‘The Martian’ Movie Sheds Light on UA Space Innovation

Matt Damon as astronaut Mark Watney seen growing potatoes in a growth chamber on Mars. Copyright 20th Century Fox, The Martian, 2016

Between the release of the movie “The Martian” next month and the news last month that astronauts on the International Space Station (ISS) ate lettuce grown in space for the first time, people are very interested in space colonization and being able to produce crops long-term in space. Here at the University of Arizona CEAC we are working with NASA on this very challenge.

The UA NASA Steckler Space Grant program has focused on a prototype Lunar [or Mars] greenhouse for human life-support. That is, a cylindrically-shaped controlled environment growing food crops hydroponically is the robotic biological processor that can provide oxygen, potable water and food calories for a person, assuming they provided CO2, electrical energy, plant nutrients and an initial charge of water. Much like Martian Mark Watney attempted! The fictional story is filled with challenges and facts and some success and failures, so to the Prototype Greenhouse in the LGH Lab. See http://ag.arizona.edu/lunargreenhouse/ for the full story. Consider that the limited resources on another planet will direct this project to learn to recycle and reuse water and nutrients, and to develop operations to increase energy and labor use efficiency.

Last month, the International Space Station team made news because they were the first to eat a crop grown in space. The astronauts on the ISS used hydroponic production to grow a small amount of lettuce in microgravity, while the focus of the UA Lunar Greenhouse is for a planet-based system that could feed astronauts continuously living on another planet. One benefit expected from this R&D, is improved Earth greenhouse food crops systems. More information about the current state of the Lunar Greenhouse project can be seen in a recent local news story featuring CEAC student, Erica Hernandez, and the director of the UA Space Systems Engineering Lab, Robert Furfaro: http://www.tucsonnewsnow.com/story/29836249/ua-researchers-build-lunar-greenhouse-prototype.

New Attendance Options, Topics at 2016 CEAC Short Courses

We are happy to announce that both the 2016 Greenhouse Short Course and the 2016 Hydroponic Crop Intensive Courses will feature new attendance options and new lecture topics for 2016.

The 15th annual Greenhouse Crop Production & Engineering Design Short Course will be held from March 20 – 25, 2016 at the beautiful Westward Look Resort in Tucson, AZ. New to the 2016 course are specific half-day sessions on “Indoor Growing” and “Lighting for Growing Crops in CEA.”

Also, in addition to our traditional webcast attendance option, we have added a new attendance option to the 2016 course where you can register for the webcast of an individual half-day session. This allows attendees to pay for and choose only get the information they want. More information about the CEAC Short Course, including registration and the tentative course program with each of the 6 half-day sessions listed, can be found on our website at: http://ceac.arizona.edu/greenhouse-crop-production-engineering-design-short-course.

In addition to a specific course on hydroponic tomato production, the 2016 Intensive Courses will also offer a course focusing on hydroponic lettuce production. You can attend the Tomato specific course from January 3 - 8, the Lettuce specific course from January 8 - 10, or both courses from January 3 - 10. The hydroponic crop intensives feature over a semester’s worth of course content presented strategically throughout the week to allow business professionals and growers to minimize their time away. The courses will combine classroom time with greenhouse time in order to put the lessons learned by lecture into real world practice. The Intensive Courses begin with the basics, but move quickly and are meant for growers of all levels. We invite you to come to Tucson to learn about hydroponic greenhouse growing and enjoy the warm winter weather! The Tomato Intensive instructor will be hydroponic specialist Dr. Pat Rorabaugh, while the Lettuce Intensive will be taught by lettuce/business expert Myles Lewis, MS. Please visit our website at http://ceac.arizona.edu/hydroponic-crop-intensive-courses or email Aaron Tevik at atevik@cals.arizona.edu for more information.
**Dr. Barry Pryor Inaugurates CEAC Seminar Series**

On August 28th, Dr. Barry Pryor of the UA Plant Sciences Department gave the inaugural talk in the CEAC Monthly Seminar Series. His lecture on “Mycoculture and Integrated Farming Systems: Closing Food Production Loops” sparked interest about how we can use mushrooms to better feed our planet and even how they could be used as key nutrients in efforts to colonization in space.

The second installment in the monthly seminar series will be given by Ed Horton of Urban Produce, LLC on Friday September 25th at 4:15pm on the topic of “16 Acre CEA Organic Vertical Farm.” This talk will be in the CEAC classroom and will be broadcasted over the internet for anyone to see. More information on registering to watch upcoming talks or viewing past lectures can be found on our website at: [http://ceac.arizona.edu/events/covering-environments-ceac-monthly-seminar-series](http://ceac.arizona.edu/events/covering-environments-ceac-monthly-seminar-series).

**New Project on Organic Tomatoes**

In June a new collaborative partnership started with local greenhouse vegetable producer Sonoran Hydroponics. The primary goal of this partnership is to address the problems of growing organic tomatoes using a standard hydroponic setup. In addition to the organic tomato project, Sonoran Hydroponics is also conducting a variety trial of bell peppers. The purpose of a variety trial is to find a cultivar of peppers that will produce a quality pepper in the harsh Sonoran Desert climate. The UA is also working with Sonoran Hydroponics to ensure that this small grower has all the resources and experience available to be a productive member of Tucson's growing urban agriculture movement. For more information about this project or the produce that Sonoran Hydroponics grows, please email TJ Johns at sonoranhydroponics@gmail.com.

**Dr. Chieri Kubota, along with the USDA SCRI Vegetable Grafting Technology Working Group, have successfully completed the first international vegetable grafting tour to Japan and Taiwan with 13 stakeholder members (seen in the picture above) from August 16 to August 22. The group was able to see multiple grafting facilities and take home valuable information that can be used here in the US. Dr. Kubota and the USDA group will be hosting another International Grafting Trip to Italy and Israel in March of 2016. More information on these trips including cost, registration, and organizers can be found at: [http://www.vegetablegrafting.org/wp/wp-content/uploads/2014/01/usda-scri-intl-grafting-field-trip-flyer-and-agenda-apr-15.pdf](http://www.vegetablegrafting.org/wp/wp-content/uploads/2014/01/usda-scri-intl-grafting-field-trip-flyer-and-agenda-apr-15.pdf). Please email any questions regarding the grafting field trips to Dr. Chieri Kubota at ckubota@email.arizona.edu.**

**Dr. Tollefson Appointed to Organic Task Force**

Dr. Stacy Tollefson of the CEAC was recently appointed by the National Organic Program (NOP) as one of sixteen members to a task force to explore hydroponic and aquaponic production practices and their alignment with USDA organic regulations. The task force will report to the National Organic Standards Board (NOSB), an advisory committee of organic industry and stakeholder representatives who recommend whether substances should be allowed or prohibited in organic production or handling, assist in developing standards for substances to be used in organic production, and advise the Secretary of Agriculture on other aspects of the organic regulations. Their primary duty will be to prepare a report for the NOSB about the current state of technologies and practices for hydroponics and aquaponics, as well as how those practices do or do not align with the USDA organic regulations. The NOSB will utilize the report to determine the best path forward regarding recommendations on hydroponics and aquaponics production systems. For more information, visit [NOSB Task Forces](http://www.vegetablegrafting.org/wp/wp-content/uploads/2014/01/usda-scri-intl-grafting-field-trip-flyer-and-agenda-apr-15.pdf).
The 2015 CEAC Summer Research Retreat was held on Friday August 21st in CEAC Classroom. There were 19 speakers discussing their work over the summer and what they have planned for the upcoming semester. It was fascinating to learn about the research the students at the CEAC are doing. The retreat was also a great way to catch up with each other before school started as our faculty, students, and staff were all over the world this summer! The picture above shows the 19 speakers at the research retreat.

With the new school year comes a new set of crops! Dr. Pat Rorabaugh has recently started up her teaching greenhouse for her PLS 217 course. As you can see in the picture to the right, the tomato plants are just a few weeks old, but will be producing beautiful tomatoes by November 1st.

This is significant because this is the last time Dr. Rorabaugh will be teaching her introductory hydroponic course as she will be retiring in June 2016. We would like to congratulate Dr. Rorabaugh on her decision to retire and we will cherish the time we still have her here at the CEAC. The CEAC will not be the same without her hard work and passion!

- Dr. Gene Giacomelli attended the event Grow Riverside in Riverside, CA from June 11 – 13, 2015. Grow Riverside is a program whose principal goal is to foster the growth of a sustainable local food and agriculture system that benefits the community, environment and economy of Riverside. Dr. Giacomelli sat on a panel organized by Jim Bergantz of Agri-Tech Greenhouse, Co. that discussed Indoor Farming within large cities. The picture above shows Dr. Giacomelli during an interview by local media.

-Drs. Gene Giacomelli and Murat Kacira attended the GreenSys 2015-International Symposium on New Technologies and Management for Greenhouses in Evora, Portugal from July 19-23. Dr. Kacira delivered an oral presentation titled “Improving Aerodynamics in Indoor Plant Factory.” At the same symposium, Dr. Kacira gave a keynote lecture titled “Advances and challenges in CFD Applications for Optimizing CEA Systems.” Dr. Kacira also represented International Society for Horticultural Science (ISHS) at the symposium. Dr. Murat Kacira can be seen in the picture above delivering his lecture at the GreeSys Symposium.
Student Awards & Accomplishments

Recent Graduates & New Graduate Students

-CEAC Students Karla Garcia (seen above) and Caitlyn Hall (seen bottom right of page) attended and each gave poster presentations at the annual NCERA-101 meeting held in Columbus, OH from July 8 – 11, 2015. Karla’s presentation was on “Re-examining photoperiodic flowering responses of American strawberry cultivars” and Caitlyn’s presentation was on “Engineering modeling and analysis to develop sustainable mushroom production systems in semi-arid climates.” The students’ advisor, Dr. Chieri Kubota, and CEAC research specialist, Mark Kroggel, were also in attendance. Immediately following the NCERA-101 meeting, the group attended Cultivate 2015 from July 11-14, also in Columbus, OH.

-CEAC Post-Doctoral student Fei (Jeff) Jia gave a presentation titled “Multi-wavelength laser diodes based real-time optical sensor for microalgae production application” at the 5th International Conference on Algal Biomass, Biofuels and Bioproducts, June 7-10, 2015, in San Diego, CA.

-CEAC Doctoral student Ying Zhang and her advisor, Dr. Murat Kacira, attended the GreenSys 2015-International Symposium on New Technologies and Management for Greenhouses, held in Evora, Portugal from July 19-23. They combined to deliver an oral presentation titled “Improving Aerodynamics in Indoor Plant Factory.”

-CEAC Aquaponics graduate students Brunno Cerozi and Giovanna Hesley participated in the filming of a University of Arizona Engineering School Graduate Student Recruitment Video, where they highlighted the graduate student activities at the UA-CEAC. Giovanna is featured at the 3 minute mark and the specific focus on the CEAC and Brunno at the 4 minute mark. View the full video here: https://www.youtube.com/watch?v=pOdHMxCv69c

Fei (Jeff) Jia successfully defended his dissertation over the summer. The title: “Multivariable and sensor feedback based real-time monitoring and control of microalgae production system.” Jeff is continuing his research at the CEAC under Dr. Murat Kacira as a Post-Doctoral Student.

Ying Zhang defended her thesis this summer and is now a PhD student in Dr. Kacira’s lab. Ying’s thesis was titled “A Computational Fluid Dynamics (CFD) study on improving air flow uniformity in indoor plant factory system.”

Kayla Bertsch recently received her undergraduate degree in Agricultural & Biosystems Engineering (ABE). She is now starting an Accelerated Master’s Program within the ABE department under Dr. Kacira.

Caitlyn Hall completed her ungraduated degree in May 2015 and started her ABE Master’s program in August at the CEAC under Dr. Chieri Kubota. Caitlyn has been working with theoretical analysis of mushroom production and its resource use under arid climate conditions. The picture below is of Caitlyn at the NCERA-101 meeting in Ohio.
CEAC Quarterly Newsletter by the Controlled Environment Agriculture Center,
The University of Arizona, College of Agriculture and Life Sciences.

1951 E. Roger Rd., Tucson AZ 85719 (520) 626-9566 | http://ceac.arizona.edu/

Written and produced by Aaron Tevik with help from the CEAC Faculty and Staff ©2015

The Controlled Environment Agriculture Program is a collaboration among UA College of Agriculture and Life Sciences (CALS) departments, schools, Centers and Institutes. Its programs are supported in part by State funding directed to the Department of Agricultural & Biosystems Engineering, and School of Plant Sciences. Center Director: Dr. Gene Giacomelli.

For more information or to subscribe, email Aaron Tevik at atevik@cals.arizona.edu.