

# URBAN AG NEWS



## ROBERT COLANGELO

**FOUNDING FARMER AND CEO**

Green Sense Farms to expand vertical farming operations in U.S. & China **PG 16**

**KNOW YOUR GOALS** before investing in a water treatment system **PG 56**

**DURON CHAVIS** Helping people eat, live healthier through urban agriculture **PG 6**



# URBAN AG NEWS

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Urban Ag News actively seeks to become a connector for niche agricultural industries, **bringing together growers with growers, growers with manufacturers, growers with suppliers and growers with consumers.**

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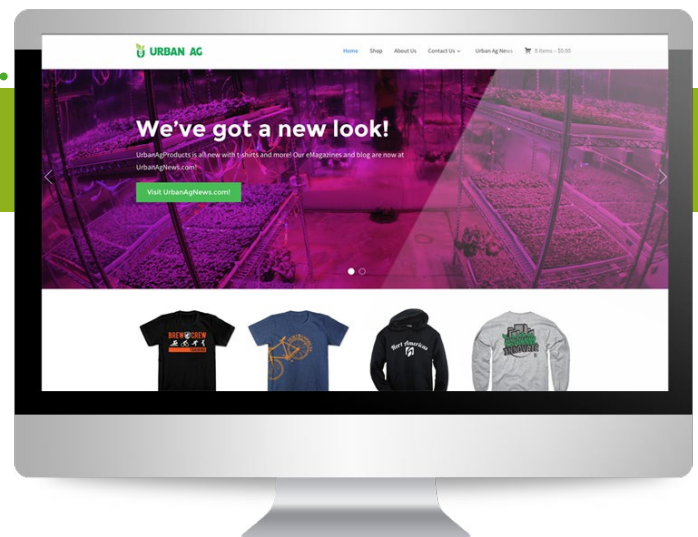
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Green Sense Farms to expand its Vertical Farming Operations in the U.S. and China

*Photo courtesy of Green Sense Farms*



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### Hort Americas



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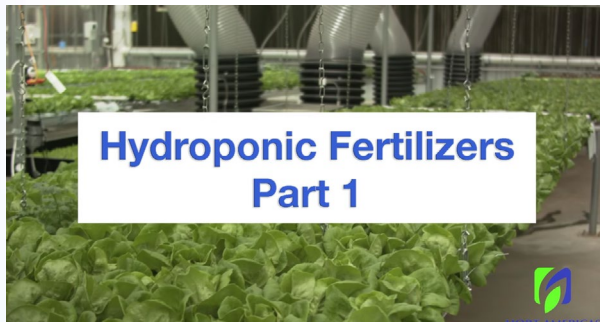


Nashville's Jeremy Barlow owner of Sloco

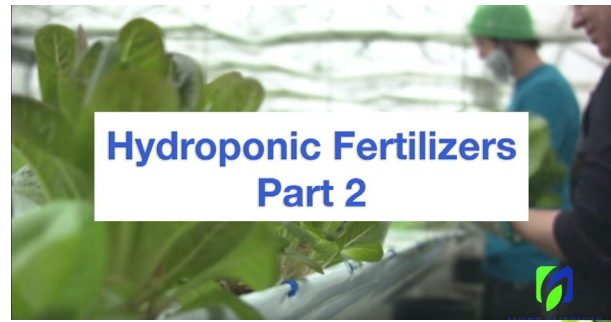


Susie Marshall of Grow North Texas

## HYDROPONIC FERTILIZERS



Understanding Hydroponic Fertilizer Options and Stock Solutions



Blending Hydroponic Nutrient Solutions and Stock Solutions





HELPING PEOPLE

eat & live  
HEALTHIER

» — THROUGH — «

*Urban Agriculture*

By David Kuack

**DURON CHAVIS,**



INDOOR URBAN FARM DIRECTOR  
AT VIRGINIA STATE UNIVERSITY,  
IS HELPING CITIZENS OF  
RICHMOND AND PETERSBURG, VA.,  
HAVE ACCESS TO LOCALLY-GROWN  
PRODUCE YEAR ROUND.



When Duron Chavis started the Happily Natural Day festival in Richmond, Va., in 2003, he never imagined how this one day event would lead to his involvement with and promotion of urban agriculture.

“The festival focuses on holistic health, cultural awareness and social change,” said Chavis, who is indoor urban farm director at Virginia State University in Petersburg, Va. “During the festival I started meeting and working with black farmers from rural parts of the state. Some of the farmers told me that during the festival I should start talking about where food comes from and how it is related to health and wellness and the African-American community. We started offering programs that were directly related to the topics of food and farming.”

Duron said since the annual festival focuses on health and wellness, farmers attend and sell their fresh fruit and vegetables.

“For one program we talked about the environment and sustainable agriculture,” he said. “During a panel discussion some of the farmers said they didn’t have the time to bring their food into urban centers. They lacked the staffing and were spending so much of their time farming that they weren’t able to drive into the city to cultivate a rapport with customers. They said they needed a liaison, someone who could serve as a middleman for their efforts in the city.

“As a result of this discussion I started working with the farmers. I did a pop-up farmers market. I worked as the farmers market manager for a project called the Richmond Noir Market, which opened in 2010. That project gave me a one-on-one

*Photos courtesy of Duron Chavis, Va. St. Univ.*



**WATCH  
THE VSU  
VIDEO** 



DURON CHAVIS, INDOOR URBAN FARM DIRECTOR AT VIRGINIA STATE UNIVERSITY IN PETERSBURG, VA., IS HELPING TO CONVERT A YMCA RECREATION CENTER INTO AN INDOOR URBAN FARM.





THE HARDING ST. URBAN AGRICULTURE CENTER IS BEING EQUIPPED WITH VERTICAL TOWERS, AEROPONIC TABLES, AN AQUAPONICS SYSTEM AND AN EBB-AND-FLOW SYSTEM. GROW LIGHTS WILL BE POWERED BY SOLAR PANELS INSTALLED ON THE ROOF.

opportunity to work with the farmers. We would set up a market stand every Saturday and talk to people about producing their own food and the importance of being organic and not using pesticides.”



## GETTING INVOLVED WITH URBAN AGRICULTURE

In 2012 Chavis decided it was time to fully commit to working on an urban agriculture project.

“The lease on my apartment in Richmond was up and I needed to move so I made a conscious effort to move into a neighborhood that had a vacant lot on the street,” he said. “This was around the time that Occupy Wall

St. was going on and a lot of people wanted to be involved with their communities. I gathered together people who were interested in community organization and told them that we should start a community garden. I said let’s start an urban ag project in the middle of the city to address some of the food access issues people were facing. There were about 20 people involved with the project.”

The first garden was about 3,000 square feet in which the community volunteers built 20 4- by 6-foot raised beds.

“I was able to get funding from different sources to support the project,” Chavis said. “I was out in the garden every weekend working with community members on different production practices and how to steward the garden.”





Looking to expand his involvement with urban ag further, Chavis began working with John Lewis, who had started a program called Renew Richmond in 2009. Lewis is a certified prevention specialist/health education specialist with the Virginia Health Department, Division of Adolescent Health. “We started working together on an urban farm,” Chavis said. “John had about an acre of land in the middle of city. We have expanded so that we now have a total of six urban ag sites, an urban farm which includes high tunnels, two school gardens and community gardens.”

The produce grown on the urban farm is sold to local grocery stores, restaurants and to people in the community.

“We have a modified version of community supported agriculture,” Chavis said. “We offer delivery of veggie boxes to those people who cannot go to the pop-up farmers markets. All of the community gardens and farm are in the Richmond city limits.”



## CONVERTING A YMCA INTO AN INDOOR FARM

Because of the urban ag projects Chavis was doing in Richmond, he attracted the attention of Virginia State University and extension specialist Dr. Marcus Comer, who was working on an indoor farm project in Petersburg.

“I talked to him about my philosophy on entrepreneurial urban ag and the impact it had on the economy of the low income community,” Chavis said. “We started working on this indoor farm in 2014.”

The Harding St. Urban Agriculture Center is a former YMCA recreational center located in a residential neighborhood.

“The building is around 100 years old,” Chavis said. “Prior to becoming a YMCA, it

was a performance hall that featured black entertainers like James Brown, Sam Cooke and Aretha Franklin who weren’t able to perform at white venues.

“We removed the basketball floor and installed vertical towers, aeroponic tables, an aquaponics system and an ebb-and-flow system. We set up lighting rigs to hang lights from. We installed solar panels on the roof to power the lights inside the facility. We are installing modular climate control units for the different types of growing systems to control the light intensity, temperature and humidity. There is also a kitchen that we are renovating to turn into a culinary arts classroom.”

Chavis said some Richmond high school students are involved with a six-week program called Growing Up, which teaches students about culinary arts and urban agriculture. He said once the urban ag center’s kitchen is finished, high school students in Petersburg will have an opportunity to participate in the program. Students who graduate from the program will then become mentors for the next incoming class.

“On the second floor of the ag center are rooms where we are planning to teach health and fitness classes,” Chavis said. “We will also be teaching urban agriculture and entrepreneurship.”

“Another piece of equipment we have installed is a 10- by 12-foot walk-in cooler. We are not only running an indoor farm, but we have become an aggregator of produce. Local farmers bring in their fresh produce for sale and distribution. What we grow at our urban farm in Richmond, which is about 30 miles away, is brought to Petersburg and then is shipped out to wherever it needs to go.”

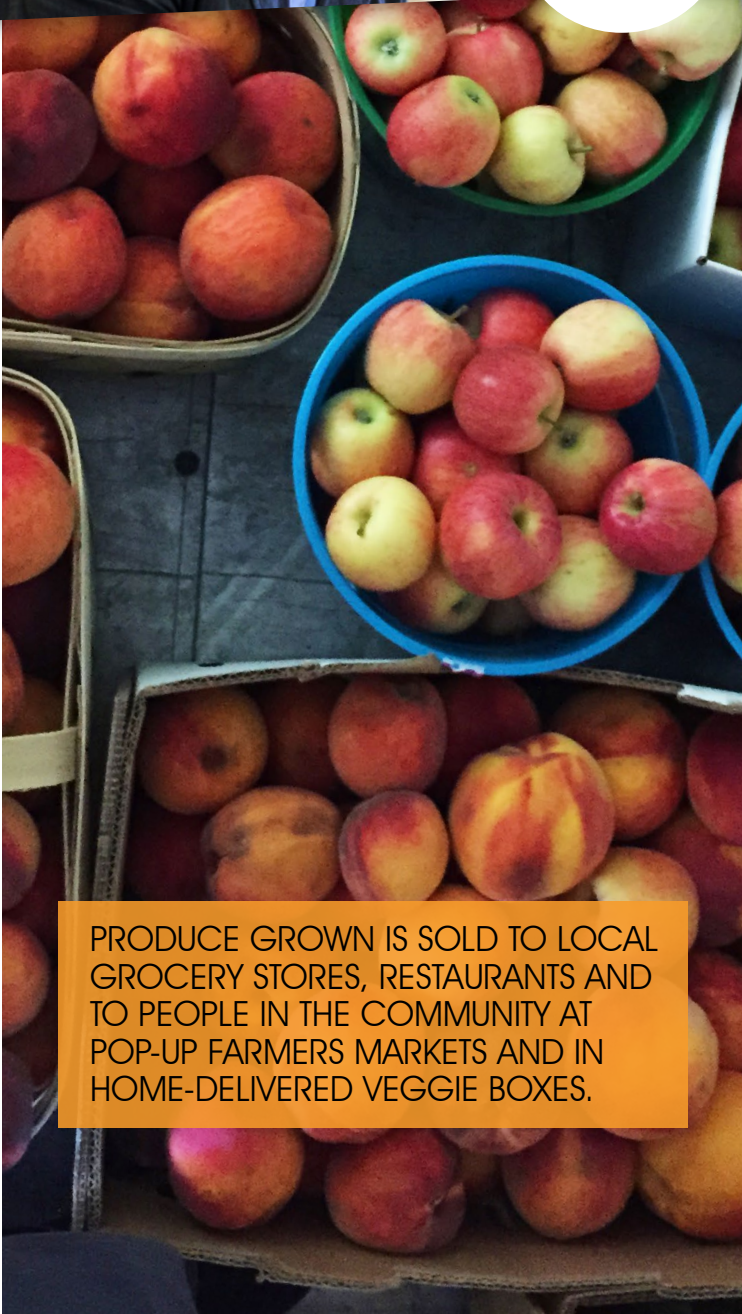
Outside of the urban ag center is a micro-farm consisting of 4,000-5,000 square feet of raised beds along with an orchard with about 32 trees on another vacant lot.

“What we can’t grow in the indoor farm in





WATCH  
HIS TEDX  
VIDEO



PRODUCE GROWN IS SOLD TO LOCAL GROCERY STORES, RESTAURANTS AND TO PEOPLE IN THE COMMUNITY AT POP-UP FARMERS MARKETS AND IN HOME-DELIVERED VEGGIE BOXES.



the building we can grow outside,” Chavis said. “With the urban farm in Richmond and the facilities here in Petersburg we are able to grow year round.”

Crops that have been grown inside the urban ag center include kale, mustard greens, basil, lettuce, Swiss chard, peppers, tomatoes, spinach, and watercress.

“Our focus is on growing what the people actually want to buy,” Chavis said. “For the local community there is a staple group of products that we are going to grow, including tomatoes, cabbage, peppers, collards, squash and cucumbers. We have to grow accordingly for what most of our clientele is interested in buying.

“All of the food that is grown is sold. We are a research center, but part of the research is economic sustainability. Our focus is community engagement and teaching the community so that they can do these things for themselves. Our effort is a balance. Our goal is to increase the number of end users that want to purchase the produce we are producing.”



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## INDOOR AG-CON LAS VEGAS APRIL 5-6

Indoor agriculture is one of the fastest-growing parts of global farming as it aids in tackling issues of drought and offers local fresh produce year-round to consumers. Indoor Ag-Con – the US indoor agriculture industry’s leading conference – will be hosting its 4th Annual Indoor Ag-Con in Las Vegas, NV on April 5-6, 2016 to discuss the prospects for this technology-rich industry.

The two-day seminar will be hosted at the Las Vegas Convention Center, and is tailored toward corporate executives from the technology, investment, vertical farming, greenhouse growing, and food and beverage industries, along with hydroponic, aquaponic and aeroponic startups and urban farmers.

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# e-GRO Webinars

## Lighting Part 1: Introduction and Benefits of Supplemental Lighting with Roberto Lopez, Purdue University

Greenhouse Supplemental Lighting

**e-GRO** Electronic Grower Resources Online

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THE LIGHTING KNOWLEDGE COMPANY

1:00 to 1:45 Eastern

### Intro and Benefits of Supplemental Lighting

Roberto Lopez  
Floriculture Extension Specialist and Research  
rglopez@purdue.edu



**PURDUE**  
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Greenhouse supplemental lighting is important to maintain crop growth, quality and yield during winter months and cloudy days. As an additional production cost it is important to know plant response to supplemental light and when you are providing too much light that the plant cannot utilize. Attendees will learn about different lighting strategies (time clock, light threshold, or lighting to a daily light integral target) and the costs and benefits of each strategy. Attendees will also learn how to properly maintain and clean supplemental lights, to calculate how many lamps are needed and the hours the lamps need to be on to reach a light target, and

how to calculate the energy usage and costs of these lamps. Neil, Josh and Roberto will also present recent research findings comparing plant responses and cost of supplemental light using high pressure sodium (HPS) and light-emitting diodes (LEDs).

## Growing Lettuce and Culinary Herbs Hydroponically with Chris Currey, Iowa State Univ. and Brian Krug, Univ. of New Hampshire

**e-GRO** Electronic Grower Resources Online

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### Growing Lettuce and Culinary Herbs Hydroponically



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Brian Krug  
Floriculture Extension Specialist  
brian.krugg@unh.edu

**IOWA STATE UNIVERSITY**

**University of New Hampshire**  
Cooperative Extension

Are you looking to diversify your production? Are hydroponics something you are interested in? Then hydroponic lettuce and culinary herb production may be for you! Hydroponic lettuce, greens, and culinary are some of the most popular crops being grown in greenhouses. Join us for this webinar to cover the fundamental of producing leafy hydroponic crops. We will cover everything from hydroponic systems, substrates, and fertilizers to light, temperature, and cultivar selection.



## Measuring Light in the Greenhouse

Roberto G. Lopez and W. Garrett Owen  
Floriculture Extension and Research



## Measuring Light in the Greenhouse

Photosynthetic light influences crop growth, yield, and quality and therefore accurate light measurements are essential. In this video we will demonstrate how to properly measure and record instantaneous light intensity and daily light integral (DLI) in the greenhouse using quantum sensors. Additionally, you will learn how to maintain and adjust these light sensors.



## Measuring Light from LEDs

Roberto G. Lopez, Heidi Wollaeger, and W. Garrett Owen  
Floriculture Extension and Research



## Measuring Light from LEDs

Light-emitting diode (LEDs) arrays are becoming an alternative to other traditional lighting sources for horticultural applications. In this video we will demonstrate how to measure instantaneous light intensity using a quantum meter and spectroradiometer calibrated to measure light from LEDs.



**GREEN SENSE FARMS**

*to expand its*

**VERTICAL FARMING OPERATIONS**

*in the*

**U.S. AND CHINA**



# RATIONS



TO MEET THE INCREASING DEMAND FOR CLEAN, SAFE PRODUCE IN BOTH THE U.S. AND CHINA, **GREEN SENSE FARMS** LOOKS TO OPEN ADDITIONAL VERTICAL FARMING OPERATIONS ALONG WITH A **TRAINING FACILITY** TO CREATE JOB-READY GRADUATES TO GROW IN CONTROLLED ENVIRONMENTS.

*By David Kuach*



Robert Colangelo, founding farmer and CEO at Green Sense Farms  
*Photos courtesy of Green Sense Farms*

Robert Colangelo, founding farmer and CEO at Green Sense Farms, in Portage, Ind., knows what it takes to be successful in emerging markets.

“I have been very fortuitous in my career,” Colangelo said. “I have been at the forefront of three emerging markets. In the 1990s I operated one of the first companies in the Soviet Union and rode that wave of democratization and privatization of state-owned Russian businesses.

“I was at the forefront of the brownfield industry. Redeveloping contaminated properties, repositioning them for new and productive use. And now I have been lucky to be at the forefront of the emerging vertical farming market.”

Colangelo said all of the new markets he has been involved with have very similar patterns.

“They all require tenacity as the early phase of the market ebbs and flows until it reaches a critical mass,” he said. “They require flexibility and the ability to manage technology. It’s the culmination of my previous experiences that have allowed me to have a diverse amount of skills required to make vertical farming work. This is probably one of the more complex ventures I have ever undertaken, but I love it. I also have a great partner, Carl Wenz, who is a CPA and has complementary skills to mine.

“To be successful in vertical farming, you really have to understand the produce business, have a good understanding of fundamental business operations and be able to integrate many different technologies into a working system. You have to understand plant physiology, packing and post-harvest processes. And you have to have marketing and sales skills and be able to raise capital. That is a unique skill set for one person and requires an experienced team. If you’re not good at all of those areas of expertise, then you’re going to have a real challenge succeeding in the vertical farming market.”



## ■ STARTING OUT WITH “BIG” PARTNERS

Even though Green Sense Farms has only been producing crops since 2014, the company was formed in 2012 and has been doing research and development since 2009. The company’s vertical farm operation is located in a 120,000-square-foot industrial warehouse building. It leases 20,000 square feet in a multi-tenant building.



“We have two grow rooms,” Colangelo said. “Each room measures 60- by 60- by 25-feet tall. One room is dedicated to lettuce. It has nine vertical towers that are 14 levels high. The second room has seven towers with 10 levels in which we produce baby greens, including kale, arugula, bok choy, watercress, upland cress and culinary herbs. About 80 percent of the product goes to grocery stores and 20 percent goes to produce companies, which service restaurants and institutions.”

Colangelo said in order for his company to be a major player in the vertical farming industry required picking “big” partners.

“We looked at lighting and picked a lighting partner,” he said. “This allowed us to focus on building the best vertical farm and our lighting partner can provide us with constant R&D on LED lights. We picked a fertigation partner that could take a well-defined fertigator from the greenhouse industry and customize and tweak it so that it would work in an indoor vertical farm and create the automation controls that link all the different systems together. We formed a partnership with a climate control company so that we just don’t treat our air and filter it and cool it, but we also adjust the humidity because plants transpire and put a lot of moisture in the air. Lastly, we are working with a seed company that together with our LED company can breed non-GMO seeds that grow best under LED lights in indoor controlled environments. This enables us to not only maximize our yields, but through using the right seed with the right LED light recipe, we can double our yields and productivity. This is complex stuff and you have to pay attention to the details. And you have to be at a scale that is big enough to make this economical.”

## ■ EXPANSION IN THE U.S.

Green Sense Farms is in the process of building additional farms in the U.S.

“We have formed a partnership with Ivy Tech Community College in South Bend, Ind., to build a hands-on training center on the campus,” Colangelo said. “This will be a working commercial farm.”

“One of the challenges in this industry is that there are not enough trained people. So we are creating our own “farm team” to mine talent. The training center will be similar to McDonald’s Hamburger U. in Oak Brook, Ill. We plan to train 15 students every six months. At the end of the six months the students are job-ready to work in the ag industry and to also work in vertical farms. We call it “earn to learn.” The students will be paid to work at the farm. This facility will be larger than the one we are operating in Portage.”

Green Sense Farms is also in discussion to put a vertical farm at distribution centers in the Indianapolis area operated by grocery store chains.

“Our goal is to blanket the Midwest,” Colangelo said. “Our strategy is to put these vertical farms at the points of consumption and distribution. We are planning to build farms at perishable food distribution centers and at institutional campuses, including hospitals, colleges, corporate campuses and military bases.”

“After Chicago, Indianapolis is the next up-and-coming Midwest city. There is a great food scene. It is also an entrance to the South. The Midwest is a good location because of its short growing season and its cold winters. With the vertical farms we can grow indoors 24/7 and harvest 365 days a year.”

## ■ EXPANSION IN CHINA

At the same time that Green Sense Farms is expanding its vertical farms in the U.S., it is also building a network of farms in China. The company's goal is to build 100 farms in China with its local operating partner Star Global Agriculture. It began work on its first China facility in March 2015. Located in the city of Shenzhen, the vertical farm is expected to start growing produce in June.

"Shenzhen is located right across the border from Hong Kong," Colangelo said. "There are 48 million people within 50 miles of our farm. Our plan is to build 10 farms in the city in the next 24 months. They would serve Hong Kong and Macau, which is considered the Las Vegas of the East.

"China has 1.4 billion people. The country is transforming from a manufacturing economy into the largest consumer economy. In a very short time China is going to have incredible buying power. As a middle class emerges, Chinese consumers are demanding higher quality food."



Colangelo said China's transformation over the last 25 years into one of largest industrial manufacturing economies ate up a lot of farm land and produced heavy pollution.

"A lot of the food supply has been affected by the industrialization," he said. "There is heavy air pollution, ground water has been contaminated in the large cities and there are terrible traffic jams. Putting vertical farms in the cities close to the people reduces congestion, controls the cleanliness of the food, and supplies emerging markets that want to eat healthy, fresh greens.

"There is a tremendous amount of capital available. In China there aren't as many rules and regulations as we have had to deal with in the states so we can move much more quickly. Even though we started in the U.S. and we will continue to build our network here, with the availability of capital and less regulations to deal with in China, we feel that we can build a network of farms much more rapidly there."

Colangelo said the company's goal in China is to pioneer the lettuce market.

"We know there is an emerging lettuce market. We feel that we can dominate that," he said "But we also know that we have to grow different greens for the Chinese palette. Some of the crops include Chinese onions, baby bok choy and mustard greens. Some of the herbs will also be different such as coriander."

Colangelo said with China's population the potential market is immense.

"Initially we will put as many farms as we can in Shenzhen," he said. "Then we'll blanket Shanghai, Beijing and Chengdu. Those cities have large population centers (20 million plus) where we can build a circle of farms around the cities.

"The traffic congestion is so bad in China that it would be better to build smaller farms closer to consumers. Even in a small area it takes a long time to go a short distance during rush hour. It's better to have several small farms than to have a big farm in a central location."

A man with glasses and a goatee, wearing a teal zip-up sweater, is smiling and holding a small cluster of leafy green plants. He is standing in a vertical farm with multiple levels of plants under bright, colorful grow lights. The background shows rows of plants on different levels, creating a sense of depth and scale.

**“PUTTING VERTICAL FARMS IN  
THE CITIES CLOSE TO THE  
PEOPLE REDUCES  
CONGESTION, CONTROLS THE  
CLEANLINESS OF THE FOOD,  
AND SUPPLIES EMERGING  
MARKETS THAT WANT TO EAT  
HEALTHY, FRESH GREENS.”**

**—ROBERT COLANGELO  
FOUNDING FARMER AND CEO AT GREEN SENSE FARMS**

GREEN SENSE FARMS PRODUCES LETTUCE, BABY GREENS, INCLUDING KALE, ARUGULA, BOK CHOY, WATERCRESS, UPLAND CRESS, AND CULINARY HERBS. ABOUT **80 PERCENT** OF THE PRODUCT GOES TO GROCERY STORES AND **20 PERCENT** GOES TO PRODUCE COMPANIES, WHICH SERVICE RESTAURANTS AND INSTITUTIONS.



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## ■ THE FUTURE OF VERTICAL FARMING

Colangelo said the indoor vertical farming market in the U.S. is a rapidly emerging market.

“There are a lot people rushing into vertical farming either because they see it as a way to stop world hunger, as a lifestyle change or they see it as a responsible and sustainable way to grow,” he said. “All those things are great. Vertical farming can help those things, but it is not a panacea.”

He said vertical farming has raised the bar for sustainable farming.

“You are seeing some field farmers becoming much more sustainable, as they use precision farming techniques to conserve water, fertilizer and pesticides,” he said. “Greenhouse growers are also becoming much more responsible on how they minimize water and fertilizer use.

“Each of those methods of farming are targeted to grow different crop types better. Field farming is fantastic for commodity crops like corn, wheat and soybeans. Greenhouses are great for tomatoes, cucumbers and peppers. Vertical farming is a great way to grow leafy greens. Vertical farming really takes a skilled practitioner with a good management team, a good understanding of the produce business and good understanding of controlled environment agriculture and patient capital.” Colangelo sees more people rushing into vertical farming which will result in a high failure rate.

“I expect that eventually a few companies will emerge in the long run that will be large scale companies,” he said. “Internationally I see vertical farming growing in constrained markets where produce travels great distances. There is either a lack of water, a lack of land or heavy pollution that drive the creation of farms.”

Colangelo said the vertical farming market is rapidly expanding at the same time it is maturing quickly.

“When I started in this industry in 2009, it was a cottage industry,” he said. “Today you really need to bring your A team to start a vertical farm. You have to have a strong management team. You have to be well capitalized. You have to be strategically focused with a cogent business plan. You have to have an experienced growing team in place. You have to have a good command of the technology that’s ever changing. And you have to be willing to constantly innovate and be agnostic towards your current technology.

“Our first grow room is going on three years old and it’s already a museum. We have already retrofitted it with new technology. We have farm designs that go way beyond where we’re at now and we’re just getting started. The only constant in life is change, either be the catalyst for change, be changed or die.” 🌱

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<http://greensensefarms.com>.

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**INDUSTRY  
NEWS**

## HOW LED LIGHTING TREATMENTS AFFECT GREENHOUSE TOMATO QUALITY



To satisfy increasing consumer demand for locally grown, fresh tomatoes during off-seasons, greenhouse tomato growers often need to rely on supplemental lighting. Tomato growers are looking to light-emitting diodes (LEDs), favored for their energy-saving potential, as an alternative to high-pressure sodium lamps (HPS) in greenhouse operations. A recent study offers new information about the feasibility of using LEDs in greenhouse tomato operations.

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AeroFarms, an indoor, aeroponic farm transforming agriculture as we know it, has grown more than 250 varieties of leafy greens and herbs with unparalleled consistency and flavor, selling to a wide range of customers including chefs and restaurants.

[>> Click for more >>](#)

## DR. ROBERTO LOPEZ JOINS MICHIGAN STATE UNIVERSITY HORTICULTURE FACULTY

Dr. Lopez's area of research at MSU will include hydroponic greenhouse and indoor production of leafy greens and vegetables. Roberto will also add to MSU's horticulture curriculum by offering courses in greenhouse structures and management, floriculture production, and hydroponic food production. As part of his extension appointment, he will become the newest member of the MSU Greenhouse/Floriculture Crop Production Team which serves the \$480 million dollar Michigan Greenhouse Industry (3rd largest in the U.S). [>> Click for more >>](#)





## LETTUCE SEE THE FUTURE: LED LIGHTING HELPS FARMING GO HIGH-TECH IN JAPAN

Humans have spent the last 10,000 years mastering agriculture. But a freak summer storm or bad drought can still mar many a well-planted harvest. Not anymore, says Japanese plant physiologist Shigeharu Shimamura, who has moved industrial-scale farming indoors thanks to special LED lights developed by GE.

>> [Click for more](#) >>

## INTERIM PRESIDENT AND CEO OF AMERICANHORT STEPS DOWN

David Savoia, former interim president and CEO of AmericanHort, has stepped down from this position to pursue other priorities, according to a press release from the horticulture association.

AmericanHort is currently operating under the leadership of Sherry L. Johnson, AmericanHort vice president of knowledge and business advancement and interim CEO, as well as the team of vice presidents including Craig Regelbrugge, senior VP of industry advocacy and research, and Alicia Rittenhouse, VP of member and strategic engagement. >> [Click for more](#) >>

## GROWTAINER AND GLENN BEHRMAN



## THE DIANE REHM SHOW: THE GROWTH OF LARGE-SCALE INDOOR URBAN FARMING

The face of agriculture is dramatically changing in and around cities worldwide. From Anchorage, Alaska to Tokyo, Japan, multi-story indoor farms provide fresh produce, fish and other products to local residents. Some facilities are greenhouses using natural sunlight, others use grow lights.

>> [Click for more](#) >>

## HYDROGARDEN STARTS INTERNATIONAL SCHOOL SPONSORSHIP TO MARK 20TH YEAR IN BUSINESS



In celebration of its 20th successful year of trading, Coventry-based HydroGarden Wholesale Supplies Ltd, has embarked on a long term sponsorship of Zuurany's Primêr, a primary school near Kareedouw, in the Eastern Cape of South Africa. HydroGarden employee Daniel van Straaten approached the board of directors on behalf of the school where his mother is the principal to find out if they could offer any support. >> [Click for more](#) >>



## GREENTECH 2016 TO BE PACKED WITH INSPIRING SESSIONS AND SPEAKERS

Gain knowledge and grow your business perspective, obtain key advice and build knowledge from over 20 inspiring speakers tackling over 30 topics in the GreenTech Theatres. Delve deep into the new trends and hottest topics, as well as practical hands-on advice from real-world cases and years of experience. The theatres are focused around the four central themes of GreenTech: water, biobased, energy and crops particularly aimed at growers and investors.

[>> Click for more >>](#)

## CROPKING INTRODUCTORY GROWER WORKSHOP

More than just supplying the best equipment for growing, it is important to educate both new growers and potential growers about the industry that they are venturing into. A good understanding of what is involved in the growing process, as well as the options that are available gives a potential customer the ability to make smart decisions.

Our grower-site workshops are scheduled frequently and held in close proximity to existing grower operations in Lodi, Ohio: April 21-22 | May 19-20 | June 16-17

[>> Click for more >>](#)

INDUSTRY NEWS

## 2016 TOUR DE FRESH SPONSORSHIPS AVAILABLE NOW

This year's Tour de Fresh cycling event, presented by The California Giant Foundation and supporting Let's Move Salad Bars to Schools, is heading back to the west coast. The three-day ride leading up to PMA Foodservice Conference will begin July 26 in Napa Valley and end July 28 in Monterey, Calif. Additionally, Tour de Fresh announced a second event – a one-day, 100k ride in Dallas/Fort Worth. Tentatively scheduled for Oct. 1, 2016, this event will also benefit the salad bar cause and will serve as a model for more regional Tour de Fresh events.



[>> Click for more >>](#)

## NEW WHITE PAPER AVAILABLE ON THE IMMENSE POTENTIAL OF ASIA'S INDOOR AG INDUSTRY

Newbean Capital and SG Farming jointly authored a white paper on Asia's indoor agriculture industry. "The Rise of Asia's Indoor Agriculture Industry" was released at Indoor Ag-Con Asia last month. It offers a broad overview of the region's industry, the most advanced in the world with approximately 450 plant factories.

Please click here to go to Indoor Ag's website to download the complete white paper on Asia's indoor agriculture industry. When you are there you might as well check out their other detailed report on Robotics & Automation or the Feeding the Future analytic white paper on the state of indoor agriculture.

[>> Download the complete white paper >>](#)



# CRITICAL FOODSCAPES: WHAT DOES THE FUTURE HOLD FOR URBAN GARDENING?



A one day Conference on July 7, 2016, at the University of Warwick, UK. This conference seeks to put critical – but constructive – pressure on some of the assumptions which underlie current theory and practice of urban gardening; as such, the conference organisers welcome papers encompassing a broad range of approaches and perspectives considering the past, present and future of urban gardening.

[>> Click for more >>](#)

## NEW CASE STUDY ON URBAN PRODUCE

Hort Americas has produced a new case study on Urban Produce and their use of LED lighting.

[>> Click for more >>](#)



## STUDY FINDS PHILIPS LED LIGHTS PROVIDE IMPROVED ENERGY EFFICIENCY AND PRODUCTION FOR GROWING FOOD CROPS IN SPACE

Philips Lighting, a Royal Philips (NYSE: PHG, AEX, PHIA) company and global leader in lighting, has collaborated with The University of Arizona Controlled Environment Agriculture Center (CEAC) to test energy efficient ways to grow food that will help feed astronauts on missions to the moon, Mars and beyond. [>> Click for more >>](#)

## SUSTAINABLE AGRICULTURE TRAINING / CAL POLY POMONA LAUNCH NEW HYBRID COURSE AND A NEW SCHOOL NAME

The training division of Archi's Acres has a new name, Archi's Institute For Sustainable Agriculture (AiSA). Archi's Institute For Sustainable Agriculture and Cal Poly Pomona Ag Department announce the launch of a new Hybrid (Sustainable Agriculture Training) Course in addition to the popular Six-week Day Course and 12-Week Nights & Weekends Course.

[>> Click for more >>](#)

# THE NIGHTLY SHOW WITH LARRY WILMORE STRANDED IN A FOOD DESERT

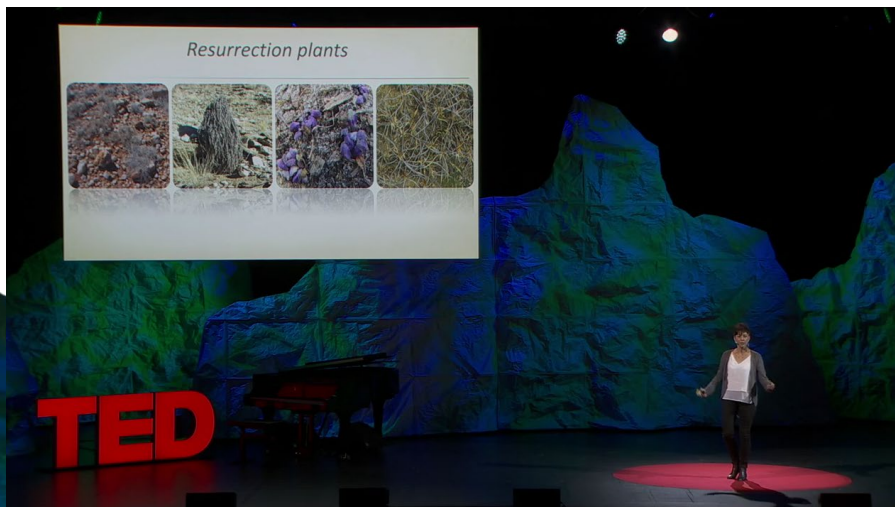
MARCH 17, 2016



How we can make crops **survive without water**  
Jill Farrant

## TED

Ideas worth spreading



As the world's population grows and the effects of climate change come into sharper relief, we'll have to feed more people using less arable land. Molecular biologist Jill Farrant studies a rare phenomenon that may help: "resurrection plants" — super-resilient plants that seemingly come back from the dead. Could they hold promise for growing food in our coming hotter, drier world?





## HORT AMERICAS AND URBAN AG NEWS HAVE ONCE AGAIN DECIDED TO PARTICIPATE IN AND SUPPORT 2016 TOUR DE FRESH.

Tour de Fresh, presented by The California Giant Foundation, is a one-of-a-kind, collaborative event that unites the most significant brands and influencers in the fresh produce industry for a four-day cycling event. The purpose of Tour de Fresh is to raise funds to benefit the Let's Move Salad Bars to Schools campaign. The inaugural event in 2014 raised over \$142,000 and placed over 40 salads bars in schools in California, Colorado, Florida, Illinois, Michigan, Minnesota, Missouri, New York, Ohio, Texas, Wisconsin and the District of Columbia.

The goal of this year's 2016 Tour de Fresh and its participants is to privately finance 100+ new salad bars in school districts across the country. At a cost of less than \$3,000 per salad bar per school, sponsors and participants alike strongly believe that providing healthy eating opportunities for school children should be a requirement.

This year Hort Americas is supporting the Irving Independent School District in Irving, Texas. To learn how to support Hort Americas, Urban Ag News and their efforts to place salad bars in schools, follow them on Facebook, Instagram, LinkedIn and Twitter. The unique Let's Move Salad Bars to Schools program extends beyond the healthy foods consumed during the breakfast or lunch hour. Increased daily access to a variety of fruits and vegetables provides a personal experience about choices that can shape behavior far beyond the school lunch line. Children learn to make decisions that carry over outside of school, providing a platform for a lifetime of healthy snack and meal choices.

**CONTACT HORT AMERICAS TO FIND OUT HOW YOU CAN SUPPORT THE 2016 EFFORT!**

hortamericas.com  
customerservice@hortamericas.com  
469-532-2383



[www.tourdefresh.com](http://www.tourdefresh.com)



# CONTROLLED ENVIRONMENT AG — 2 16 — EVENTS TO ATTEND

## THE URGENT REQUIREMENTS OF PROTECTED AGRICULTURE – PANEL DISCUSSION

COUNTRY: PANAMÁ

DATE: MAY 24, 2016

SPONSORS: IICA, SENACYT, CAF, MINISTRY OF AGRICULTURE (MIDA),  
MINISTRY OF COMMERCE (MICI), INTER-AMERICAN DEVELOPMENT BANK (IADB)

MODERATOR: DR. GERARDO ESCUDERO

PANELISTS: DR. VÍCTOR SÁNCHEZ – SENACYT

MAURICIO REVES – CAF

DR. HUMBERTO RODRÍGUEZ – TECHNOLOGICAL UNIVERSITY

DAVID PROENZA, FDCEA PRESIDENT

## THE VERTICAL FARM; THE TRANSFORMATION OF THE AGRICULTURAL SECTOR

COUNTRY: CHILE

DATE: AUGUST 25, 2016

SPONSORS: IICA CHILE, CAF CHILE,  
MINISTRY OF AGRICULTURE IN CHILE, ETC.

SPEAKERS: DR. RODRIGO CAMBRA, UP  
*GROWING FOOD IN CONTROLLED ENVIRONMENT*

DR. HUMBERTO RODRÍGUEZ, UTP  
*AUTOMATING THE VERTICAL FARM*

LIC. DAVID PROENZA, FDCEA  
*URBAN FARMS; AN AUTOMATED VERTICAL FARM*

DR. GERARDO ESCUDERO, IICA  
*THE CIPAC PANAMÁ*



# THE VERTICAL FARM; THE TRANSFORMATION OF THE AGRICULTURAL SECTOR

COUNTRY: PANAMÁ  
DATE: OCTOBER 13, 2016  
SPONSORS: IICA, CAF, MIDA, MICI, ETC.  
MODERATOR: LIC. MANUEL FERNÁNDEZ  
SPEAKERS: DR. RODRIGO CAMBRA, UP – *GROWING FOOD IN CONTROLLED ENVIRONMENT*  
DR. HUMBERTO RODRÍGUEZ, UTP – *AUTOMATING THE VERTICAL FARM*  
LIC. DAVID PROENZA, FDCEA  
*CASE STUDY; URBAN FARMS; AN AUTOMATED VERTICAL FARM*  
DR. VICTOR SANCHEZ – SENACYT  
*THE NECESSITY OF R&D IN CEA AND INDOOR FARMING.*  
DR. GERARDO ESCUDERO, IICA  
*THE CIPAC PANAMÁ (PANAMÁS R&D AND TRAINING CENTER)*



## SECOND CONGRESS ON SCIENCE AND TECHNOLOGY

COUNTRY: PANAMA  
DATE: AUGUST 29 –  
SEPTEMBER 2. 2016  
SPONSOR: UNIVERSIDAD  
AUTÓNOMA DE  
CHIRIQUÍ;  
SPEAKER: DAVID PROENZA, FDCEA  
*URBAN FARMS  
AN AUTOMATED  
VERTICAL FARM*



[fdcea.com](http://fdcea.com)





# FDCEA

FOUNDATION FOR THE DEVELOPMENT OF  
CONTROLLED ENVIRONMENT AGRICULTURE

The Foundation for the Development of Controlled Environment Agriculture is a private foundation created in 2014.

## *Mission*

To join the future stakeholders of controlled environment agriculture in order to build a platform in which shared resources can be used to invest in the development of a shared industry.

## *How we work*

To create an industry that sees the available natural resources and then develops the necessary strategies to maximize the production of fresh produce in a wide variety of climates our Foundation invest in the research and education needed to develop technology and talent.

We are committed to specific areas of need. We work with experts to define strategies and goals with a clear understanding of how we will achieving them.

## *Learn more and join us!*

For complete understanding of who we are, what we do and how to benefit from being part of the FDCEA please contact us directly or visit our website for more information.



FDCEA.COM

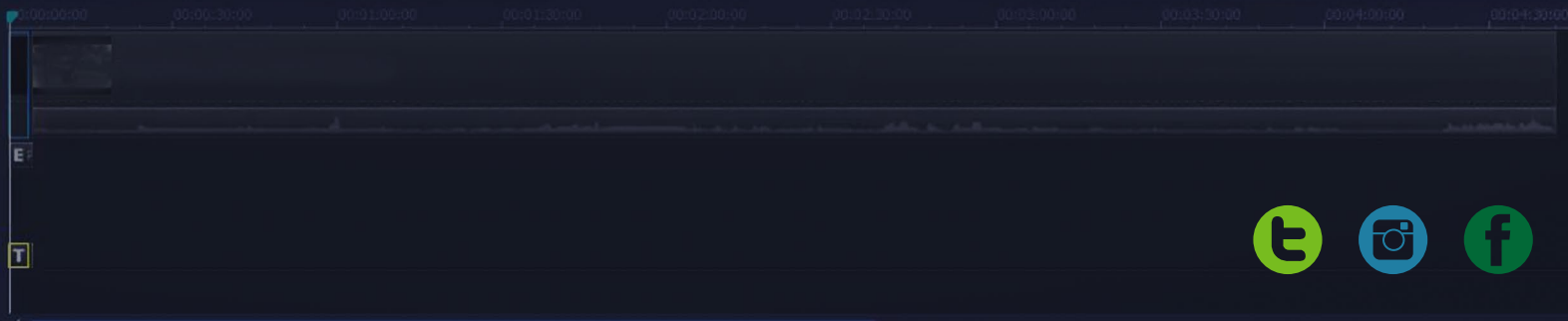
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**IFAD** - the International Fund for Agricultural Development - is a specialized agency of the United Nations. We work with poor rural populations in developing countries to eliminate poverty, hunger and malnutrition; raise their productivity and incomes; and improve the quality of their lives.



## AN INTERVIEW WITH DR. GARY STUTTE

*Limerick, Ireland-Palm Desert, CA*  
*By Jim Pantaleo*

It was an honor and a privilege to recently speak with Dr. Gary Stutte, Principal Investigator at the NASA Kennedy Space Center, and timely too, given the controlled environment agriculture (CEA) events occurring on the International Space Station (flowering zinnia and lettuce successfully grown) and in the Oscar-nominated film *The Martian*.

I first met Dr. Stutte at a CEA conference in Panama last May and while I appreciated his contribution to the event; detailing his work at Kennedy Space Center over the past 25 years to an audience of 300 participants, it was over a cigar and cognac (both of which I partake of once a decade) on the final evening of the event

in which I was schooled on the finer points of space exploration and how to successfully grow life-supporting plants in zero gravity. Gary is friendly, unassuming, humorous, clearly a deep thinker and seemingly, endlessly focused on the heavens.

Currently, he is earnestly engaged in bringing CEA to Ireland, the UK and beyond with his new start-up, SyNRGE (the name is based on the NASA and LIT studies below). He noted the entire country of Ireland has a mere 50 acres of high quality commercial greenhouse space. It would appear to any observer Ireland is ripe for indoor Ag to take hold given the oft gray, wet and infrequently-sunny climate.

Dr. Stutte has recently finished a Marie Curie Fellowship at the Limerick Institute

of Technology on Symbiotic Nodulation in a Reduced Gravity Environment (SyNRGE III) along with Florida-based Dr. Michael Roberts. A welcomed infusion of new STEM-based Ag tech jobs would continue to drive the Emerald Isle's economic recovery (see: Irish down-turn 2007-2013) while stoking the "Celtic Phoenix."

The more one listens to Gary Stutte the more enlightened one feels. Touching the inner reaches of true, space exploration is a long, tedious and devout journey. Any amount of time spent with an individual who has dedicated a life's work to such a humanity-advancing cause is time well-spent indeed.

**JP:** Gary, thanks so much for taking the time to speak with me...What have you been up to lately?

**GS:** I've been pretty busy since I saw you last. I've attended a couple more vertical farming conferences; just before Christmas I went to a Plant Factory symposium in Seoul, South Korea. It was certainly interesting and the industry is beginning to really grow in Asia.

Personally, I've been working on a number of projects; at Kennedy Space Center we're continuing to look at dwarf plums – we're going to try to get fruit into space – and longer term you can have a continuously cropping plum. That's being done in collaboration with NASA and the US Department of Agriculture (at the Appalachian Fruit Research Laboratory in Kearneysville, WV).

I have recently started a small company called SyNRGE LLC. It's named after a series of flight experiments my collaborator, Dr. Michael Roberts, and I have been doing looking at plant microbe interactions. And the goal of this company is identifying technologies that were developed for producing plants in space and the impacts on biology and developing

those for Earth applications.

Our first major effort is preparing an experiment to the International Space Station. It is being funded by the Center for the Advancement of Science in Space (CASIS) and is being tested now and will be launched on SpaceX 8 hopefully later this spring. We're very excited about that. It's going to be looking at a legume model, a little clover-like plant called *Medicago truncatula*, and looking at bacteria and fungi that have bio-stimulatory affects. We want to see if we can reduce the stress and increase the production and growth of plants in micro gravity by developing these plant-microbe interactions.



Above: *Medicago truncatula* - Source: Legumeinfo.org

**JP:** It will grow a legume did you say?

**GS:** It is a legume. That's why we selected it. It is the model species for the legumes which are the soy beans, the peas...it's in the same family as alfalfa which is used for fodder. This family of plants is responsible for roughly 20% of the protein we take in either directly or indirectly. We take it in directly from the diet of garbanzos or hummus or beans or tofu. Indirectly, it is fed as clovers, medic, in vetches and alfalfa to live stock for that conversion into live stock protein. They also are some of the only plants that will survive in some of the most harsh, nutrient-poor soils around the world. Our goal is to try and improve those capabilities.

**JP:** Given your recent travels, what's your take on the current state of indoor vertical farming for food production in the United States and globally?

**GS:** My observation is vertical farming is expanding very rapidly in Asia. Growth seems to have been nearly exponential from small, demonstration units to large, commercial units. Some very innovative concepts for production; there are interactions at putting vertical farms as part of hospital settings, within restaurants, straight commercial food production to salads to fast food restaurants. It's meeting a real demand and I see that growing. I think in the US it is off to a bit slower start but interest is growing. The initial pioneers of indoor farming have provided some real lessons and those are being learned from by next wave of investors and producers. Questions are certainly being asked and new facilities are on the books, and some very large ones are coming on-line. So I think it's quite promising.

**JP:** Do you see a marriage between academia and research and those in private enterprise, like the AeroFarms of the world?

**GS:** I think your observation is absolutely correct in that my sense is as this industry develops that alignment with academia and professional researchers will increase. Dr. Gene Giacomelli at the University of Arizona (Controlled Environment Agriculture Center) has been instrumental with consulting and collaborating with groups around the country. The Founder and Chief Executive Officer of AeroFarms, Ed Harwood and Chief Science Officer, is Director of Agriculture at Cornell University. So I think that has been critical for one, credibility and second, transferring knowledge of critical technology implementation and this collaboration will help ensure success.

There are certainly within the academic community skeptics of the long term viability of vertical agriculture. There are certainly challenges that are often "washed over" by the industry as well. Power management,

humidity control, nutrient management, pest management, equipment failures are all challenges. Further, the potential benefits that are provided by vertical agriculture and indoor farming are often not that much greater than can be produced in the field due to the increased economic costs. These hold even with transportation cost to market field grown crops built in. That said, as the population of the world increases and becomes more urbanized, the ability to have locally produced food from not only the cache of marketing but on the broader questions of food security, food quality, and fresh and consistent supply to large populations centers I think will be critical.

Some of the smaller units are going to be able to supply produce, and increase quality of diet in food deserts. In inner cities, they will enable turn-key agricultural operations to be set up and operated in places that have limited access to fresh food. I think these, and others are going to be valuable niches that are being filled as this industry develops.

**JP:** Please share your Kennedy Space Center experiences and those projects you were involved in that have advanced human's ability to grow living things within a controlled environment in outer space.

**GS:** That's an interesting question. I have been involved with closed system controlled environment agriculture for close to twenty-five years. The original project I was involved with was called CELSS (Controlled Ecological Life Support Systems) and the objective was to demonstrate the feasibility of keeping people alive, from a biological perspective, from plants on a one-person scale. Out of that test among other things we were able to create a grow chamber of 20 square meters of growing area. We had ninety-six (96) 400 watt high pressure sodium (HPS) lamps. NASA had converted and retrofitted a hyperbaric test chamber from the Mercury and Gemini



space programs for hydroponic production of plants. It allowed us to recycle the water, maintain closures so as to recycle the air and monitor CO2 use, water use and nutrient use on a very precise level.

Over the course of about a decade, a number of crops were grown in the Biomass Production Chamber. We grew lettuce as a leafy vegetable, and as a rapid cycling test crop. We grew wheat which was a grain. We grew potatoes which was a starchy root crop. We grew soy beans which was a legume and a bean which provided protein oil. We grew rice, another grain and carbohydrate source and finally, tomatoes which was a fruiting vegetable. We were able to learn a lot. We were told you had to have soil to grow potatoes but in our soil-less, nutrient film technique (NFT) we were able to get twice the World Record field yield of potatoes in two-thirds of the time. Our yields of lettuce were exceeding the current production models. Wheat exceeded all field yields in about half the time. So we were able to truly demonstrate the limits of productivity in many of these crops. And we were able to advance the control and monitoring capabilities with sensor development, production modeling

and physiological studies at a whole crop level in a closed, controlled environment. We had over 600 peer-reviewed papers come out of CELSS Breadboard project.

Work was initiated with light emitting diodes (LED) in the late 1980's. LED research first funded by NASA at the University of Wisconsin. At Kennedy Space Center our first LED arrays were hand-built about 1991. I think it is arguable that much of the work that came out of NASA and KSC in particular, laid the framework for the explosion of the LED lighting industry now. It enabled the first demonstrations that you could grow plants under LED's.

**JP:** What did you think of the 'growing potatoes' scene in *The Martian*?

**GS:** I was happy to see it up there. From the outset *The Martian* was a very enjoyable film. It was extremely well done and I think pretty accurately represented what Mars looks like. It highlighted many of the challenges and approaches that will be required of people to live for a long time on Mars. It highlighted the need for oxygen, CO2 removal, limitations of



Source: 20th Century Fox, *The Martian*

water, the need for food, the limits of power, dust storms and the need to reuse and reutilize supplies. Those are all critical issues and I think very well highlighted. They picked a good crop. Potatoes in our tests were the winners in the “yield derby” in terms of being able to convert an amount of carbon dioxide into edible food or what we call our “harvest index.”

**JP:** What about the fact that he was tilling the soil?

**GS:** Hydroponics would have been easier to manage but let’s give him some credit, he was sort of stuck. As it turns out, the Martian soil has these compounds called perchlorates in them which would be toxic to the roots. On Earth, they wouldn’t be too much of a problem. You can rinse those out with water... but he (Matt) didn’t have a lot of water. His water calculations were off by about 400%. So he would have needed a lot more water to meet the transpiration demands of the plant, even if he’s recovering and recycling off of the inside of the grow unit (I would assume was all lined with plastic).

So he’s a got a soil, he had a few nutrients in utilizing his own feces to enrich to soil for nutrients. It’s an age-old practice. In reality you would probably mix some of the feces in with the soil to cut the nitrogen load and a bit of ammonia. But building the soil with the bacteria and feces is a reasonable approach. So he very systematically had his “daughter plants,” he cut them, planted those to increase the number of plants for production, and slowly built up his soil.

One of the biggest shortcomings would be the structures – he just didn’t have enough light to get high yields. First, the light intensity from sunlight on Mars, under best of conditions, is about one half of that on Earth, so yields would be lower. Second, Mars atmosphere is about a 1000th of what it is here on Earth which means you’d have to have a very thick structure to

maintain a pressure that a human (or a potato) could survive in. That structure is going to have to be very rigid and at the same time transparent in order to actually get enough light in. Those materials simply don’t exist at the present time, and I’d assume that whatever the structure is, will block some of the light coming in as well.

**JP:** Please share your thoughts with what’s going on with Scott Kelly (and the lettuce and zinnias grown) on the ISS recently.

**GS:** First, I think it’s just absolutely fabulous. The Vegetable Plant Production System (Veggie) has been up there for about a year now. I was fortunate enough to be very much involved in the early design stages of the rooting system, testing the lights and evaluating crop systems. Upon my accepting the Marie Curie Fellowship in Ireland, Dr. Gioia Massa took the lead on developing the VEGGIE flight experiment. She is doing a great job. What I think has been really important is that it (Veggie) has been a symbol that we’re moving on to the next level.

Astronauts have been able to grow their own food in space and they have eaten the fruit of their labor. That has resonated with people all over the world and received an incredible amount of visibility. The second experiment was to test another plant, the flowering of a zinnia; that truly means we are able to take our food and our recreations with us as we explore the universe and the psycho-social benefits of plants can all be incorporated in space now. And it’s being done. Scott Kelly has done a good job of highlighting that. The publicity is resonating that it is possible to take these familiar crops that we grow on Earth with us into space. What I would like to see is to highlight how these closed system challenges of growing remotely on a space station can apply back down here on Earth. Instead of feeding three astronauts, you can help feed three million people in a city or three billion of a growing population on Earth.



 **Scott Kelly** @StationCDRKelly · 9h  
Yes, there are other life forms in space! #SpaceFlower #YearInSpace

*Above: Zinnia – The first flower grown in space.*

**JP:** How's life in Ireland?

**GS:** Life in Ireland is good. I have been splitting my time between Ireland and Florida, and a lot of time recently has been in Florida to prepare for this upcoming CASIS-sponsored flight experiment where we'll be looking at plant-microbe interactions. In Ireland, I'm working with several groups to identify and develop opportunities in controlled environments. There are challenges but things are beginning to develop over here. Personally, I enjoy it in Ireland and I think it provides some real opportunities as a springboard for controlled environments moving into Europe.

**JP:** I would imagine it is gray and moist today... as it will be tomorrow... and the day after?

**GS:** The climate is really interesting and always an adventure! I got up this morning and it was overcast. I had a meeting. I walked out and it was sunny. As I walked across the bridge over the River Shannon the clouds were coming and I said "Oh I hope the rain holds off!" Which it did; I got hit by a hail storm instead. Then it cleared off and it was crystal blue and pleasant all afternoon.

*Sounds like they could use a wee bit o' the CEA! 🌱*

Jim Pantaleo works to develop all aspects of indoor vertical farming and writes as an industry advocate.

He wishes to express heart-felt thanks to Dr. Gary Stutte, Chris Higgins and the staff at Urban Ag News.

# The Inside Story, 1971



by Archives of Ontario

This film profiles greenhouse farming in Leamington from soil preparation to marketing and consumption (it also includes shots of Ontario Food Terminal in Toronto).



## GOD'S ACRES ALL YEAR VEGETABLES IN STEINBACH, MB

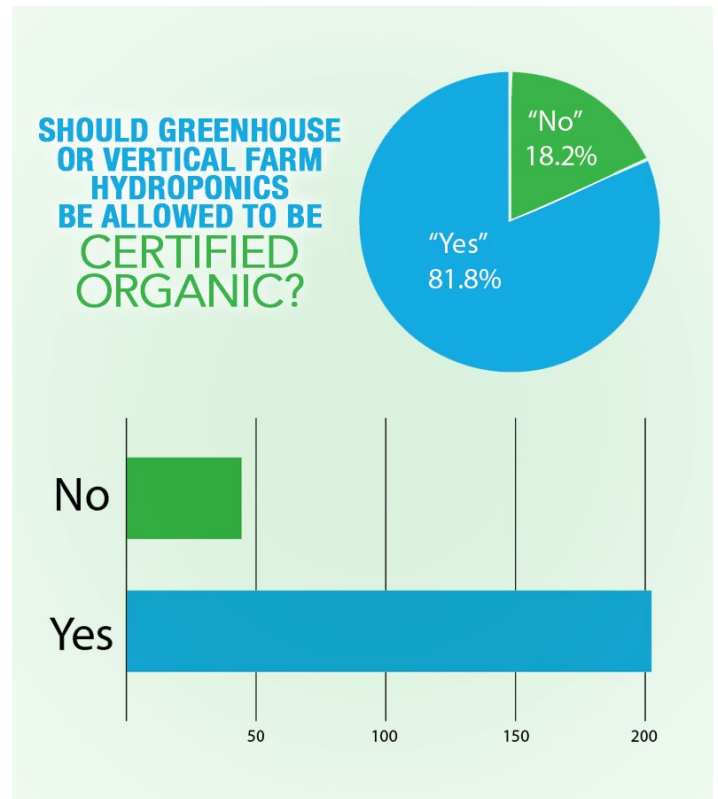
BY SHAWTV WINNIPEG

JESSICA CABLE INTRODUCES US TO HANS STEINMANN, OWNER/OPERATOR OF GOD'S ACRES, AN AMAZING FARM THAT GROWS VEGETABLES ALL YEAR LONG!



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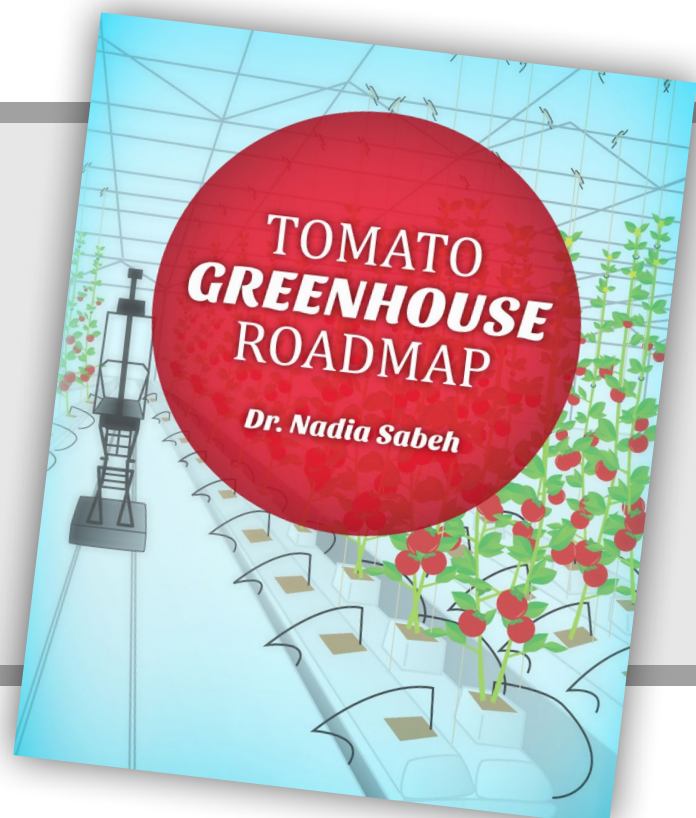


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# JAPAN

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## SPECIAL REPORT

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### JAPAN PLANT FACTORY ASSOCIATION WORKSHOPS FOCUS ON PLANT FACTORY PRODUCTION, BUSINESS ISSUES

For anyone who believes plant factories (PFALs)/vertical farms are only for leafy greens or for anyone who has given up growing strawberries in plant factories, they may have to reconsider their way of thinking. There is a great future ahead for strawberries, especially after the Japan Plant Factory Association (JPFA) held its 96th monthly workshop on “Next-Generation Strawberry Growing System.”

The workshop gave participants the opportunity to learn what is happening in Japan’s commercial strawberry PFALs. Also during the workshop, academic researchers and research institutes provided updates on what they have been working on with state-of-the-art strawberry cultivation methods which further raised the excitement about the positive growth potential of strawberry PFALs.

#### Workshop topics

JPFA has been organizing workshops every month together with companies and academics/research institutes since 2009. Every session deals with different subjects and allows

for the exchange of views from various backgrounds. During each workshop more than 100 PFAL-conscious farmers, companies, researchers and individuals invigorate the discussions.

#### *The most recent workshop sessions included:*

- LED grow lights. Product features were presented by seven of Japan’s major LED grow light companies to learn about each product’s characteristics based on real data that had been released by the companies.
- The real issues related to workability, operational management, sales and distribution confronting commercial farm operators. The details of actual experiences were talked about by large scale commercial PFAL farms. One of the topics covered was how these farms have overcome operational issues and improved their profitability after having received support from Chiba University and JPFA, etc. Unique vegetable suppliers and distributors shared their expertise with the attendees.
- Current situations on leading Japanese greenhouse farms (CEA).

## Much more than education

On July 13, 2016, JPFA will be celebrating its 100th event in Kashiwa-no-ha campus. Japan Plant Factory Association (JPFA) is a non-profit association devoted to academic and business advancements in the plant factory/vertical farm/CEA industry. More than 10 consortium R&D projects are conducted in PFALs and greenhouse facilities onsite. Along with the monthly workshops, JPFA also offers training courses and intensive business session courses every month for professional growers and potential industry entrants. Business matching, consulting service, research activities and any collaborations are always welcome.

For more: Japan Plant Factory Association,  
[info.english@noplantfactory.org](mailto:info.english@noplantfactory.org);  
<http://noplantfactory.org/english.html>

*-Eri Hayashi*  
Japan Plant Factory Association (JPFA)  
E\*Green Lab Inc.





# *Urban Ag* **ZONING**

LESSONS FROM SAN ANTONIO





BY MITCH HAGNEY

In many cities, urban gardeners operated in a legal gray zone in terms of where they were permitted to grow and sell produce. Many growers were uncertain about whether they could use spaces like alley-ways, restaurants, or rooftops in addition to backyards.

Most laws don't currently account for indoor farms, because they are a distinct break from what zoning would normally interpret as a farm. Many officials aren't even sure if a shipping container system is a building, and vertical farms wouldn't be zoned agricultural under current laws.

### *Changing current restrictions, laws*

To ease the transition to larger scale controlled environment agriculture, advocates will have to adjust zoning and permitted use laws.

It may seem like a non-issue to many gardeners or farmers that food production should happen throughout the city, but some residents and policymakers are apprehensive about letting commercial food production and sales occur in residential areas.

Many cities have already struggled with the tension that comes with unusual urban land use, and these conflicts will only become more common as urban agriculture rises in popularity. In Santa Fe, an urban farm which sold produce on site ran into problems because of restrictions on its residential type zone. The business, Gaia Gardens, was cited by inspections agents for multiple problems, including a lack of permitting and business license. The tension escalated to a city-wide disagreement that the city council had to legislate reactively.

Sacramento, trying to avoid being reactive to problems, worked hard to clearly establish guidelines through an urban agriculture ordinance. The process ended up creating stringent restrictions that gardeners and farmers resisted. Even after a second ordinance was passed to loosen them, farms are still limited by acreage and produce can only be sold on certain days of the week on site unless the property's "primary use" is agriculture.

In Austin, a farm located in a single-family residential district was temporarily shut down after a disagreement over an unpleasant smell from neighbors caused the city to intervene. HausBar Urban Farm eventually reopened after a combination of fixing certain code violations like too many structures on the property and the encouragement of an urban agriculture





ordinance, but only after a tense time between many residents and growers.

In San Antonio, there are nearly 100 community gardens and a handful of urban farms. The Food Policy Council, a local nonprofit, wrote and submitted amendments to the Unified Development Code after coordinating and receiving input from different groups throughout the city. The Development Code in San Antonio is updated once every five years, and primarily concerns available land uses in different zones. The city council passed the urban agriculture code amendments.

### *Proactive in San Antonio*

Leslie Provence, vice president of the Food Policy Council and the prime author of the code amendments said, “Our city has always had chickens in neighborhoods and we’re blessed with a big agricultural background. We wanted to be proactive to affirm that growing anywhere is allowed before any complaints could lead to restrictions.”

Experienced policymakers generally recommend gathering stakeholders together before making any firm recommendations, and those crafting law to affect urban agriculture may find value looking broadly at who is included in that stakeholder group. In San Antonio, the Food Policy Council brought in typical participants like gardeners, urban farmers, and development

services, but they also solicited help from the city’s Metro Health Department and the Housing Authority.

Those extra stakeholders had information that proved useful. Both departments had experience dealing with development restrictions that came out of zoning policy, so they knew specific language to use or avoid. Once the language change was submitted, their sign-on approval helped convince councilmembers that broad support already existed, smoothing the way for easy passage.

Some of the amendments legalized the sale of produce on site at either homes or farms, something that was previously unlawful. This brought the city into compliance with a recent state law which allowed for “cottage foods” to be produced and sold at homes without standard business permitting.

Ultimately, the amendments also created several new legal definitions for farms themselves. A “residential market garden” is for residents who grow crops on their residential property who want to sell uncut produce to buyers. They are legal in every zoning district in the city and there are no restrictions on days of the week or sales volume. An “urban farm” is for outdoor property, either in an open lot or greenhouse, that is not located on a residence where produce is raised and can be sold off-site. “Indoor growing” is raising or harvesting any crops on a commercial basis indoors.

In San Antonio, residential gardens and indoor growing are both permitted by default in every zoning district. Only open lot urban farms have a restriction, where they must apply for a special use permit to be in certain residential districts. Those special use permits can be costly and slow to acquire.

“Our opening bid was to make everything legal in all zoning districts,” Provence said. “Late in the process, city staff came back with some restrictions on multi-family districts. We agreed to that when you submit zoning code changes they can be shot down at any time, even if it’s due to a minor edit or clarification, so we ended up pushing a more conservative amendment in the end to be safe.”

Several council members have since changed their stance on the residential urban farm special use requirement, with plans to revisit the subject in the coming months.

### *Making progress*

As both a commercial hydroponic farmer and a board member of the Food Policy Council, I was a part of the code amendment process from the beginning. Between drafting language, submitting it, and receiving approval, the total process took nearly a year.

The incremental approach of targeting multiple on-the-books city codes one at a time rather than drafting a single urban agriculture ordinance has so far received no real opposition and required few resources from San Antonio policymakers. The next goals for the city’s urban farming community are to eliminate the special use permit requirement for residential lots and expand the amount of livestock legally allowed on residential properties (currently they’re limited to three chickens and two mammals).

One obstacle that is harder to remove is that Texas individual home owners associations (HOAs) can restrict farm or garden production and city governance has no ability to intervene. The authority of HOAs over their members’

property is protected at the state legislature, so a reduction in restrictions has to take place either at the neighborhood level or in the state capital. Most homes in San Antonio aren’t within HOAs, however.

In San Antonio, the code change resulted in a wave of excitement and participation in urban agriculture projects by the general public and the Food Policy Council in particular. More importantly, it signaled that the city is ready for commercial urban farming businesses to move in and flourish. 🌱

Mitch Hagney is a writer and hydroponic farmer in downtown San Antonio. Hagney is CEO of LocalSprout.





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# IS THE FUTURE OF FARMING IN PUBLIC SCHOOLS?

BY JENNIFER PRESCOTT

On a chilly February 26, excited student greenhouse ambassadors of PS84 in Williamsburg, Brooklyn greeted a host of city and local dignitaries arriving to tour and cut the ribbon for the launch of their amazing 1,500-square-foot hydroponic greenhouse classroom rooftop facility. As New York City Council member Stephen Levin observed, “it’s 34 degrees out and we are in this beautiful greenhouse growing food!”

Principal Sereida Rodriguez-Guerra—observing the student ambassadors guiding each guest on a tour, with thorough explanations of each hydroponic system—was understandably proud of the students and the school community as she reflected on the last 4 years of work steering the development of the greenhouse along with NY Sun Works. “These guys”, she said gesturing to the students, “dressed in black and white, look at them, just listening to them, and this is just a small portion of our children. Our children have been working the green classroom, they know the hydroponic systems, they know how they work, and they’re just as excited to be up here and do it at a bigger scale, but I really really want to thank Diana Reyna, because we both grew up here in Williamsburg, and for her to believe in our vision, and really rallying everyone up to stand behind us and see this through, thank you so much.

The festivities continued as Principal Rodriguez-Guerra then introduced Brooklyn Deputy Borough President Diana Reyna to the podium. Reyna has been a significant force in galvanizing the will and

funds for the traditionally underfunded public school’s educational programs in her borough. She is fighting for “21st century technology and skills” for these kids. And to be sure, Borough President Adams and Deputy President Reyna recently allocated 2 million dollars to NY Sun Works for the development of 12 classroom greenhouse/labs over the next year.

“These are the scientists, the lab researchers, these are the academic visionaries and entrepreneurs that we need to invest in, and so we want to make sure they don’t fall short,” Deputy Borough President Reyna said at the opening. “Within each school district, we’ve mapped out what the options are so that when you graduate PS/MS 84 that you will have a high school to go to to have this same [greenhouse classroom] learning experience and a more challenging and rigorous curriculum within your own community, making sure that everyone understands that you will compete globally, and you will be prepared to do so.”

Technology and farming for the future is exactly what PS84’s greenhouse science lab represents. The systems include a large NFT (nutrient film technique) system for leafy greens, Dutch bucket systems for vine crops like melons, tomatoes and cucumbers, a state of the art aquaponics system, tower gardens for herbs, a vertically integrated growing system (a NY Sun Works proprietary design), and rainwater catchment and evaporative cooling systems, making the lab as environmentally friendly and efficient as possible.



NY Sun Works greenhouse/labs also include STEM and environmental science curriculum that can be integrated with existing science curricula at the discretion of the school. In addition to building an understanding of all facets of sustainability—pollution, contamination, bio-diversity and conservation—students that participate in a NY Sun Works greenhouse/classroom lab gain valuable experience in urban farming as they learn science.

Advocates for the development and expansion of the “Brooklyn Project” (as NY Sun Works has come to call it)—including council members Antonio Reynoso and Stephen Levin, as well as Borough President Adams and Deputy President Reyna—do not shy away from addressing the social justice issues these greenhouse labs help to address. For families with often limited access to healthy food, sharing urban farming knowledge with their families and community represents a powerful shift in the urban landscape with regard to the value of food. At the opening, student ambassador Olivia proclaimed “my favorite part [of the greenhouse] is that we grow food to make people healthy.”

Jennifer Prescott  
School Liaison & Program Support  
NY Sun Works

*Photos courtesy of Daphne Youree*






# KNOW YOUR GOALS BEFORE INVESTING IN A WATER TREATMENT SYSTEM

BY DAVID KUACK





## A WATER TREATMENT SYSTEM IS NOT GOING TO ADD VALUE TO YOUR PRODUCT. IT'S ALL ABOUT REDUCING THE RISK OF CROP LOSSES.

One of the advantages that ornamental plant growers have over growers of hydroponic edible crops is that ornamental crops are usually produced with some kind of root substrate.

“Most ornamental plant growers are not purely hydroponic,” said Paul Fisher, who is University of Florida professor and floriculture extension specialist. “That means ornamental growers have more options they can use for water treatment compared with a hydroponic system where the roots are bathed in the recirculating solution. For instance, with hydroponics, a grower needs to be especially sensitive to the accumulation of chloride from chlorination or copper from copper ionization in the recirculating nutrient solution.”

## KNOW YOUR WATER CONCERNS FIRST

Fisher said one of the challenges that growers face with water treatment is the tendency to choose a solution without first finding out what the problem is.

“There are many different potential water quality problems that growers can have,” he said. “These can be broken down into microbial problems (plant pathogens or biofilm), chemical problems (salts, alkalinity and occasionally pesticide residues) and particle (filtration) problems. Growers should think in terms of these three different types of potential problems.

“They should test their water and only then decide on the appropriate solution. No single technology is a silver bullet. In some instances, water treatment companies are aggressively pushing one particular technology that they sell, which may be a good solution for one problem, but not others.”

Fisher said before growers make any decision about water treatment, they need to define what issues of water quality they want to address.

“When a grower sends a water sample to an analytical testing lab, the most common water test is to measure the concentration of dissolved ions,” he said. “These tests could include alkalinity, sodium and chloride, electrical conductivity (EC), hardness (calcium and magnesium) and other ions such as iron or boron in the water.

“A complete lab analysis will help growers select the best fertilizer recipe, because the nutrient solution is a combination of the water source and added fertilizers. For example, if growers have enough calcium and magnesium in their irrigation water, then they may not need to add these nutrients in the fertilizer. Chemical water analysis also helps decide if additional treatment is necessary, such as acidification if water alkalinity is high or reverse osmosis if the EC is high.”

## COMMON, UNCOMMON WATER ISSUES

Fisher said if growers are using well water or a municipal water source, the most likely problems to treat for are alkalinity or high salts, depending on where a grower is located.

“High alkalinity is a very common water treatment issue in our industry,” he said. “Irrigating with highly alkaline water is like adding lime to a crop with each watering. The pH climbs over time leading to iron deficiency. Injecting an acid such as sulfuric, nitric, or phosphoric acid may be needed.”

Fisher said another common issue with water is high EC. Typically the most common cause for this is sodium chloride. He said reverse osmosis is one of the treatment options for high EC where ions are removed when water is passed at high pressure through a membrane.

“One of the biggest differences from one hydroponic location to another is the incoming water quality,” he said. “For example, in the Midwest if there is a limestone aquifer and growers are using well water, there may be enough calcium and magnesium that these nutrients don’t need to be in the fertilizer solution. In contrast, in parts of the Northeast and North Carolina where the water has a low EC, growers must choose a fertilizer that is going to contribute most of the nutrients.

Fisher said another challenge with EC management that is important for hydroponic growers is to know what is making up the EC in their recirculating solution.

“For example, nutrient levels drop over time because of uptake by plant roots, but the water source contains a significant amount of dissolved ions,” he said. “Then much of the EC may be coming from sodium and chloride rather than nutrients such as nitrogen, phosphorus and

potassium. These growers will have to do a certain amount of replacement of their nutrient solution. For example, they may have to dump a certain amount of their nutrient solution every two weeks to prevent the sodium chloride from accumulating. This can be an environmental hazard (encouraging eutrophication of water supplies) and also increases fertilizer costs.”

Fisher said once growers deal with common water quality issues they may face issues that are unique to different parts of the country.

“I am working with a grower in Indiana and another grower in Florida who have high iron in their water,” he said. “The iron is clogging filters either directly because of rust particles or because of bacteria growing on the iron. There can be a mix of iron that is already a solid particle, which is rust, and there is also dissolved iron.

“The process of removing iron is to oxidize it and turn it into rust. This can be done using chlorine or potassium permanganate or some other oxidant. Ozone could also be used. Once the iron is turned into rust the water can be run through a sand filter. The filter will trap the iron particles. The filter will have to be washed out periodically to remove the particles. These are examples of why it is important to test the irrigation water first, identify the issues, and choose appropriate solutions.”

## BIOLOGICAL ISSUES

Fisher said if growers are using well water or municipal water it is very unlikely that the water is going to be the source of a plant pathogen. These water sources may be helping to distribute a pathogen if growers are recirculating the water, but the incoming water is likely to be very clean. He said when the water source is surface water, from a pond, or from a recirculation tank, it’s more likely that the water could be a significant source of pathogen inoculum.



BEFORE GROWERS MAKE ANY DECISION ABOUT WATER TREATMENT, THEY NEED TO DEFINE WHAT ISSUES OF WATER QUALITY THEY WANT TO ADDRESS.

Fisher said one of things that can happen with any of these water sources is that there are three types of biological problems:

1. Plant pathogens
2. Biofilm
3. Human safety bacteria (i.e. E. coli)

“The most common pathogens that would be favored in irrigation water are the oomycetes of *Phytophthora* and *Pythium*,” Fisher said. “If growers have root disease problems and suspect that their irrigation water may be a part of the disease distribution, they can send a water sample to a university extension lab for testing. However, it can be hit-or-miss as to whether or not a pathogen is going to be present in a particular water sample. Routine sampling of irrigation water for disease detection is not something that most growers normally do because of the time and cost.”

Fisher said many of the state extension plant diagnostic testing labs are able to run samples for plant pathogens.

“The labs typically plate organisms out to the genus level of the organism, identifying whether it is *Pythium* or *Phytophthora*,” he said. “It really matters a lot what the species is, which many labs are able to analyze, although this may take longer and cost more. *Pythium* can be quite ubiquitous. *Phytophthora* tends to be more aggressive than *Pythium*.”

*Photo courtesy of Paul Fisher, Univ. of Fla.*



“The University of Guelph diagnostic lab will check the DNA fingerprint of what’s in the water. The lab can compare a sample with a data base of other plant pathogens.”

## DEALING WITH BIOFILM

Fisher said when growers contact him with a biofilm problem, he asks them to send samples to a water testing lab to measure the aerobic bacteria count from different sampling points in their irrigation system. Usually, but not always, he said, well water has a low bacteria count.

“If growers are using pond water, it is very likely that there is going to be a high bacteria count,” he said. “These high bacteria counts occur because of the presence of microbes including cyanobacteria and other algae. When there are very high bacteria counts, growers usually have to treat for microbes if they use mist nozzles or drippers. The microbes may not be plant pathogens that cause disease, but they may clog irrigation emitters and filters.”

Fisher said if growers have a biofilm problem, they need to determine where the bacteria are coming from.

“Growers would collect water samples from the water source, after the water is chlorinated, after the fertilizer is added to the water, and out in the greenhouse,” he said. “By testing samples from

these different locations will identify where the bacteria are growing in the irrigation water and where the water treatment needs to occur. It will also tell growers, whether the treatment systems they are using, for example, chlorine, chlorine dioxide or ozone, are effectively controlling the microbes.”

## PARTICLE ISSUES

Fisher said particles in the water could include algae from pond water or sediment (clay, silt or sand). These particles can clog up filters and water emitters.

“Water testing labs should be able to provide a measurement of turbidity, which is the clarity of the water, and also the amount of total suspended solids (TSS),” he said. “A lab will take a specific water sample volume, filter it through a very fine filter and then dry it down and weigh it. This will determine the TSS in terms of milligrams (weight) of particles in a liter of water.

“From experiences with growers, if there is more than 5 milligrams of suspended solids per liter of water, it is quite likely that there are enough particles in the water to cause some issues in the irrigation lines.”

Fisher said growers who are using municipal water typically use screen filters.

“It is unlikely that a high concentration of suspended particles will come from a municipal water source,” he said. “For risk management purposes, however, growers usually install one or more screen filters with enough filtration to remove any suspended particles that are large enough to clog up the finest irrigation emitters in the system.”

In the case of well water, Fisher said growers occasionally may pull up some suspended particles like silt that may require they install some additional filtration.

He said there are two kinds of recirculated water. Pond water usually comes from the water that is drained off outdoor areas or as runoff from a greenhouse. The other source of recirculated water drains off from ebb-and-flow concrete floors or troughs/benches in a greenhouse and is stored in concrete tanks. Water from these sources has similar needs in regards to filtration.

“Pond water will contain algae and other bacteria,” Fisher said. “With ebb-and-flood systems there can be root substrate and plant debris. With pond water there are usually pumps that are pumping water through a filter and then the water, which is under pressure, goes all the way to the greenhouse. There is usually a series of filters for organic materials, including disc filters, sand filters and sometimes screen filters.

“The greenhouse that is being filled with water and then drained back is filtered and stored in another supply tank. This is typically where paper filters, vibrating screen filters and rotating drum filters are used. This is usually a gravity-fed system.”

## AGRICHEMICAL RESIDUES

Fisher said if growers suspect they are having a problem with their crops that is not related to nutrition or disease, it may be an agrichemical issue.

“Growers may suspect there is something toxic in their water that might be herbicide runoff from a neighboring farm or it may be growth regulator residues from past applications,” he said. “There are special labs that are able to test for these chemicals. But growers need to know what chemicals to specifically ask a lab to test for.

“In my research program we are doing a lot of work on removing paclobutrazol residues

from irrigation water using carbon filtration. Paclobutrazol has a half-life of about six months in irrigation water. It is normally applied in the parts per million range. But the chemical has activity in the parts per billion range, even as low as 5 parts per billion, on sensitive crops like begonia. There can be some leachate from the spraying or drenching of paclobutrazol that gets into recirculated irrigation water that can then impact untreated plants.”

## KEEP THE SYSTEM CLEAN

Fisher said growers should try to keep their irrigation systems clean, but they don't have to sterilize them.

“Cleaning out the recirculating tanks, greenhouse surfaces and irrigation lines several times a year is good idea,” he said. “Although most of the microbes in a recirculation system are likely to be beneficial or benign, the equipment can start to clog. There is going to be algae growth and there is the possibility of pathogen spores getting embedded in biofilm. The goal is to keep the system clean, but there is no need to continually kill all of the organisms in the system.

“Growers who are not using fine drippers or mist nozzles are less likely to have a problem with clogging from biofilm.”

Fisher said after power washing the water storage tanks growers can apply an agricultural cleaning product, such as Strip-It, which is widely used. This helps to remove biofilm.

“This treatment may keep the system clean enough that it is not necessary to continually inject some type of sanitizing agent,” he said.

## MAINTAINING DISSOLVED OXYGEN LEVELS


Fisher said dissolved oxygen is mainly an issue for hydroponic growers because roots are bathed in the nutrient solution. In contrast, when growing in a root substrate with a high level of air porosity (from large particles in the substrate), the roots will receive adequate oxygen so long as the plants are not overwatered.

“If growers are using a nutrient film technique (NFT) system, then the movement of the water helps oxygenate the nutrient solution,” he said. “Aeration of the nutrient supply tank may still be required.

“With floating pond systems, low oxygen conditions are likely to occur. If the water temperature is warm, there is going to be a lot of biological activity occurring and respiration by the microbes. Warm water also holds less oxygen than cool water. It is a good idea to install some type of bubbler. A bubbler creates small bubbles that add oxygen to the water and raise the dissolved oxygen level. If the oxygen level becomes low in a hydroponic solution then it can favor pathogenic organisms such as Pythium. The water should contain at least 5 parts per million of dissolved oxygen.”

## INVESTING IN A TREATMENT SYSTEM

Fisher said growers should place their emphasis first on ensuring their plants are healthy and growing well. Their incoming water should be from a high quality well or municipal source and there should be a high level of overall sanitation. With this



foundation in place, he said, an expensive water treatment system may not be needed.

Fisher said growers need to think in terms of profitability of their business when considering water treatments.

“Margins are tight for most growers so they need to think about how they are going to generate a positive return on their investment,” he said. “If there is an existing chemical, biological or physical water quality problem that has been clearly identified (including lab testing), then investing in a targeted water treatment solution to that problem will rapidly be paid back.

“However, if growers are spending money on a water treatment system that they don’t need, then they don’t have that capital available to spend on an alternative investment such as supplemental lighting that could increase their yields.”

Fisher said a water treatment system is not going to add value to growers’ products.

“No one is going to pay growers more for their product just because they have installed a water treatment system,” he said. “It’s really about crop losses and reducing the risk. When growers have a root rot problem caused by a water-borne pathogen, then they can very quickly pay back the benefits of a water treatment system.” 🌱

For more: Paul Fisher, University of Florida, Institute of Food and Agricultural Sciences Extension.

David Kuack is a freelance technical writer in Fort Worth, Texas; [dkuack@gmail.com](mailto:dkuack@gmail.com).

*Photo courtesy of Mike Evans, Univ. of Ark.*



# Happy Retirement

# PATRICIA RORABAUGH

PH.D.

*Urban Ag News & CEAC would like to THANK Dr Rorabaugh*

Thank you for contributing to the industry of controlled environment ag!  
Thank you for 18 years of educating nearly 500 students!

## *From the CEAC:*

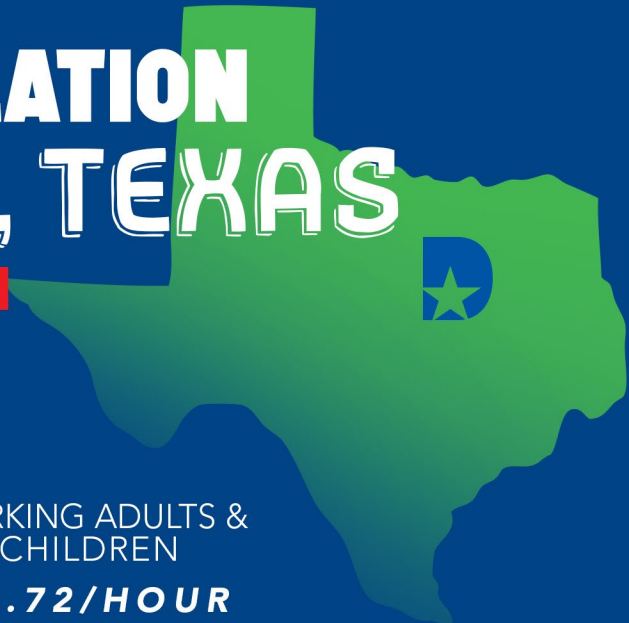
“The CEAC would like to congratulate Dr. Pat Rorabaugh on her well-earned decision to retire in the summer of 2016. Anyone that is familiar with the CEAC knows that Pat is the engine that keeps us running full speed ahead. Whether you visited the CEAC as a student, a short course attendee, or to take a greenhouse tour, Pat was always there going the extra mile to make sure every last question was answered. We will miss her, but will also cherish the time she is still here at the CEAC. The CEAC and the ag industry will not be the same without her hard work and passion!” [Click here for more>>](#)





# LIVING WAGE CALCULATION *for* DALLAS, TEXAS

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1 ADULT	2 WORKING ADULTS & 2 CHILDREN
<b>\$10.37/HOUR</b>	<b>\$13.72/HOUR</b>

## *Annual Expenses*

1 ADULT

**\$3,022** ON FOOD  
**\$0** ON CHILDCARE  
**\$2,144** ON MEDICAL  
**\$7,224** ON HOUSING  
**\$4,697** ON TRANSPORTATION  
**\$2,253** ON OTHER THINGS  
**\$19,340** REQUIRED ANNUAL INCOME AFTER TAXES  
**\$2,228** ANNUAL TAXES  
**\$21,568** REQUIRED ANNUAL  
 INCOME BEFORE TAXES

2 WORKING ADULTS & 2 CHILDREN

**\$8,903** ON FOOD  
**\$7,977** ON CHILDCARE  
**\$6,597** ON MEDICAL  
**\$10,956** ON HOUSING  
**\$11,553** ON TRANSPORTATION  
**\$5,178** ON OTHER THINGS  
**\$51,165** REQUIRED ANNUAL INCOME AFTER TAXES  
**\$5,894** ANNUAL TAXES  
**\$57,060** REQUIRED ANNUAL  
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\$20,260



**FARMING, FISHING, & FORESTRY**

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# NEW GROWING SYSTEM ARRIVES IN UK

By Nina Pullman

Originally published on Tuesday, February 16, 2016 by the Fresh Produce Journal

Growing in confined and protected spaces has become even more viable with the arrival of the Growtainer. Nina Pullman chats to co-founder Glenn Behrman.

**GLENN BEHRMAN:** We have found that LED lit, climate-controlled vertical farming is perfect for the production of herbs and leafy greens. Products can even be grown in a supermarket parking lot. Just a few of the advantages of this type of production are that products are much fresher, there is more control, no pesticides and more opportunity to produce smaller quantities of gourmet and ethnic products.

## WHO IS CURRENTLY USING THEM IN THE UK?

**GB:** This portable high-tech indoor farm left our Rotterdam facility for a wellknown UK grower last week – our first UK customer. This is the first unit of its kind built and sold in Europe. There are operating units in the USA in Dallas, Texas and New York City. We already have orders for other major European cities, both for research and production.

## HOW DO THEY COMPARE TO EXISTING GROWING SYSTEMS?

**GB:** Nothing will ever replace the traditional field grower or greenhouse grower, at least not in our lifetimes, but this is the beginning of technology-based production. I believe that this will encourage more young people to get involved with farming, I believe that it will motivate and inspire people to further creativity and research in agriculture. I think that Controlled Environment Agriculture is still in its infancy but it's catching on very quickly. When I first started getting involved with this (after 40 years in horticulture) it was science fiction, but now it's ready to become mainstream.



## HOW MUCH DOES A GROWTAINER COST AND WHAT FACILITIES DOES IT COME WITH?

**GB:** A Growtainer costs between \$90,000 (£62,000) and \$100,000 (£70,000) and can be delivered to most of Europe. Each unit comes equipped with the appropriate LED lighting, climate and environmental controls, a complete irrigation system including monitoring and dosing and a specially designed Growrack system with from 30 to 50 growing levels (depending on the crop).

## HOW BIG IS THE GROWTAINER AND HOW MUCH COULD IT PRODUCE OF A TYPICAL BABY LEAF LINE, FOR EXAMPLE?

**GB:** Each grower is different and I don't like to make production representations. But each Growtainer can hold between 180 and 250 standard 10" by 20" grower trays. Take micro-greens – using that scenario a grower can produce 250 trays every 10-14 days. Growtainers are stackable and can be modified in many different configurations. The idea of a Growtainer farm is very appealing since they only require a very small footprint.



## WHAT ELSE SHOULD A GROWER KNOW ABOUT GROWTAINERS?

**GB:** I think the two most important things that I'm working on are a series of crop-specific Growtainers and a significant amount of research in Controlled Environment Production. I'm very curious about the power of CEA. Not everything is profitable in a controlled environment for one reason or another so what we are doing is developing a Growtainer that is based on a profitable business case. We know what crops have the highest profit potential in this high-tech environment so we're designing and building Growtainers that are perfect for those crops.

<http://www.fruitnet.com/americafruit/article/1474/parts-of-san-diego-quarantined-as-psyllid-countmounts>

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FARMER TYLER TALKS WITH BRETT ELLIOTT, FARM MANAGER AT ELLIOTT GARDENS



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