolon development. He can statistically analyze the daughters separately, based on their branching position, date of initiation, distance from the mother plant, and more. He is hoping this data will provide insight into the development rate and branching pattern of these plants, to inform management decisions.

By the time of this writing, Sam's mother plants have grown between 30 and 120 daughter plants per mother, with an average of around 80 daughter plants per mother: a huge increase over what would typically be seen in the field

(about 25). The exact number of daughter plants varies depending on treatment, and although the project is still ongoing, Sam believes that the plants with the highest CO_2 concentration and the highest light intensity produce the most daughters per mother. In the first repetition of this experiment, for Monterey the 850 µmol mol^{-1} and 1200 µmol mol^{-1} CO_2 concentrations produced 13.2% and 8.5% more daughter plants per mother plant than the 500 treatment. For Fronteras, the 850 µmol mol^{-1} and 1200 µmol mol^{-1} CO_2 concentrations produced 16.9% and 12% more daughter plants per mother plant than the 500 treatment. Additionally, the impact of increasing light intensity (from 250 µmol m^{-2} s^{-1} to 500 µmol m^{-2} s^{-1}) resulted in a 28% (Monterey) and 69% (Fronteras) increase in daughter plants per mother plant.

It seems that CO_2 enrichment may be a way to improve daughter plant number or growth rate of mother plants, so please keep an eye on the PIP-CAP news for the final analysis and potential recommendations. Greater CO_2 and greater light intensity may be just one more tool we can utilize to make strawberry propagation more sustainable and more profitable in greenhouses and controlled environments.

The Hernández Lab on harvest day for Sam's CO_2 experiment.

PHYTOTRON: PHOTOPERIOD RESEARCH

Article and images by Moein Moosavi-Nezhad
Department of Horticulture Science
NC State University, Raleigh, NC

The farm gate value of the strawberry industry in the United States reached $2.3 billion in 2020. The predominant method of strawberry cultivation in the country involves annual plasticulture systems in which the growers across the US depend on obtaining new planting stock, sourced primarily from a select few strawberry nurseries in California, North Carolina, and Canada. These strawberry nurseries operate as specialized facilities, collectively generating over one billion plants each year within the United States. This production contributes significantly to the strawberry industry, augmenting the overall farm gate value by an estimated $200-300 million.

The common method of propagating strawberry plants in open-field nurseries poses challenges. This process involves multiple transfers of plant material between fields over several years before being sold for fruit production, leading to economic hardships for nursery operators and fruit producers in the US. Moreover, asymptomatic strawberry transplants can harbor harmful plant pathogens, causing disease outbreaks in production fields and resulting in significant nationwide production losses each year.

Runners in the farm nurseries grow horizontally, not only reducing plant density but also causing daughter plants (DPs) to come into contact with the soil surface, rendering them more susceptible to diseases. Additionally, the frequent need for manual removal of these runners increases labor requirements.

Figure 1. A representative image of four strawberry mother plants in a growth chamber under LED lighting.

Based on discussions with nursery growers in California, they typically utilize a density of 12,000 to 13,000 plants per acre, equivalent to approximately 0.3 plants per square foot. This planting density results in an estimated yield of 300,000 to 400,000 DPs per acre over a production period of 180 days.

An alternative approach involves cultivating stock plants in controlled environments under artificial lighting where runners grow vertically hanging from the mother plants. Here, the plant density is usually higher (i.e., ~ 0.8 ft^2), the DPs produced are typically disease-free, and there is reduced labor demand compared to traditional methods. However, due to the absence of natural light, a multitude of experiments is needed to optimize the lighting conditions, including intensity, photoperiod, spectrum, angle, and other relevant factors.

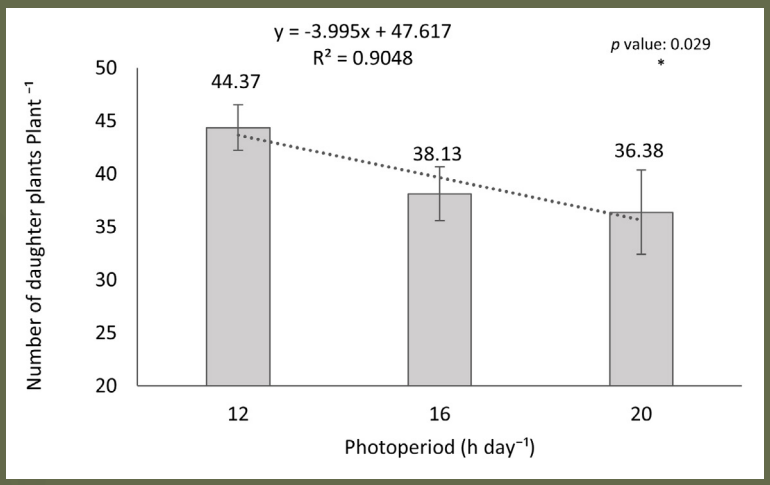
Ph.D. researcher Moein Moosavi-Nezhad has been conducting research on the cultivar Monterey since August 2022 at the Phytotron facility of NC State University. The research centers on

cultivating strawberry stock plants for propagation, with a specific focus on studying the impacts of different photoperiods and plant densities.

Photoperiod

In the first experiment, Monterey strawberry tray plants (initial crown diameter = 12.2 ± 2.3 mm) were planted in 1.8 L pots with a plant density of 0.8 plants. ft^{-2}. The photoperiod was set to 12, 16, and 20 h provided by white LED lights with the same daily light integral (DLI) of 26 mol day^{-1}. Temperature, relative humidity, and CO_2 were set to 26 °C, 60 %, and 400 µmol mol^{-1}, respectively, with data logged every five minutes to ensure consistency across treatments. Following 64 days of growth under these conditions, DPs and runners were harvested, and yield and morphological parameters were recorded.

With the same input of light (i.e., same DLI), both the number of DPs and stolons increased by 18 and 34.2 percent, respectively, only by lowering the duration of light (Figure 2). After a period of 64 days, Monterey stock plants grown under the 12-hour photoperiod produced more than 44 DPs and eight stolons.



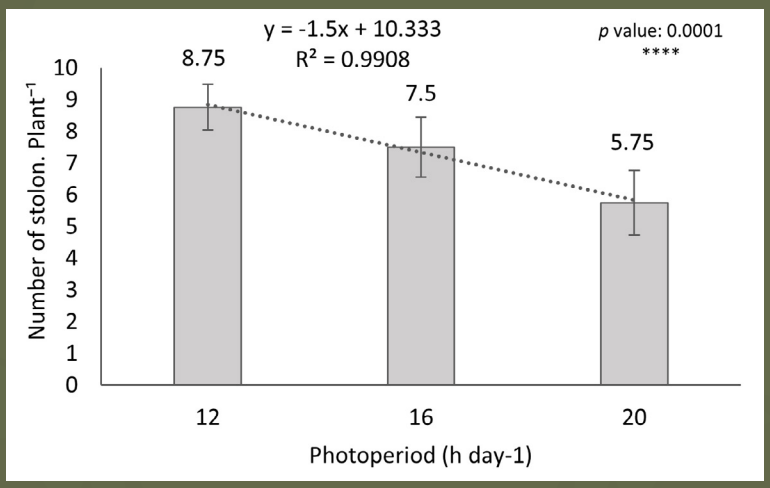


Figure 2. The number of daughter plants (top) and stolons (bottom) following growth under three different photoperiods with the same DLI.

Did you know?

Strawberries have high levels of nitrate, which increases blood and oxygen flow to the muscles. People who eat strawberries before exercising have greater endurance and burn more calories.

- 'Strawberries and the science behind them' by Michigan State University Extension

Runners hanging from mother plants ~ eight weeks into the experiment.

Setting up the low tunnels at the beginning of the season, in Ithaca, NY.

THE FIRST OF MANY PRESSURE TESTS

Article by Mark Hoffmann
Department of Horticulture Science
N.C. State University, Raleigh, NC

Every new system needs to undergo a whole series of "pressure tests". This is also true for CEA propagated strawberry plants. After all, our plants have never touched soil and have never seen the sun before they are planted in the field. Our foremost aim is therefore to observe and evaluate how our plants perform under real-world conditions, compared to the standard planting material.

Currently we are evaluating CEA propagated plants in 5 different locations across the US. Each location is in it for their own reasons. A lot of growers in New York and the Northeastern region rely on long-day plants, planted as Frigo plants in May, with a Summer harvest season. In this region, the pure availability of CEA propagated plug plants may increase their yield tremendously in the first weeks of harvest. In the South and in FL, pest and disease issues often run havoc across strawberry fields. In addition, plant availability often is problematic and leads to set-back planting dates and subsequently lower yields. Cleaner and more punctual plant material from soil-less CEA systems would be a welcome tool for those growers.

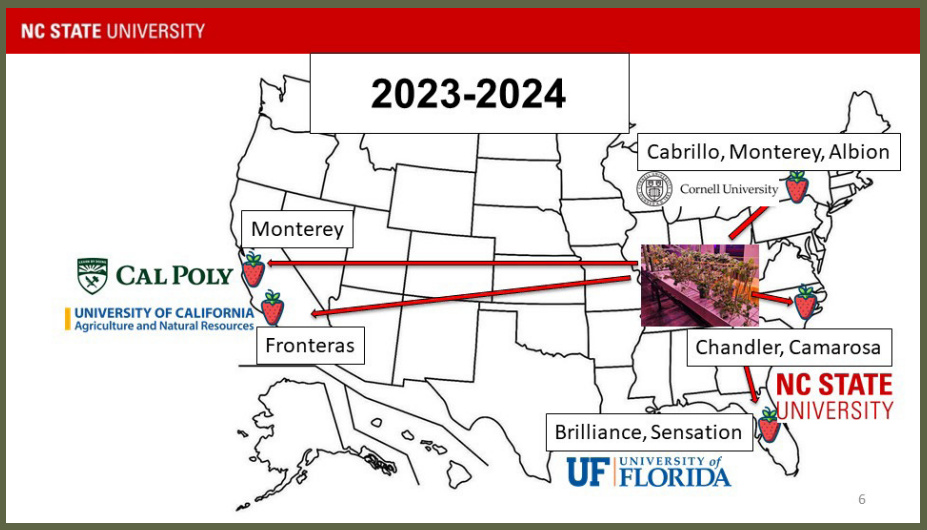


Figure 1. Map of current field trial locations

And while the California industry won't switch to plug plants anytime soon, niche needs for organic transplant production as well as the looming threat of losing Methyl Bromide absolutely warrants the investigation of potential additional propagation tools and related growing practices.

With all that said, plants propagated at our small research nursery, and conditioned in our research chambers are currently growing all across the United States in research fields (Figure 1). At Cornell University, NC State University, University of Florida, the CalPoly Strawberry Center as well as on a farm in Ventura County (UC ANR).

While Cornell University received non-conditioned plug plants of three long-day cultivars, each other location received two sets of plants: chill-conditioned (between 350-450 chill hours) and unconditioned (no chill) plants. Plants were propagated and conditioned here at NC State University by our post-doc Dr. Ibraheem Olasupo (Figure 2).

Most of those trials are currently ongoing and we will report later on those in detail. However, in this issue of the newsletter you will learn about the NY trial as well as a preliminary trial we conducted at the CalPoly Strawberry Center in San Luis Obispo in CA.

Middle: Figure 2. Strawberry Plug plants ('FL Brilliance') undergoing chilling conditioning at NC State University. Right: Figure 3. 'Cabrillo' strawberry early in the growing season at Cornell University.

CONTROLLED ENVIRONMENT PRODUCED PLANTLETS FROM CORNELL

Article and photography by Ava Forystek
School of Integrated Plant Sciences
Cornell Agritech, Geneva, NY

Over the past summer, graduate student Ava Forystek and Dr. Courtney Weber at Cornell University's Agritech Campus ran a field trial to evaluate the phenotypic differences between bare root field propagated strawberry plantlets and controlled environment (CE) produced plug plants. The sustainable production of reliable strawberry plantlets is critical for the success of the US strawberry farming industry. The current industry standard method of strawberry propagation process is complex, costly, and time consuming. Virus-indexed mother plants are propagated in methyl-bromide (MB) and chloropicrin treated fields for 2-3 years and propagules are then sold as bareroot plantlets to growers. Because of plant susceptibility and high levels of soil-borne pathogens, field propagation is reliant on soil disinfestation treatments such as fumigation.

To address the issues with the current production system, the utilization of a controlled environment (CE) strawberry propagation system was proposed. CE systems are not reliant on MB applications and plants are not exposed to soil-borne pathogens, allowing for a higher level of certainty in the production of clean plantlets. While these qualities are promising, it is critical to understand if CE produced plantlets can perform equally well as or better than strawberry plantlets produced via field propagation. The main objective of my research is to determine how strawberry plantlets produced in a CE setting perform compared to bare root plantlets produced under standard production practices in a field setting. With the fruit quality data collected and analyzed thus far, strawberry plants originally propagated in CE perform equally well or better than bareroot plants.

Cultivars 'Albion', 'Cabrillo', and 'Monterey' were grown in a plasticulture system under low tunnels with four replications. The plants were grown according to industry standards and 15 contiguous plants from each plot were flagged for fruit collection. Fruits were harvested 3x per week throughout the growing season (May-October) and were frozen to analyze throughout the winter. Plant-related data was collected throughout the growing season.

With the data analyzed thus far we have found that strawberry plants originally propagated in a controlled environment perform equally or better than plants propagated per industry standard. It was also observed that the extent of the impact of the treatment varies between cultivars. One particularly interesting finding was that the differences in plant performance are most notable in the early season, which could provide New York state growers with an early season advantage over their competitors.

Collected data and samples will continue to be analyzed to gain a broader understanding of the differences between CE and industry standard produced plantlets.

Finding the mass of a harvest.

CAL POLY INVESTIGATES RELATIONSHIP BETWEEN PLANTING DATE AND YIELD

Article and images by Samantha Simard
Cal Poly Strawberry Center at Cal Poly State University, San Luis Obispo, CA

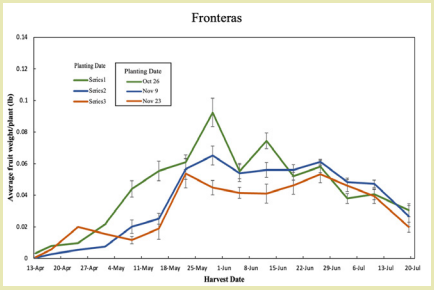
Graduate student Samantha Simard and Cal Poly Strawberry Center Director Dr. Gerald Holmes are looking at the effect of planting date on yield in strawberries. This trial is planted at Cal Poly State University in San Luis Obispo, CA and is in its second year. In addition to the repeated planting date experiment, we will be assessing yield on a chill versus no chill treatment experiment.

In the planting date experiment, 'Monterey' and 'Fronteras' were used to incorporate both a day-neutral and short-day cultivar, respectively. All plants for the trial were sourced from Dr. Mark Hoffmann's team at NCSU and shipped overnight to Cal Poly. Traditionally, California strawberry growers plant exclusively bare root plants, so using plug plants was new for all of us.
In year one, beds were planted at two-week intervals: 26 Oct, 9 Nov, and 23 Nov 2022. Each bed was planted with four plots of 'Monterey' and four plots of 'Fronteras' (20 plants/plot). Harvest data was collected twice weekly from 13 Apr 2023 to 10 Aug 2023. The results of this study show that just a two-week delay in planting significantly reduced overall yield throughout the season in both cultivars. Interestingly, 'Monterey' had larger differences in yield throughout the season, while 'Fronteras' yields did not significantly separate on numerous harvest dates.

In year two, we are repeating the planting date experiment and adding an additional experiment: chill versus no chill. The planting date experiment was planted at two-week intervals: 2 Nov, 17 Nov, and 30 Nov 2023. The chilling trial was planted 3 Nov 2023 and has the highest plant establishment rate across all PIP-CAP trials and treatments in. We are continuously monitoring plant health and will likely begin assessing yield in early March 2024.

Planting chilling experiment at Cal Poly Strawberry Center on 3 Nov 2023.

Weekly average total fruit weight per plant of 'Monterey' from 13 Apr to 20 Jul. Error bars represent standard error of the mean.

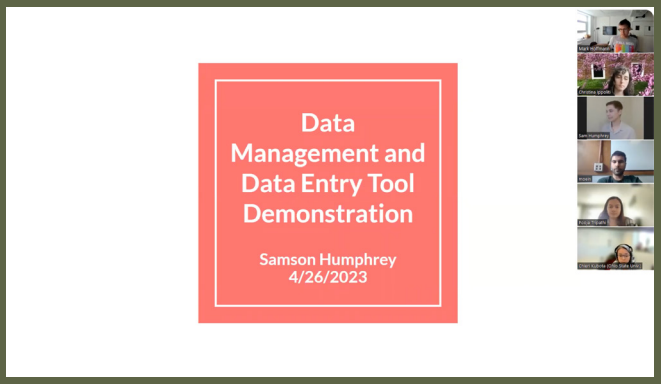


Weekly average total fruit weight per plant of 'Fronteras' from 13 Apr to 20 Jul. Error bars represent standard error of the mean.

MEDIA

SCRI PIP-CAP Strawberry Phenotyping Tool

Samson Humphrey explains the beta-version of NCSU's strawberry phenotyping data management tool for strawberry runnering evaluation. Click to watch.

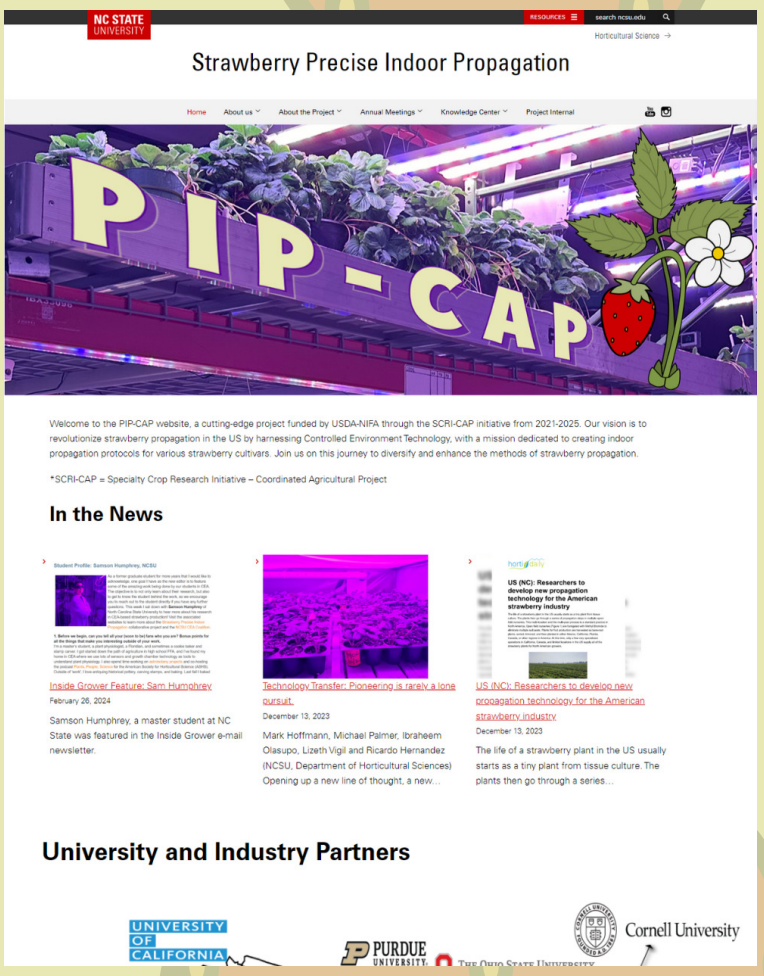


Check Out Our New Look!

Article and image by Kaitlyn Aguiles
Department of Horticulture Science
N.C. State University, Raleigh, NC

The PIP-CAP website has a new look! A new graphic greets you when you navigate to the home page. The enhanced home page's first section, In the News, brings the work our students, post-docs, technicians, and PIs do, to the forefront. Scrolling past, you will find an upgraded map to display our university partners and, below that, our industry partners. The newest feature you will find at the bottom of the page is the newsletter subscription button. Clicking on the button will take you to the landing page where you can sign up to receive the newsletter directly into your inbox.

Heading to the navigation bar at the top of the webpage, you will find new and improved sections in the drop down menus. In the About Us section, the Researches, Students, and Advisory board pages offer sleeker designs to peruse. Hover over each image to learn more about who is a part of the project! You will also find a new Contact Us page where users can submit questions to us. Under the Knowledge Center, new videos, presentations, and webinars have been added, so, go on and check out the website for yourself to discover more we have to offer!



NEXT ISSUE'S OUTLOOK

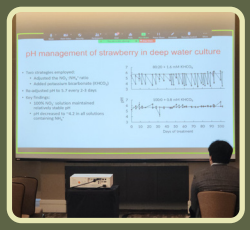
You can look forward to hearing about these topics next:

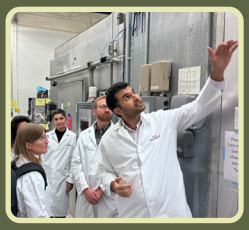
2024 Conference Annoucement
Light quality and photoperiod research at Rutgers
Field trial evaluations from Florida and California
New indoor nursery at NC State

Click here to receive the next newsletter directly in your inbox!

2nd Annual Conference

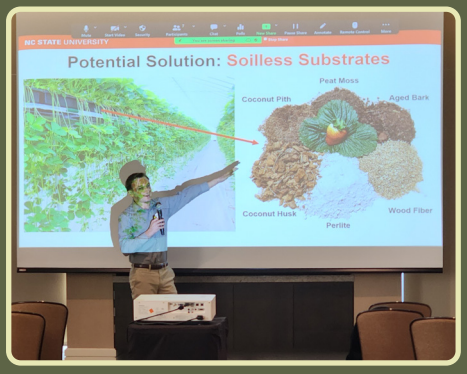
October 17th and 18th of 2023, the members of the SCRI group met in Raleigh, North Carolina for our second annual meeting. We learned from each other, saw and experienced new things, and ate good food together. You can find our detailed itinerary *here* on our website and see exactly what we discussed. Send us your thoughts!







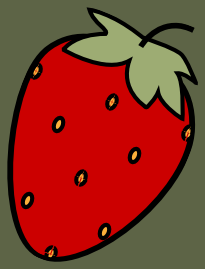




PHOTO CREDITS

Cover: *Strawberry field at the end of the season at Cornell University, photo by Ava Forystek.* **In This Issue:** *Photo by community member; Photo by Xi Luo; Photo by Ibraheem Olasupo; Photo by Ava F.* **Director's Letter:** *NCSU members of the PIP-CAP team at the 2023 Southeast Strawberry Expo in Charlotte, NC. Left to right: Moein Moosavi-Nezhad, Sam Humphrey, Dr. Mark Hoffmann, Brianna Haynes, Dr. Gina Fernandez, Joy Johnson and Dr. Frank Louws, photo by community member.* **A Journey to Learn:** *Photo by Christina Ippoliti; Photo by Christina I.; Photo by Christina I.; Photo by Sam H.* **2023 Summer Internships:** *Photo by Samantha Simard; Photo by Ava F.; Photo by Xi L.; Photo by Ibraheem O.* **The First of Many Pressure Tests:** *Photo by Ava F.; Image by PIP-CAP communications team; Photo by Ibraheem O.; Photo by Ava F.* **Outlook - 2nd Annual Conference:** *Left to right, top to bottom: Potted strawberry plants inside growth chamber inside of Phytotron, photo by Amanda Lewis; Erin Yafuso presenting slide on pH management of strawberry in deep water culture, photo by Amanda L.; Samantha S., Ava F. and Gerald Holmes in one of NCSU's greenhouses, photo by Alexa Artis. Moein M.N. showing the group one of his research chambers inside Phytotron, photo by Alexa A.; The PIP-CAP group taking a tour of NCSU's PSB, photo by Alexa A.; Inside controlled cenvironment chamber in Phytotron, photo by Alexa A.; The PIP-CAP group being shown an outdoor nursery at NCSU's MRPU, photo by Alexa A.; The group during a tour of Phytotron, photo by Alexa A.; Brandan Shur presenting a slide on soilless substrates, photo by Amanda L.; SWOT analysis poster filled out by PIs, photo by Amanda L.; The PIP-CAP group in front of Kilgore Hall, home to the Horticulture Dept. at NCSU, photo by Amanda L.; Photo being taken of CEA chamber inside of Phytotron, photo by Alexa A.*