

# URBAN AG NEWS



## **KIMBAL MUSK**

**CO-FOUNDER OF THE KITCHEN RESTAURANTS  
& THE KITCHEN COMMUNITY**

is spreading a "community through food" philosophy **PG 18**

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A conversation with  
**MICHAEL CHRISTIAN**

Founder of American Hydroponics **PG 8**

**ORGANIC PEST MANAGEMENT**

is not a one size fits all cure **PG 36**

# URBAN AG NEWS

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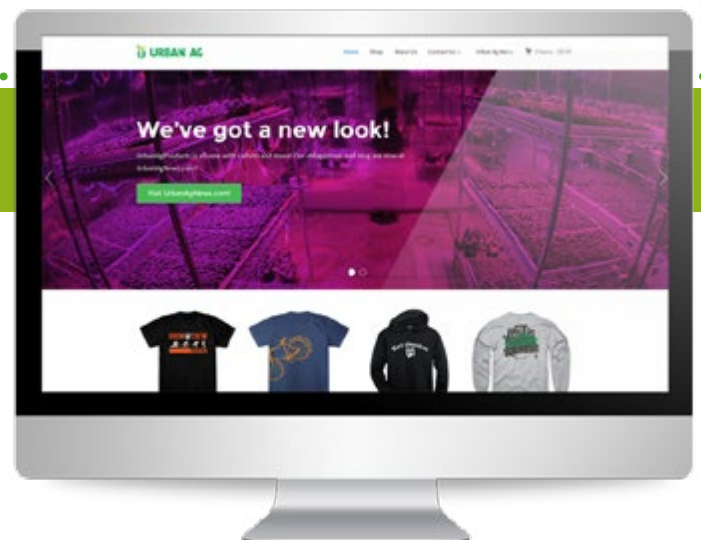
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MICHAEL CHRISTIAN

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CO-FOUNDER OF THE KITCHEN RESTAURANTS  
& THE KITCHEN COMMUNITY

is spreading a “community through food” philosophy

*Photo courtesy of The Kitchen Community*



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# TRENDING

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*A conversation about*  
**Organic Hydroponics**  
*with industry pioneer*  
**Michael Christian**

By Jim Pantaleo



At Urban Ag News, we're all about educating our readers with the goal of providing valuable input from a wide variety of industry professionals. Without question, Michael Christian, founder of American Hydroponics, fits that bill. I was delighted to sit down with him recently to learn of his 30-plus year career in the hydroponics industry and how his insight, in particular about the often contentious argument of what actually constitutes the definition of the word "organic," pertains to growing plants.

Does a plant need to be grown in soil to be truly organic? Can all the biological elements required by the plant be safely replicated to meet the definition? Will soil purists ever find common ground, no pun intended, with hydroponic growers?

These questions are essential to continuing the debate over the word "organic" including the USDA National Organic Standards Board's (NOSB) own definition written in April 1995: "Organic agriculture is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony."

Seems like a fair definition, but not so fast. To say the least, the subject is a complex one and I'm hoping Michael will shed some light, pun intended, on the subject from his point of view. If anything, I'd like for an olive branch (yes, again pun intended) to be laid upon those soil purists who don't believe hydroponic growers either have a heart nor are working, as they certainly are, at making the world a healthier and more verdant place for all.

For some background, Michael started the business in 1984 in the beautiful northern California agrarian community of Arcata, initially to meet the needs of small, hobbyist growers, and for full disclosure, those growing cannabis. Side note: Also known as the Emerald Triangle, the counties of

Mendocino, Humboldt and Trinity make up the largest cannabis producing region in the United States. And perhaps the most often maligned by federal law enforcement over the past 40 years. This could all change in November when Californians will have the opportunity to vote on the ballot measure entitled the Adult Use of Marijuana Act.

As Michael states, in those early days he essentially moved to the top of a mountain to raise kids and make some money. It wasn't until 1994 and a trip to Australia where he saw NFT (nutrient film technique) hydroponics everywhere. In his words, "That just blew me away as there was nothing like that in the U.S." The following year he made the decision to target the commercial market. To this day AmHydro, as it is known, is a well-established and trusted provider of hydroponic equipment to commercial farms and greenhouses worldwide.

Success did not come easily however, and it's only been within the last eight to 10 years that AmHydro found its groove with robust sales primarily of NFT systems into urban areas where demand for locally-grown produce is very high.

Michael recently sold a majority of his interests in AmHydro, but remains on staff to consult on various projects. He is now spending more time focusing on life's more important endeavors, including his grand kids and fly fishing.



*JP*: Michael thanks so much for sitting down with Urban Ag News today, please tell us why you believe there is an (often) adversarial relationship between hydroponically grown (soil-less) produce versus soil-grown when it comes to the definition of “organic?”

*MC*: I think it's in the interpretation. I don't know if it's in the DNA of people who have always seen plants come from soil. When they hear the word “hydroponics” they are kind of intimidated and whatever images they have, be they generated from media or who they talk to, has fortified their interpretation and they actually get angry at you. They say “No way I'd ever do hydroponics and give up my gloves!”

It triggers all kinds of madness, especially many years ago. However that all has changed in the last eight to 10 years. But usually it's because of people's ignorance as to what it is or the value of it or having never tasted it or thinking it's chemical or synthetic or bad or unnatural. All these images are associated in their heads.

One of the contentions is the biological activity in the soil is fundamental because the plant is interacting through the roots by releasing compounds and nitrates and therefore it's feeding and colonizing microbes. That's part of the health of the soil but that also happens in hydroponics and NFT. The roots actually become a rhizosphere. It's a predominant life form. It just shows up so all that biological activity whether in a foam cube or in a peat and coco plug; that biological activity is in the root zone. It really doesn't have much to do with the mechanical structure that holds the plant up. And this is what they are getting down to in the “sand box” argument.

*JP*: I've previously read your reference to “a nitrogen atom is a nitrogen atom.” How would you directly address the naysayers that produce using soil-less methodologies are designated “organic” because all the inputs and amendments are also deemed “organic?”

*MC*: That's a tricky statement because fundamentally in hydroponics all of those elements in a hydroponic nutrient solution or an inorganic mineral are elements. You can't make elements. They are on the periodic table. You can only extract them from nature. And whether you're growing chickens and collecting chicken poop, the food is being produced somewhere. Somewhere every input is coming from elsewhere.

It gets down into a difficult conversation or which is the most sustainable source for whatever input you are bringing in to develop whatever it is you are doing. If it's an organic farm, what are you using in your soil? Where is it coming from? What's feeding it?

I think fundamentally it goes back to the NOP (the USDA National Organic Program) and what their definitions are and what they think is correct.

*JP*: That dovetails nicely into my next question: Do you believe the USDA (in a 2002 statement) was premature in designating the word “organic” without the mentioning of soil (in the definition)?

*MC*: That was then and this is now and we have a different set of constraints in the world. The word “organic” has lost a lot of credibility as big ag is now in it and of all the projects I've seen, there's no way they are all organic. Somehow they jumped through the hoops and paid the fees and now they can benefit from the increased margin of organic produce. So really, the whole thing has shifted. It's going more in the direction of localizing food production. That's where the power is and that's what people are starting to appreciate more. We have a different set of challenges now than we ever had before. The real problem is in the nitrogen cycle; there really isn't enough nitrogen-fixing ability of the soil to support the number of people we have on the planet right now without synthetically producing it with natural gas and





■ (L-R) Fred Lau of Mari's Garden and Fred Humphrey of Island Growers with Michael Christian at the AmHydro research greenhouse in Arcata, Calif.

Photos courtesy of AmHydro

■ Michael Christian visits with Pierre Sleiman Jr. at Go Green Agriculture in San Diego, Calif.

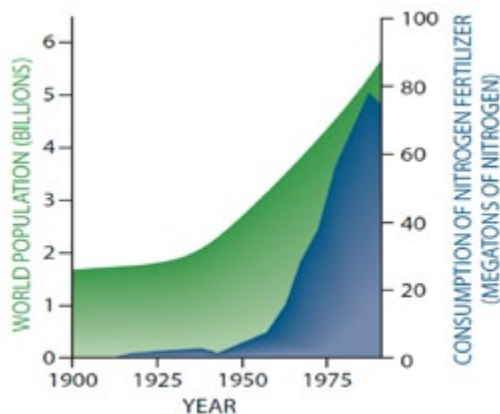


electricity. That's where the really big problem is.

I read an article in Scientific American magazine, back in 1997, and I was pretty blown away with the information they were presenting. The fact is that when you look at population growth you look at a graph and then you look at ammoniacal nitrogen production.

There was a process in the late 1800s where they were actually using natural gas and electricity in making urea (which is ammoniacal nitrogen). You can have just junk soil and then put this nitrogen in there and plants grow.

It wasn't until the 1950s when they began a process called the Haber-Bosch process in Germany and they were able to lower the cost (of creating nitrogen) by 90 percent. By the time they started making ammoniacal nitrogen, there was a direct correlation (and spike) with population growth.



The other method of nitrogen creation is from chicken or cow poop, for example, and the farmer is bringing that in and constantly adding it to the soil. When you look at the primary crops in the world which are basically legumes, grains and potatoes; those are the main crops that sustain the population. And this is where all the nitrogen tonnage is going into, not lettuce or tomatoes.

The scientific community believes there may be more than four billion people alive today because of synthetic ammonia. That's a sobering thought when you think of the carrying capacity of the earth in that all these inputs are derived from somewhere and

they are just moved around. At some point, phosphorous, for example, is just going to run out and when that does happen, how can you replace an element?

This little organic debate pales in comparison to all this other stuff.

*JP:* Why does the organic certification matter to the farmers and growers you know and work with?

*MC:* It allows them (to make) more margin. But that's changing too. I'd say maybe eight years ago all the markets would ask "Is it organic?" And the response would generally be "No, it does not qualify as organic but it is pesticide- and herbicide-free." That allowed farmers and growers to take ground as people would actually prefer that over the designation of organic, especially when it's sitting next to some really ugly looking organic produce. This and the inability of produce managers (in grocery stores) to risk putting something on their shelves that people didn't know about.

So it's been an educational process that's really been successful over the last eight years. I mean, a 25 percent extra margin is pretty decent.

*JP:* Do you believe the organic versus inorganic argument would hold true if the plants produced were flowers or medicinally-based?

*MC:* There's a couple parts to this. One is inorganic or organic, is this in a sun-lit environment like a greenhouse or is this LEDs? Because one thing that I've come to understand through the years is when they talk about PAR light (photo synthetically active radiation) they don't know (squat) about that! The electromagnetic spectrum of sunlight is so huge we only see a fraction of one percent. Our machines may be able to tell wavelengths and nanometers but as far as what a plant is actually taking in and what's affecting it, we



just don't know. For me, having done a lot of LEDs inside, there's no way that (plant) tissue is as healthy or as terse or as strong. I just haven't seen it. Whether it is inorganic or organic in an artificially lit environment, I don't see the health of the plant as I do with sunlit environments.

*JP:* Do you believe the adage that humans, for the most part fear what they do not know, has been a catalyst to the adversarial relationship between soil-grown and soil-less? Or is this fear based on the increase in indoor vertical farming operations and the soil growers essentially fear they will lose business and market share?

*MC:* I think it's all of those. I think they do fear what they don't know and a lot of these big guys, especially big ag with all their machinery, have been doing that (growing in soil) for hundreds of years. They know that they get so much per acre and they can get organic certification if they talk to "Jack" and they jump through hoops.

But meanwhile, all these localized, food production farms have such high production rates. In 8,000-square-foot greenhouses these guys are producing 6,000 heads of lettuce a week, year round. And when you look at 28 million heads of lettuce produced in the U.S. per year, you can see that all you need is maybe 15 or 20 acres located near cities and you're going to put a hurtin' on big ag. People prefer, instead of shipped-in produce at a lesser quality, they prefer locally grown. And the locally-grown guys are expanding like crazy because the market is just so open and ripe right now.

People prefer to know that the grower who is growing the food they are eating lives down the street. And why would he mess with them and put pesticides in their food? It's becoming more of a community operation.

The whole issue of pricing, distribution and organic...people just want to get food from their neighbor. People don't want to feel powerless and they can do something by going to their local store and buying something locally produced.

They can make a difference by doing that. That's an act of power and has more value than the word "organic".

*JP:* Thank you Michael. You are a gentleman and a scholar and I hope you catch some big fish! 🐟

For more: AmHydro (American Hydroponics),  
286 South G St., Arcata, CA 95521;  
(800) 458-6543;  
<http://americanhydroponics.com/>.

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■ **Michael Christian visits with Ryan Snead at The Next Season Farm in Bend, Ore.**



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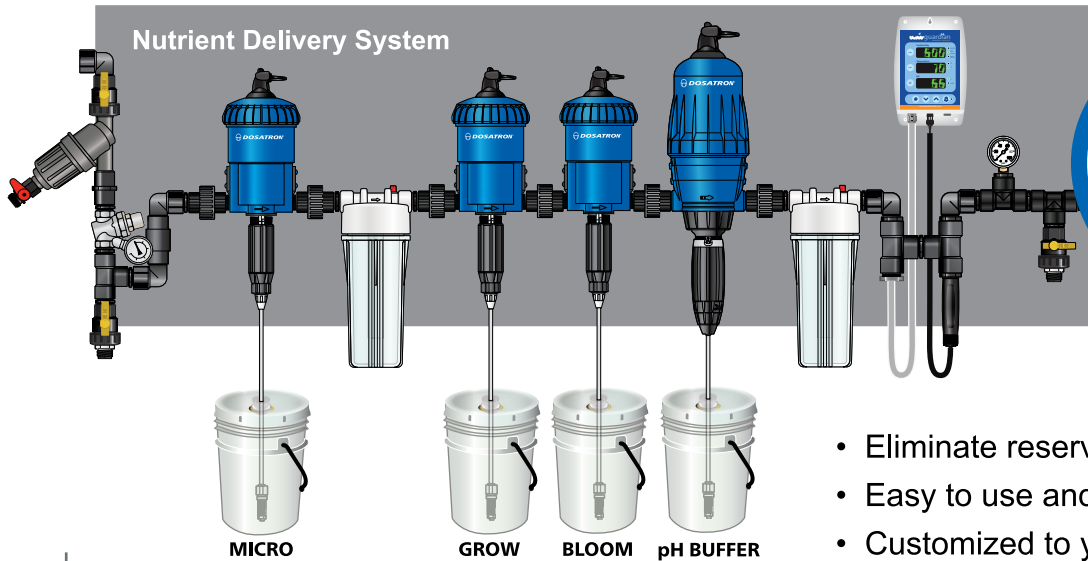


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## ARIZONA FERTILIZER INJECTOR BOARD

*Sustainable Hydroponic and Soilless Strawberry Production Systems*

This video describes the layout of the fertilizer injector board at the University of Arizona and the purpose of each of the board's components.

This project is funded by a grant from the Walmart Foundation and administered by the University of Arkansas System Division of Agriculture Center for Agricultural and Rural Sustainability.





# Optimizing Plant Performance

## Plants Spliced, LED Lights Glow, & Strawberries Bloom

Controlled environments are complex systems with many regulatory factors to be accounted for when growing abundant and delicious crops. Dr. Chieri Kubota, plant scientist at The University of Arizona's Controlled Environment Agriculture Center, looks to optimize plant performance with grafting systems, temperature and lighting evaluations, and creative solutions for growing delicious and abundant strawberries.



## e-GRO WEBINAR

### Understanding Pesticide Labels

Pesticides are still used to mitigate problems with insect and mite pests of greenhouse-grown horticultural crops. However, reading and understanding the pesticide label is important in enhancing the effectiveness of a pesticide application. The pesticide label must be read prior to application in order to determine essential information such as directions for use, dosage or rate, application intervals, restricted entry interval, and required personal protective equipment. So, every time a pesticide is going to be used...be sure to READ THE LABEL.



### Understanding Pesticide Labels (It's The Law!)

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e-GRO

Kimbal Musk  
IS SPREADING A  
"Community  
THROUGH Food"  
PHILOSOPHY

*By David Kuack*

Kimbal Musk, co-founder of The Kitchen restaurants and The Kitchen Community, a non-profit organization that has established nearly 300 school Learning Gardens, is working to spread his philosophy of the power of good food and good drink to connect people as family, friends and community.





Kimbal Musk has helped co-found nearly 300 Learning Gardens in schools, which impact about 150,000 children daily.  
Photos courtesy of The Kitchen Community







While Elon Musk has made a name for himself in moving people as co-founder, CEO and product architect of Tesla Motors, and founder and CEO of SpaceX, his younger brother Kimbal is more focused on the Earth and the food it produces. Kimbal co-founded The Kitchen restaurants to serve food and drink from local farmers, ranchers and suppliers for the sustainable enjoyment of the whole community. Part of this community establishment includes a commitment to environmentally-friendly practices, including composting, wind power, eco-friendly packaging and recycling.

Kimbal also helped co-found the Learning Gardens that serve as outdoor classrooms and experiential play-spaces that connect kids to real food and empower them to make healthier food choices. The nearly 300 Learning Gardens in schools, which impact about 150,000 children daily, are designed to be places that encourage students to learn and teachers to teach.

Kimbal Musk sat down with Urban Ag News to talk about the “community through food” philosophy and the impact it is having on suppliers, patrons, children and communities.

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*“While there are many innovations going on, we have lost touch with the very basic idea of what food is. We need to get back to what we actually should eat. What nourishes our bodies, our community and our planet. And then innovate from there.”*

*— Kimbal Musk, co-founder of The Kitchen restaurants*

**UAN:** The philosophy of the founders of The Kitchen is “community through food.” Can you briefly explain this philosophy in how it is expressed through your company’s restaurants and the cities in which the restaurants are located?

**Musk:** For me “community through food” is the essence of gathering around the table and sharing good food and drink to connect us as family, friends and a community. One example of “community through food” in motion is our family meals that we provide our staff after each lunch and dinner service. They gather around the community table (something we feature in every one of our restaurants) and eat food together that is prepared family-style. Our food and drink is sourced from the local communities where we operate, supporting farmers and local purveyors to the tune of millions of dollars a year.

While there are many innovations going on, we have lost touch with the very basic idea of what food is. We need to get back to what we actually should eat. What nourishes our bodies, our community and our planet. And then innovate from there.

**UAN:** In how many cities are your restaurants located and how many more cities are you planning to open restaurants?

**Musk:** Our goal is 1,000 cities by the end of 2025. We are impacting 47 cities across the U.S. right now with both the Learning Gardens and our restaurants. We are rapidly expanding every week.

**UAN:** Your company puts great emphasis on purchasing fresh food from its suppliers. On average, percentage wise, how much of the food used in the restaurants is purchased locally? Please define what you consider to be a “local” supplier.

**Musk:** We measure our impact on the local food and produce ecosystem by investing in a supply chain that we define in three tiers.

Tier one is locally farmed produce, bakers, ranchers and other purveyors that are within driving distance from our restaurants.

Tier two is relationship based, not necessarily local, such as our fishmonger in Maine or our Alaskan seafood purveyor.

Tier three is the traditional supply chain which enables out-of-season produce (natural and organic whenever possible) to be brought in from around the world.

Tiers one and two account for approximately 80 percent of the menu at our bistro locations and around 50 percent at our Next Door casual dining restaurants.

**UAN:** On average, percentage wise, how much of the food used in the restaurants is organically certified? Is it much easier to find organic food in some states and/or regions than others?

**Musk:** The majority of the food served at our restaurant is organic, but even when it's not certified organic it's food from purveyors and farmers who we know and trust.

**UAN:** How important is it for your company to buy local, fresh food than buying organic food that is not locally produced?

**Musk:** Our mission is to strengthen communities through food and that means working with local farmers and other purveyors that we have a real connection with.

**UAN:** For your restaurant patrons, how important is it that the food served is purchased locally vs. food that is organically

certified? Do you see much difference in how your restaurant patrons feel depending on customer demographics (age, gender, marital status, etc.) vs. location demographics (city size, East vs. West, etc.)?

**Musk:** Purchasing locally and scaling local is something we are committed to. We source locally to support our local community. We do it because it's the right thing to do, not because of demographics or sales. We have been successful with this impact model and believe that our guests see our passion through our delicious and carefully prepared food.

**UAN:** Have you had a difficult time finding local growers who can meet the produce needs of your restaurants?

**Musk:** Of course. Locally sourcing food is not easy, but we are committed to supporting our farmers. They need people who are going to be around and are going to buy their product not just today, but next week as well.

When we started over a decade ago, Colorado's local farming industry was valued at around \$5 million. Today, it's a \$20 million industry. The Kitchen restaurants are the biggest purchaser of local produce in the state.

**UAN:** Are you trying to promote organic production practices to the local growers you are working with?

**Musk:** Yes, but the local growers that we work with are, for the most part, already growing produce sustainably and organically. It's the farmers in the United States that are holding tight to industrial farming practices that we are working with to transition to organic.

Maria Rodale and I wrote an op-ed, "[Lost in transition: Why are farmers resistant](#)



to organic?”, in the Des Moines Register highlighting the problem and the opportunity.

**UAN:** Do you purchase much produce from greenhouse and other controlled environment agricultural operations (i.e., vertical farms)? Do you see your company working with more of these types of suppliers in the future?

**Musk:** In the future we will be sourcing from many more controlled environments!

**UAN:** Can you explain the relationship between The Kitchen restaurants and the non-profit organization The Kitchen Community.

**Musk:** The Kitchen Restaurant Group and The Kitchen Community are a unique combination of for-profit and non-profit enterprises that work in tandem to strengthen communities through food by accelerating a real food culture at scale.

We operate a unique, scalable model where The Kitchen Community non-profit organization paves the way for change and creates immediate and long-lasting impact. The Kitchen Restaurant Group provides sustainability, demonstrates long-term commitment and, in turn, donates a portion of the proceeds back to the non-profit. In a ‘real food culture,’ everyone knows where food comes from and how it is made. Real food is food we trust to nourish ourselves, our community and our planet.

**UAN:** Since its founding in 2011, The Kitchen Community has built over 200 Learning Gardens in schools in Colorado, Illinois, California and Tennessee. Are you looking to expand these gardens beyond those cities in which your restaurants are located?







*A study of the impact of Learning Gardens found that 23 percent of school children in Denver and Chicago actively involved in a garden are more likely to eat vegetables.*





**Musk:** We now have 290 Learning Gardens in Chicago, Denver, Los Angeles and Memphis and we are always looking to expand our impact to reach more cities every day.

**UAN:** Is there any specific number of gardens that you are trying to build in any one city?

**Musk:** Yes, our aim is 100 Learning Gardens in a single region saturating that community with healthy change and creating impact at scale. By building Learning Gardens at scale, we can accomplish three important goals: community visibility, networks for success and efficiency.

**UAN:** Have there been any efforts to measure the impact The Learning Gardens have had on the participating children's and their families' eating habits?

**Musk:** We recently worked closely with a research firm called Mission Measurement and discovered some wonderful news regarding the impact of our Learning Gardens located in Denver and Chicago. A national impact summary of the report findings can be found [online](#).

One of the key findings was that 23 percent of students actively involved in a Learning Garden are more likely to eat vegetables. That's an incredible number if you think about the impact on a national scale.

**UAN:** Are organic production practices taught to the students who participate in the Learning Gardens program?

**Musk:** While our garden educators host planting and harvesting events in the Learning Garden, we actually have a scalable model where we teach the teachers. We host teaching workshops for teachers to maximize their Learning Gardens throughout the school year. It is the teachers who share their knowledge of sustainable and organic growing and eating practices.

We don't create curriculum, but we recommend the [best available resources](#) for a variety of subjects.

**UAN:** Once a Learning Garden has been set up and operating at a school does The Kitchen Community continue to be involved at the school or is the program turned over to the school faculty to administer?

**Musk:** Our garden educators are full-time resources in each region that are closely involved with the long-term sustainability of the Learning Garden. They work directly with the garden lead at each school to ensure the Learning Garden continues to be a beautiful and useful space for the whole school once it is built and years into the future. 🌱

For more: The Kitchen Community,  
1980 8th St., Boulder, CO 80302;  
(720) 263-0501;  
<https://thekitchencommunity.org>.

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



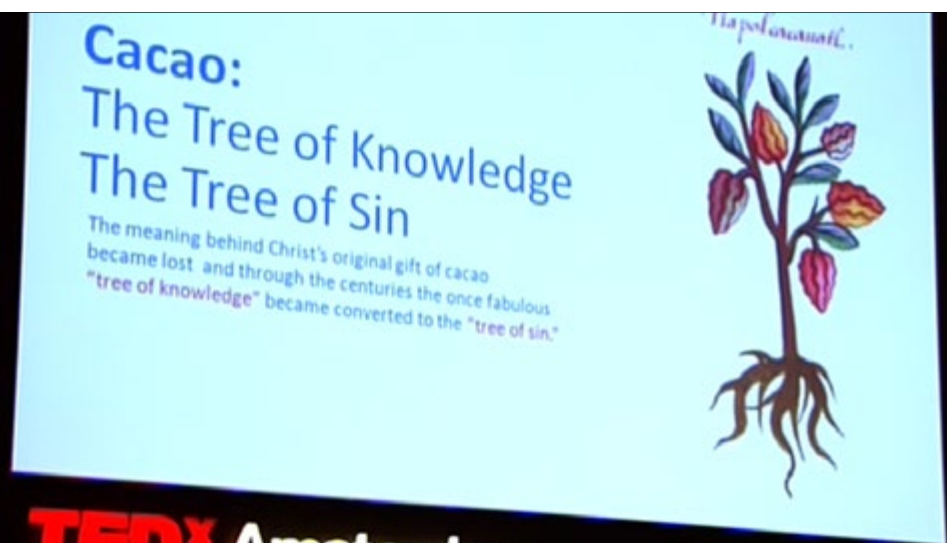
# Jack Johnson's Sustainable America

When musician and environmental activist Jack Johnson invited us to join him for an elementary school compost lesson (and schoolyard concert), we grabbed a film crew. Watch our new mini documentary to learn more about one of the music industry's greenest musicians and how the island of Oahu deals with its food waste.



**Howard-Yana Shapiro is the Global Director of Plant Science and External Research, Mars Incorporated.** Howard has guided Mars toward the goal of 100% sustainably sourced cacao production since joining up with the company in the late 1990s. His more than 35 years working with sustainable agricultural and agroforestry systems, plant systems, plant genetics, and food production systems across the world have led to his being a party to functional ecological enhancements the world over.

**[WATCH THE VIDEO >>](#)**



**TEDx Amsterdam**





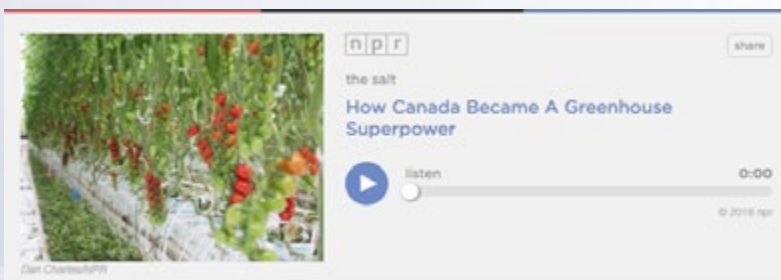
## THE SEARCH FOR TASTIER SUPERMARKET TOMATOES: A TALE IN 3 ACTS

"One of my fondest childhood memories is of eating tomatoes. We picked them in the garden and ate them in sandwiches, sitting on a picnic table under the trees outside our house. That juicy, acidic taste is forever lodged in the pleasure centers of my brain."

— Dan Charles, NPR's food and agriculture correspondent



Photo by Morgan McCloy, NPR



## HOW CANADA BECAME A GREENHOUSE SUPERPOWER

"Our cold-weather neighbor sends us more tomatoes, peppers and cucumbers than we send the other way... I was so shocked that I decided to investigate."

— Dan Charles, NPR's food and agriculture correspondent



Photo by Dan Charles, NPR

# KIDS SPEAK ON TOMORROW: VERTICALLY BUILDING A SUSTAINABLE FUTURE BY 7TH GRADER LEA S. SINGER

At the New York Sun Works' Youth Conference on June 2, 2016, building a sustainable future was the shared topic. So many ideas were presented on how the kids of this generation could help build a better, healthier future for themselves. The passion shared with all who attended was inspiring, and made you want to start a mini hydroponics system in your kitchen the minute you left the conference.

Among the numerous people who spoke, ranging in age from 10- to 15- years old, three guest speakers attended. One of them, Dr. Dickson Despommier, from The Vertical Farm, shared the newest way of growing food—VIG.

VIG stands for vertically integrated growing, which looks exactly like it sounds. The plants are lined up in rows vertically, against a wall, as opposed to taking up space on the floor. This way of modifying plant growing systems for space efficiency could very well be the standard farming technique of the 21st century.

According to Dr. Despommier, many producers have already adapted this growing technique, using it to grow an abundance of vegetables, including tomatoes, spinach and kale.

One grocery store that was shown during his presentation had a VIG setup in the store, so that customers could simply cut off the leaves they desired from the extremely fresh plants, bag it, pay for their produce, and cook it for dinner the same day it was cut. This is one of the many examples Dr. Despommier

showed the audience during his presentation. By the end of his presentation, it's safe to say attendees were all convinced of the VIG's efficiency and reliability as a new mass production growing technique.

Another VIG benefit, the free floor space leaves plenty of room for jetpacking and hoverboard riding, which will come in handy in 2050.

Lea S. Singer is a 7th grade student and aspiring writer at the Manhattan School for Children, PS333.

*"The NY Sun Works conference was a great opportunity to learn about new ways to use sustainable science and how it works. Sustainable science is very important because, if we keep going without it, it will not be good for us. The conference gave new possibilities, new ways and new approaches on how to save our world."*

—Nate Hajdu, 7th grader and member of NY Sun Works Youth Conference Press Team

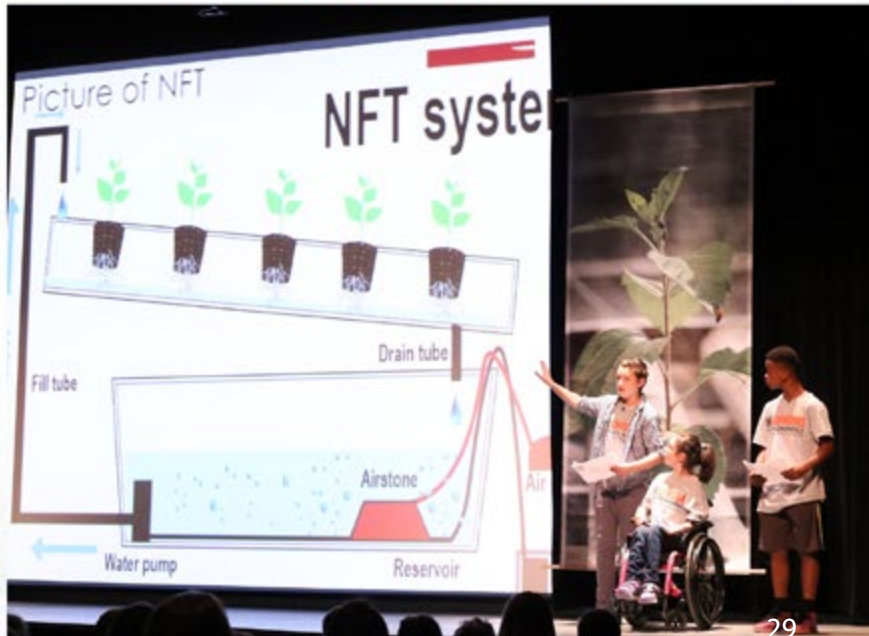
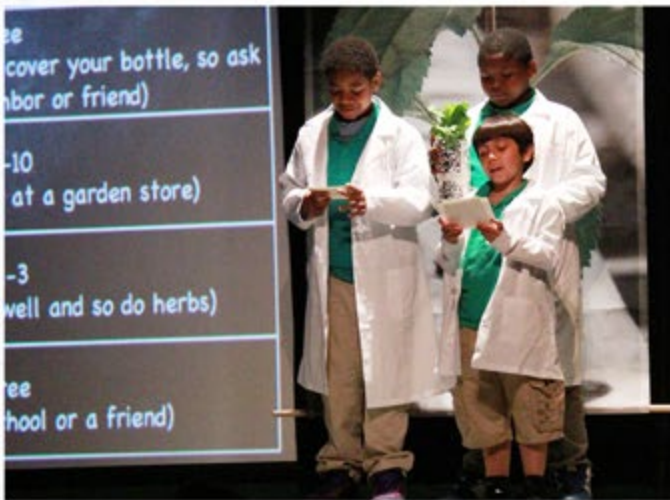
**ONE OF THE GUEST SPEAKERS AT THE CONFERENCE WAS DR. DICKSON DESPOMMIER FROM THE VERTICAL FARM WHO DISCUSSED VERTICALLY INTEGRATED GROWING (VIG).**



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NY Sun Works is a non-profit organization that builds innovative science labs in urban schools. Through their Greenhouse Project Initiative they use hydroponic farming technology to educate students and teachers about the science of sustainability. [www.nysunworks.org](http://www.nysunworks.org)







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**INDUSTRY  
NEWS**

## FLUENCE BIOENGINEERING ACHIEVES BREAKTHROUGH IN HORTICULTURE LIGHTING EFFICACY ACCORDING TO UNIVERSITY STUDIES

Recent tests conducted by Rutgers University and Utah State University confirm the Fluence VYPRx PLUS lighting system has achieved an efficacy 21 percent greater than the best technologies in a previous study; breaks 2.0 micromoles per joule barrier. >> [Click for more](#) >>



## TOMATO GROWERS CONVINCED OF ROBOTICS – THREE GROWERS TAKE A HEAD START WITH THE PRIVA DE-LEAFING ROBOT

During last month's GreenTech 2016, the Priva De-Leafing Robot was introduced to the market. This robot is the first product, worldwide, that provides growers with an economically viable alternative for manual de-leafing of tomato crops. Three major growers from the consortium involved in the development, Lans, Prominent and Vereijken Kwekerijen expressed their commitment and will start working with the robot. The Priva De-Leafing Robot is the first in a series of solutions for automated crop labour in horticulture.

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



## NEW ORGANIC PRODUCT PROMISES TO INCREASE YIELDS FOR CONVENTIONAL GROWERS

Enriched Biochar Biology Blend, a new substrate additive designed to increase yields was launched in June to coincide with the first day of the Green Tech trade event in Amsterdam. Carbon Gold's Biology Blend is an easy-to-use growing additive suitable for conventional, hydroponic and organic cultivation systems. The product is a unique blend of biochar, bacteria, fungi and trace elements that boosts yields by improving plant health and increasing the efficiency of nutrient uptake. >> [Click for more](#) >>





## HORT AMERICAS OFFERS TERRA GENESIS ORGANIC HYDROPONIC FERTILIZER

Proudly brought to the commercial Hydroponic and Organic grower by Hort Americas and specifically developed for re-circulating NFT (Nutrient Film Technique), the Terra Genesis Organic Hydroponic Fertilizer is packed with the essential micro and macro nutrients, amino acids and vitamins your plants hunger for!



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## AGRA TECH IS BUILDING HIGH-TECH GREENHOUSES

Agra Tech, Inc. in Pittsburg, CA, is a manufacturer of commercial greenhouse systems. They've recently unveiled several new High Quality videos that tell the company's story through the words of its customers and narrated by its own employees. Agra Tech's Owner John Pound did a voiceover for one of the videos and enjoyed seeing the production process firsthand. "We learned about what they (our customers) think of us, which is always good for any company to know."

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



## URBAN FOOD SYSTEMS SYMPOSIUM

The 2016 Urban Food Systems Symposium will be held June 22-25 at the Kansas State University Olathe campus in the metropolitan region of Kansas City. Our goal is to bring together a national and international audience of academic and research-oriented professionals to share and gain knowledge on urban food systems and the role they play in global food security. This symposium includes knowledge on: urban agricultural production, local food systems distribution, urban farmer education, urban ag policy, planning and development, food access and justice, and food sovereignty.

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

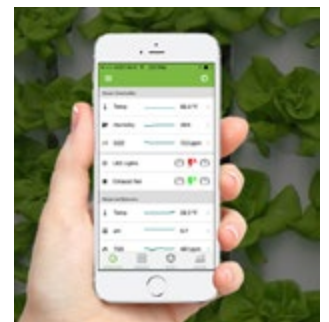
## NATIONAL AGRICULTURAL LEADERS TO GATHER IN VIRGINIA BEACH WITH GOAL OF STRENGTHENING SUPPORT OF U.S. SMALL FARMERS

More than 700 agricultural leaders from across the country will gather in Virginia Beach September 20-22 to identify ways to secure the future success of our nation's small farms and ranches, numbers of which have been dwindling for decades, while the number of very large farms has seen rapid growth.

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

## DENVER-BASED HYDROPODS, INC. NOW SHIPPING LINE OF CONNECTED GROW CONTROLLERS AND SENSOR MODULES

Hydropods, Inc. has announced that the Hydropods Environment Controller and Hydropods Nutrient Controller are now shipping to customers. These cloud-based Wi-Fi Controllers enable growers to see, monitor and control a grow operation from anywhere using their Smartphone. They are designed for use in at-home hydroponics and for small to medium-sized greenhouse and indoor agriculture growers. >> [Click for more](#) >>





## NEW HIGH TECH FARM SPROUTING UP IN HUMBOLT COUNTY, CALIF.

American Hydroponics of Arcata and the Humbolt County Office of Education are partnering to build a high production year-round hydroponic vegetable production facility in Eureka. Construction is currently underway at the Redwood Acres Fairground on Harris St. for a 4,320 square foot state of the art hydroponic farm that will provide high quality, pesticide free food for the local community.

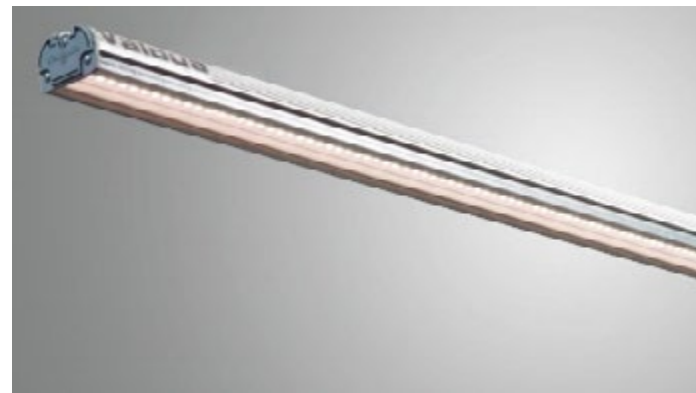
>> [Click for more](#) >>

### INDUSTRY NEWS

## VALOYA EXPANDS ITS SELECTION OF PROFESSIONAL LED GROW LIGHTS

The Valoya C-series is complemented with the C75 DIM, a 1475 mm (5 feet) model in addition to the previously launched 1200 and 1800 mm models (4 and 6 feet). C-series fixtures are ideal for growth rooms and chambers, vertical farms and other demanding applications, where high IP rating and high light intensity is needed.

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



## NUETECH IS PROUD TO ANNOUNCE THE LAUNCH OF A NEW LED LIGHT

The SATURN LED grow light has been designed for different growing applications needs and is suitable for green houses, high ceiling indoor vertical farms, and plant growth with a higher PAR value to activate efficient photosynthesis activities, including plants with a thicker canopy requiring more power to penetrate and reach.

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

## URBAN PRODUCE NAMED 2016 SMALL BUSINESS OF THE YEAR

Urban Produce received the prestigious 2016 Small Business Award at the 17th Annual Family Owned Business Awards presented by the Orange County Business Journal on Tuesday, June 21. The Horton family was recognized as pioneers in the vertical farming field and honored for contributions to their community. This award comes just after Urban Produce announced the licensing of their patented growing technology, the High Density Vertical Growing System.

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





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Urban Ag News is a *connector* for a niche industry. We bring together farmers, growers, researchers, educators, manufacturers, suppliers, as well as everyone else interested in controlled environment agriculture (CEA). Our goal is *education*. By providing a unique blend of entertaining and educational content our readers and viewers will achieve a basic understanding of the science, leaders and technology shaping the industry and leading us into the future.

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all the sponsor opportunities.*







# HORT AMERICAS AND URBAN AG NEWS WILL PARTICIPATE IN AND SUPPORT 2016 TOUR DE FRESH!

**Hort Americas general manager Chris Higgins will be riding in this year's Tour de Fresh to raise funds to install salad bars in Irving, Texas, public schools.**

As in 2014 and 2015, Hort Americas is once again a proud sponsor and rider participant in this year's Tour de Fresh. Tour de Fresh 2016, presented by the California Giant Foundation, is the first-of-its-kind, collaborative event that unites the most significant brands and influencers in the fresh produce industry.

Tour de Fresh is a four-day cycling event that raises funds to benefit the Let's Move Salad Bars to Schools campaign. The inaugural 2014 event raised over \$142,000 and placed over 40 salad bars in schools in 11 states. The 2015 event was also a success in multiple states. The two previous events raised more than \$300,000 and placed over 100 salad bars in U.S. schools.

The overall goal of Tour de Fresh 2016 and its participants is to privately finance 100+ new salad bars in school districts across the country. At a cost of \$3,100 per salad bar, event sponsors and rider participants strongly believe that providing healthy eating opportunities for school children should be a requirement. Please join Hort Americas in its shared cause to make a difference and provide access to fresh fruits and vegetables for children in public schools.

This year's Tour de Fresh will occur in California from July 26-29. With the support of Hort Americas, its general manager Chris Higgins will be riding for the Irving Independent School District in Irving, Texas. Like last year, Chris is hoping that many of his closest friends and business partners will join Hort Americas in this opportunity to create positive change and support Tour de Fresh 2016.

If you are interested in helping to sponsor this year's event, Hort Americas and Chris would ask you to support him by making a financial donation at <https://www.crowdrise.com/HortAmericas>. If your company makes a donation of \$500 or more, Hort Americas will include your company's logo in all of its pre- and post-ride marketing efforts. Hort Americas will make a cash donation for all donations made in product.

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# ORGANIC PEST MANAGEMENT IS *NOT* A ONE SIZE FITS ALL CURE

BY DAVID KUACK





If you want a recipe for how to specifically control insect pests, then you would best be served using conventional chemical pest management.

“When you look at things through an organic lens, it’s all about context,” said Michigan State University entomologist Matt Grieshop. “There are options to choose from, but your pest management choice is going to be dictated by your specific needs and circumstance. What works for one grower may not work for another for a whole host of reasons. You have to educate yourself about the system.

“It’s not as simple as putting a chemical in a tank and spraying. That is a very successful form of agriculture, but it is completely contrary to the philosophy of an organic system.”

Grieshop said there are two misconceptions when it comes to organic insect control.

“The average person on the street thinks that organic pest management is something that takes care of itself and growers don’t have to do anything. Which is absolutely bogus,” he said. “You are building a system that nature never would have thought up and that would never work in nature. Nature doesn’t work the way that agriculture works. So you are always going to have pest management issues of some sort. You’re going to have to do something.”

The second misconception about organic insect control is there are an infinite number of replacements to manage whatever pests growers may encounter.

“There are insect pests in Michigan that we struggle with every year just because we don’t have good control tools for them,” Grieshop said. “Pesticides exist because agriculture is unnatural and pests are inherently difficult to manage, especially on fresh produce.

“The tools for organic production are limited. You have to supplement that tool set with a lot of intelligence and experience. It is complicated and that is why not everyone is an organic grower. If it was easy, everyone would do it.”

Grieshop said organic pest management is not a one size fits all cure. That is chemical agriculture.

“The thinking behind chemical agriculture is I can grow whatever I want, wherever I want, whenever I want and to accomplish that all I have to do is apply a lot of petrochemicals and high energy inputs to make the system do what I want,” he said. “If I have a problem, I’ll spray with a chemical and kill what needs to be killed. In organic agriculture, it’s really about growing the right thing in the right space at the right time. This means you have to know more about what you are doing. If you know that you have a high incidence of an insect pest or a disease, then you choose a crop and a cultivar that are appropriate for the environment.”

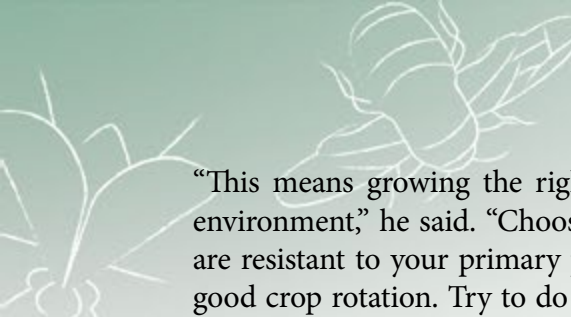
## INSECT CONTROL CHOICES

Grieshop said pest management for organic growers begins with preventive and cultural pest management.



LADY BIRD BEETLE ADULTS AND LARVAE FEED PRIMARILY ON APHIDS AND OCCASIONALLY ON OTHER SOFT-BODIED INSECTS AND INSECT EGGS.

*Photos courtesy of Matt Grieshop, Mich. St. Univ. Entomology*



“This means growing the right crop for the environment,” he said. “Choose cultivars that are resistant to your primary pest issues. Use good crop rotation. Try to do everything you can to create a favorable crop environment and an unfavorable pest habitat. If that doesn’t work then you move onto biological and physical inputs.”

Grieshop said for both field crop and controlled environment agriculture situations there are pesticides that are USDA-National Organic Program compliant. Products that are labeled for use on both these types of production systems include:

- *Bacillus thuringiensis* used primarily for lepidoptera pests.
- Spinosad-based products provide good control on soft-bodied insects and Lepidoptera caterpillars. Spinosad is a natural product derived from the soil bacterium *Saccharopolyspora spinosa*.
- Neem-derived products provide good control against soft-bodied insects and some pathogenic fungi.
- *Beauveria bassiana* is a soil-borne pathogenic fungus that attacks soft-bodied insects.
- Nematodes are soil-borne roundworms that are applied to the soil and infiltrate the larvae of thrips and fungus gnats, cut worms and grubs. Grieshop said nematodes make good sense in a small scale system, especially if growers can produce them in-house. [Michigan State](#) and [Cornell University](#) have made videos on how to raise nematodes.
- Diatomaceous earth is a mined product that is effective against soft-bodied insects, including snails and slugs. These prehistoric calcium-based microbes have sharp edges that damage an insect’s exoskeleton leading to desiccation.
- Pyrethrum, a naturally derived chrysanthemum extract, is a broad spectrum, short residual neurotoxin that is effective mostly on soft-bodied insects.

Grieshop said the following controls are best used in greenhouse applications because they tend to disperse unless there is a means to contain them in an insect-infected area.

- Predaceous mites can be used against thrips and other plant-eating mites.
- Ladybird beetles are effective against aphids. Grieshop doesn’t suggest using the beetles for field agriculture because they tend to disperse unless there is a means to contain them in an insect-infected area.
- Lace wings are predaceous on larvae of primarily soft-bodied insects including aphids.
- Parasitoids and other predators can be purchased for specific insect pests. Grieshop said growers really need to know what insect pests they are dealing with before using these types of controls.

“All of the organic growers I work with actively try to foster biological controls in their plantings,” Grieshop said. “If you avoid spraying a lot of broad spectrum neurotoxins, you’re going to have more insect diversity in your system because you are not killing everything. Other things growers can do are to maintain flowering plants year-round and maintain the soil using cover crops. All of these things promote biodiversity in the production system and promote predaceous and parasitic insects. These practices may also promote pest insects too if growers aren’t sure of what they are doing. Shelter- and plant-based food sources are common resources for both beneficials and pest insects.”

## OMRI-CERTIFIED PRODUCTS

[Organic Materials Review Institute \(OMRI\)](#) is a nonprofit organization that works with input suppliers that service the organic market.

“Manufacturers and suppliers pay OMRI as a third party to certify their products are compliant with the National Organic



*DALOTIA CORIARIA* (ROVE BEETLE)  
IS A SOIL-DWELLING BEETLE THAT  
FEEDS ON A WIDE RANGE OF SMALL  
INSECTS, INCLUDING FUNGUS GNATS,  
THRIPS, SHOREFLIES AND MITES.







IF A GROWER RELEASES BIOLOGICAL CONTROL AGENTS IN A GREENHOUSE, LIKE THESE PREDATORY MITES ON RASPBERRIES, HE HAS A REASONABLE EXPECTATION THAT THE MITES WILL STAY WHERE HE WANTS THEM TO BE ACTIVE. THERE ARE NO SUCH GUARANTEES IN OPEN FIELD PRODUCTION SETTINGS.



Program,” Grieshop said. “These products include fertilizers, substrates, food preparation sterilants and pest management controls. Growers can look for the OMRI seal if they are buying organic inputs.

“However, for certified organic growers selling in an organic marketplace, the OMRI stamp does not guarantee 100 percent that the product can be used. Growers must confirm with their organic certifier if an OMRI-certified product can be used. Growers need to talk with their particular organic certifier before they make an application of any input.”

Grieshop said there will be times that a product has the OMRI stamp, but a particular certifier may not agree with an OMRI classification.

“The certifier has the final say on a grower’s farm as to whether or not something can be certified,” he said. “The certifier is not legally required to accept a product’s OMRI certification. However, nothing prevents the grower from going to a different certifier. And this is one of the many reasons growers choose a specific certifier.”

## COMPARING CONTROLLED ENVIRONMENT, FIELD PRODUCTION

Grieshop said controlled environment agriculture has more organic insect control options than field agriculture, but a lot of that has to do with the economics behind the two production systems.

“In a controlled environment such as a greenhouse or vertical farm, production space is considered by the square foot,” he said. “Making an economic decision about a CEA system, boils down to how many dollars is each square foot of production space worth? In a field crop environment, the typical thinking is in dollars per acre (43,560 square feet). Depending on the value of a square foot, in a greenhouse that might be 100 to 200 times

more compared to a field-grown crop. That means the greenhouse grower can afford a lot more controls than a field grower.

“If a grower has 1,000 square feet of greenhouse space, and expects to make \$50,000 off that space, that’s \$50 per square foot of income that he’s protecting. If a grower is producing field corn, he might expect to make \$4,000-\$5,000 per acre. That is \$5,000 over 43,560 square feet. What the field grower can afford to protect is a lot lower.”

Grieshop said a second difference in CEA is a greater amount of control over the environment and the control over the space.

“If a grower is going to release biological control agents in a greenhouse, he has a reasonable expectation that they are going to stay where he wants them to be active,” he said. “In an open field there are no such guarantees.

“Those are the two big functional differences. The gross economic value of the system and the ability to change things. Both of those factors essentially give CEA growers insect control options that would never be considered for open field culture. It doesn’t change the availability of those inputs, it just changes whether they are relevant.” 🌱

For more: Matthew Grieshop, Michigan State University, Department of Entomology, Center for Integrated Plant Systems Bldg.; (517) 432-8034; [grieshop@msu.edu](mailto:grieshop@msu.edu); [http://www.ent.msu.edu/directory/matthew\\_grieshop](http://www.ent.msu.edu/directory/matthew_grieshop); <http://www.opm.msu.edu>; [http://msue.anr.msu.edu/topic/info/organic\\_agriculture](http://msue.anr.msu.edu/topic/info/organic_agriculture).

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

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# VOICES of HORTICULTURE

with Dr. Steve Millett

## Dr. Frits Went and the Pursuit of the McCree Curve

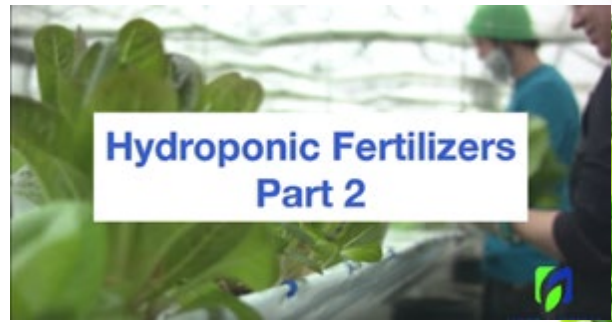
**Dr. Bruce Bugbee of Utah State University** was the opening speaker at the 2016 International Society for Horticulture Science Symposium on Light in Horticulture. Dr. Bugbee talks candidly with me about how understanding history can give us a keen insight into today's botanical questions about light and the outlook of our future.



## HYDROPONIC FERTILIZERS



Understanding Hydroponic Fertilizer  
Options and Stock Solutions



Blending Hydroponic Nutrient  
Solutions and Stock Solutions

# Urban Agritourism ★ BRINGS EXTRA FARM REVENUE





Sometimes rather than bringing crops to the customers, customers come to the crops. The public's enthusiasm for urban farming goes far beyond buying the produce, and that means that many customers seek to be more than just recipients of local food, they want to be participants in the process.

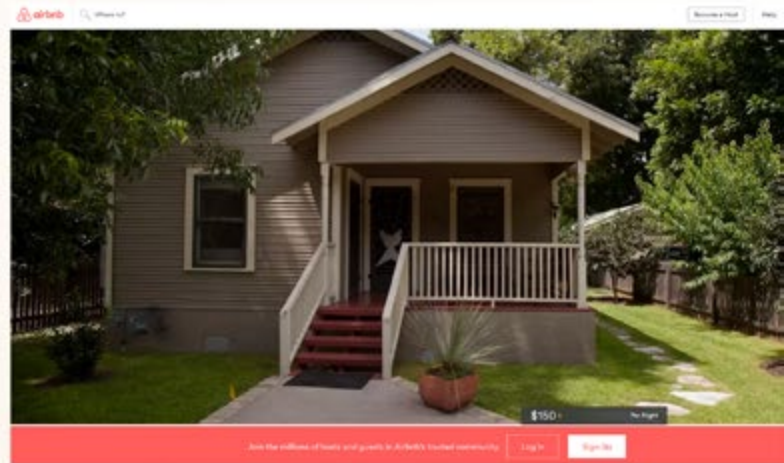
Experiences at the farm allow the public to participate directly, which can bring farmers additional revenue sources that are less tied to their production capacity. For small farms, that can provide a big boost. Customers coming to the farm certainly isn't a totally new phenomenon. Navigating corn mazes, attending petting zoos, shopping at farm stands, and picking their own fruit have allowed members of the community to directly connected to farms throughout the years.

Today's growing culture of local agriculture is spurring even more creative relationships between the public and their local farms. Pop up dinners and restaurants on site are emerging throughout the United States.

Bed and breakfasts on farms are an older tradition, but new online renting platforms like [AirBnB](#) have really unlocked agritourism as a revenue option for "farmstays." Many rural getaways on big acreage are featured on the site which all across the world, but short-term space renting from tourists who want a unique experience is an option that's particularly tempting for urban agriculture.

AirBnB's own "wish list" of urban farms to visit has 32 entries. Many of these are simply beautiful vacation rooms with had impressive backyard gardens. Several fall into a permaculture tradition of living with the land. A few are truly commercial urban farms that happen to have a guesthouse or room available for others to experience life on an urban farm in addition to their planned trip to a city.

Earlier this year AirBnB CEO Brian Chesky said, "The No. 1 reason people chose to travel on Airbnb is they want to live like a local.



They don't want to be tourists stuck in long lines, fighting with the crowds to see the same thing as everyone else. Our hosts offer more than just generic hospitality — they welcome travelers from around the world into their communities.

In Austin's eastside, Hausbar Urban Farm welcomes travelers into both downtown Austin and their farm community. They're a true commercial farm, delivering their their poultry, eggs, rabbits, and vegetables to around nine restaurants every day. On the same property they rent out a guest house through AirBnB.

Dorsey Barger and her wife Susan Hausman opened the guest house in 2014. Dorsey describes it as an unusual type of hospitality. "We are completely passionate about urban sustainable agriculture, and we like to give others the chance to really jump into the experience - to harvest some crops, hangout with the animals all day, to find out how their guest house compost buckets become part of the farm. If they're less interested or don't have the time, they can just learn a little about it indirectly as they stay here and explore Austin."

Unique local experiences like HausBar's urban farm match up closely to the direction AirBnB has been prioritizing for the last few months. They are offering an "experiences feature" which allows guests to book additional tours, activities, and services when they book a room.

For example, guests pay a little extra to go on a tour of Muir Woods when visiting San Francisco with a local, or pay to go out to drinks with Parisians when in the city of lights. Urban farm experiences, whether in the form of classes, tours, farm-to-table dinners, or pick your own produce, can bestow unique opportunities on visitors who are seeking an authentic interaction with a place. They pair up well with locations that also offer overnight stays, but sites that don't want to be host guests overnight can just list activities, as long as the program is in their city.

According to Dorsey from HausBar Urban Farm, "If it is at all possible for anybody to do urban or suburban agriculture, it's a fantastic additional source of income. A guest house helps to diversify and provides a good cushion, even if you have a bad season. People are becoming more and more interested in where their food comes from, so there seems to be a lot of demand."

For years, WWOOF, World Wide Opportunities on Organic Farms, has gotten volunteers all over the world to visit organic farms and contribute labor in exchange for a place to stay. Their farm listings have grown to 61 countries

and tens of thousands of volunteers have participated. Agritourism and farm stays can turn that momentum into a monetized resource for sustainable farms.

HausBar Urban Farm ran into a problem with the city when they enforced a law that prevented multiple dwellings on an urban farm property. For a while, Dorsey and Susan had to stop selling their produce, so they began to rely more on their guest house. "It's why we're still in business," Dorsey said. "Our customer base had pretty much gone away, but we were able to keep the farm alive through the guest house."

Eventually, there was a public outcry and the laws were adjusted so that HausBar Urban Farm could reopen. Dorsey says, "Now that the farm is really thriving by selling to restaurants, it's great additional income. I love hospitality and taking care of people. As our guest house business has grown, our farm has grown with it. I think there's a correlation." 🌱

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





# Positive Stories from Muslim Nations



## Pakistani farmer and grower Naeem Qazi

was one of the first to build a greenhouse with a steerable climate in his country. In order to learn the ins and outs of greenhouse cultivation he went all the way to Holland to follow a training course at GreenQ (Now Delphy) in The Hague.

In the video, Naeem explains that he became interested in greenhouse farming as a result of the fact that his open field crops could only provide him with an income for three months per year. After his father died, he remembered his father's advice to adopt new and modern farming techniques. He got in touch with a group who selected him to travel to Holland to follow a training on controlled environment agriculture.

**Watch the video!**



## Could Agriculture Bloom in the Desert?

by PBS NewsHour

Thanks to Qatar's harsh desert environment and growing population, researchers have embraced the tiny country as a laboratory to address global concerns. As part of the NewsHour's series "Food for 9 Billion," special correspondent Jon Miller reports on their inventive efforts to ensure water and food security for the future.



In the small South Dallas neighborhood of Bonton, you don't expect to find a farm. You expect to see crime, drugs, and gang violence. They believe that their neighborhood should change from within, driven by their own people, using their own hands. This has been at the heart of the work in Bonton and is the driving force behind the newest, and possibly most unique mission, Bonton Farms.

Bonton is located in a "food desert." With 63% of residents lacking personal transportation, and the nearest grocery store a 3-hour round-trip bus ride away, residents rely on the local liquor stores for their groceries. The impact on their health is devastating.

*"Vegetables are a part of it, but it's really about being able to work with men who want better for themselves, and are searching for ways to do that."*  
— Daron Babcock, Founder



## WATCH THE BUILDING OF Little Leaf Farms' greenhouse in Devens, MA.



Outside



Inside







## *Ekbic, a vertical farm salad bar in Istanbul*

Ekbic is a vertical farm salad bar in Istanbul that grows lettuce, mint, parsley, chives, leek, and dill in one shelf in an NFT growing unit.

LED is used for lighting, and central automation for fertilizer. This fertilizer is organic, and no chemicals are used for spraying. Each unit has 4 shelves, and each shelf has 4 gullies. Each growing unit has its own water circulation, and central automation controls EC and pH levels.

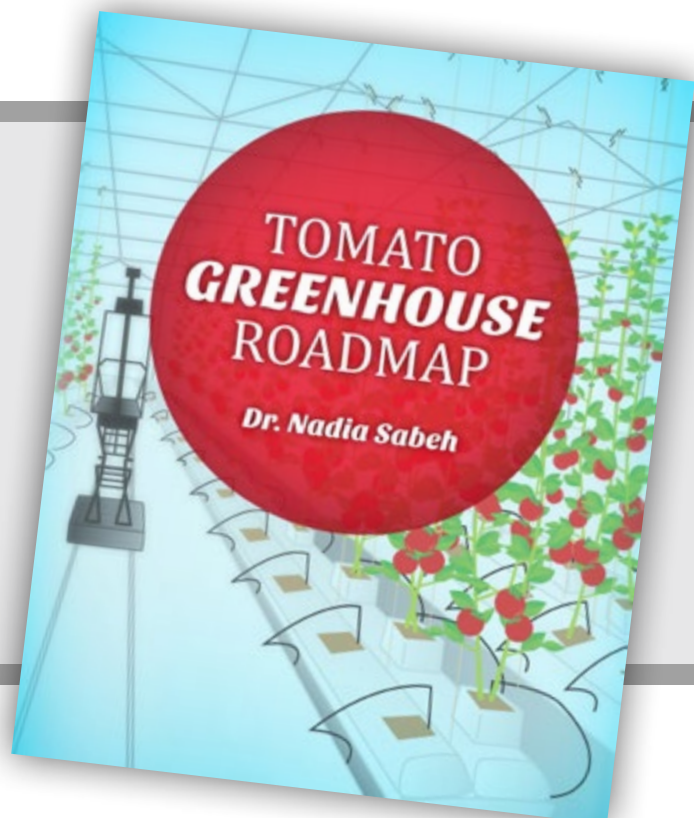
Insects are kept at bay by using organic crop protection, as well as light traps.

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# JAPAN

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## SPECIAL REPORT

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### JAPAN PLANT FACTORY ASSOCIATION (JPFA) EXCITED TO BE COLLABORATING WITH URBAN AG NEWS

We are immensely proud to be working together with Urban Ag News for our upcoming, fall 2016 event in the United States as part of an international project of the Japanese government and the Ministry of Economy Trade and Industry (METI). This international project aims to promote global PFALs (Plant Factory with Artificial Lighting) and the vertical farm industry by encouraging multi-discipline, international business and research and development cooperation. We will focus on selecting companies that possess prominent technology or outstanding capacities for technological development in order to facilitate international collaboration. More details on the event will be announced by Urban Ag News at a later date.

JPFA is targeted at developing and disseminating sustainable and innovative plant factory systems. Beyond multiple onsite consortium R&D projects conducted in PFALs and greenhouses, several research committees will have numerous active members conducting discussions and research together

to allow forward progress to occur. Research committee subject matter include: LED grow lights, PFAL operational management, high-tech greenhouses, and more.

Moreover, together with our esteemed CEO, Dr. Toyoki Kozai, we have the privilege of cooperating with many companies and institutions possessing cutting-edge technologies and deep, innovative knowledge. We further share a passion for offering a viable solution to global issues and challenges such as food security, environmental sustainability, energy output, and addressing resource constraints that our planet has and will be facing for many years to come. Any international collaboration including funding or investment is highly welcomed.

JPFA has been organizing workshops every month with companies and academic research institutions since 2009. We are excited to commemorate the 100th workshop event on July 13, 2016, in Kashiwa-no-ha campus, a smart city outside Tokyo.



## Japan Plant Factory Association

The JPFA is a non-profit association devoted to academic and business advancements in the Plant Factory/ Vertical Farm/CEA industry. Around 20 consortium R&D projects are conducted in PFALs and greenhouse facilities, onsite and off-campus, each year. Apart from monthly workshops; training courses and intensive business session courses are offered every month for professional growers and potential entrants/operators. Business and R&D cooperation, consulting services, research activities, and any collaboration are always welcomed!

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

*-Eri Hayashi*

Japan Plant Factory Association (JPFA) Director  
International Relations & Consulting  
E\*Green Lab Inc., CEO







**In Holland, “Volkstuin Onder Glas” is taking community gardens to a whole new level!**

**Watch the video!**

*(It's in Dutch.)*



## ISHS International Horticultural Congress

Julian Cribb is an author, journalist, editor and science communicator. He is principal of Julian Cribb & Associates who provide specialist consultancy in the communication of science, agriculture, food, mining, energy and the environment. His published work includes over 8000 articles, 3000 media releases and eight books. He has received 32 awards for journalism. His internationally-acclaimed book, *The Coming Famine* explores the question of whether we can feed humanity through the mid-century peak in numbers and food demand.



Dr. Shenggen Fan has been director general of the International Food Policy Research Institute (IFPRI) since 2009. Dr Fan joined IFPRI in 1995 as a research fellow, conducting extensive research on pro-poor development strategies in Africa, Asia, and the Middle East. He led IFPRI's program on public investment before becoming the director of the Institute's Development Strategy and Governance Division in 2005. He has served as the Chairman of the World Economic Forum's Global Agenda Council on Food and Nutrition Security since 2012. In 2014, Dr. Fan received the Hunger Hero Award from the World Food Programme in recognition of his commitment to and leadership in fighting hunger worldwide. Dr Fan received a PhD in applied economics from the University of Minnesota and bachelor's and master's degrees from Nanjing Agricultural University in China.





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**WHY USDA  
organic-certified  
PRODUCTION METHODS  
SHOULD INCLUDE  
hydroponics  
& aquaponics**

**By David Kuack**





*Photos courtesy of Coalition for Sustainable Organics*

## THE COALITION FOR SUSTAINABLE ORGANICS IS WORKING TO KEEP HYDROPONICS AND AQUAPONICS AS USDA ORGANIC-CERTIFIED PRODUCTION METHODS.

Organic hydroponic and aquaponic growers are waiting for the results of a National Organic Program task force report which is scheduled for release this month. Members of the NOP Organic Hydroponic and Aquaponic Task Force were appointed last fall to examine hydroponic and aquaponic production practices and their alignment with USDA organic regulations. The task force includes members who are USDA organically-certified hydroponic growers.

Hydroponic and aquaponic growers are concerned that the report may contribute to the overturning of the long-standing USDA policy to certify their operations. The reason for this concern is that there is an effort by some field growers to stop the organic certification of hydroponic and aquaponic growers by USDA.

Lee Frankel, executive director of Coalition for Sustainable Organics, said the organization was formed in March 2016 to give growers a platform to preserve their ability to choose the most appropriate growing method, including those where the plant is not grown in the outer-crust of the Earth, to meet their site specific conditions when producing organically.

“The coalition members believe that sustainability and using natural inputs are the pillars of the organic philosophy and

movement,” he said. “For instance, some of the initial members are from Arizona and southern California, where water availability is a major issue. Being able to grow hydroponically helps these growers use up to 10 times less water to be more sustainable.”

The coalition currently has 35 members and includes growers from the United States, Mexico and Canada. Some of these organic growers produce in the field as well as hydroponically.

Frankel said the supply of organic products is becoming more international.

“Nearly one-third of all USDA-certified operations are now outside the United States,” he said. “USDA sets the standards and determines what inputs can and cannot be used, regardless of country or method of production. USDA then accredits certifiers to inspect operations around the world.

“Opponents have cited the fact that there are a number of other countries that have a ban on hydroponic organic products. But if you examine the matter more closely, the issue is often a question of semantics. For example, growers in Canada and even in some of the Nordic countries in the European Union can grow organically in containers despite a ban on hydroponics in their regulations.”

### OPPOSITION TO HYDROPONIC, AQUAPONIC PRODUCTION

Frankel said one of the main opposition groups pushing for the changes in USDA organic rules is Keep the Soil in Organic. The spokesperson for the group is David Chapman, who operates Long Wind Farm in Vermont. Chapman is a member of the NOP Organic Hydroponic and Aquaponic Task Force.

“Other groups that have spoken out against hydroponic organic production include many of the organic trade associations and organic





**Using hydroponic production methods has allowed some organic growers to use up to 10 times less water and to be more sustainable.**

certifiers in the northeastern part of the United States,” said Frankel. “Some of the certifiers have been working with field growers for a long time so they feel it is in their best interest to support their current customers.”

While there is a philosophical debate as to what organic growing does or does not mean, Frankel said there is also an economic component.

“Retailers and consumers are voting with their pocketbooks,” he said. “They appreciate a variety of flavorful and available hydroponic and aquaponic organic products on a consistent basis that meet their expectations for produce grown without synthetic pesticides.

“Sustainability and economics go hand in hand. As inputs are reduced, seasons are extended and yields are increased, enabling growers to reduce their costs.”

Frankel said another benefit to growing in containers is that it is really scale neutral.

“It allows for people who are just getting started, who were not fortunate enough to inherit a family farm or are in urban areas with high land costs, to be able to grow organically,” he said.

## **CHANGES TO CURRENT STANDARDS**

Frankel said USDA selected members for the NOP task force from a cross-section of people in the organic industry. They represent a broad range of technical expertise, knowledge and philosophies to examine the current regulations.

“These people were tasked with helping clarify the regulatory issues and to describe the current technologies in use,” he said. “I expect that the task force will describe how container, hydroponic and aquaponic production systems operate, how they meet the current standards and identify different interpretations of the regulations.

“The task force is not technically supposed to make recommendations. The task force is analyzing whether the production technologies used today meet current USDA regulations, standards and laws. The task force will also determine whether any areas within those regulations may need to be updated, revised or defined based on their findings.”

Frankel said once the report is released, the National Organics Standards Board will study the document and determine if it would like to recommend changes to the current regulations. NOSB has traditionally sought input and testimony from the organic industry prior to making recommendations on any proposed changes or modifications.

“If NOSB votes to forward recommendations to USDA, USDA would then translate those recommendations into formal proposed regulations and open them up to public comment,” he said. “USDA would then respond and would incorporate meaningful comments into the final rule.”

## **TIME FOR GROWERS TO RESPOND**

Frankel said release of the task force report will be another opportunity for hydroponic growers to tell their story to prevent NOSB from starting the process to push the growers out of the organic market.

“Organic-certified hydroponic and aquaponic growers need to make a case about the validity of what they are doing,” he said. “In addition to their production methods being thousands of years old, USDA has long recognized the legitimacy of these systems. The systems have helped to grow demand for organics while reducing inputs and opening the market for new growers.

“Most critically from a philosophical perspective, these production systems use the same biological processes as those of organic field growers.”



**The Coalition for Sustainable Organics includes growers from the United States, Mexico and Canada. Some of these organic growers produce in the field as well as hydroponically in greenhouses.**



Frankel said growers have a number of ways of bringing attention to their rightful place in the organic industry.

“Growers need to participate in the all-important public comment periods in the rulemaking process,” he said. “Growers can have their retail customers share their stories through company newsletters. Highlighting growing operations with CSAs (community supported agriculture) or reaching out to the local press can help spread a common message while building a grower’s own business. Hosting farm visits is often the easiest way to directly show how a grower’s operation is following the organic principles of cycling nutrients, eliminating synthetic pesticides and conserving resources such as land and water.”

Frankel said these farm visits for fellow growers,

certifiers, elected officials, trade association staff, USDA officials and even NOSB members have proven to be an effective method to dispel any misconceptions spread by opponents of these organic production systems.

“From the coalition’s point of view, everyone deserves organics,” he said. “Containers are an integral part of a more resilient production system that allows for growers of all sizes and economic backgrounds to produce organic products that an increasing number of consumers are demanding.” 🌱

For more: Coalition for Sustainable Organics, (619) 587-45341; [info@coalitionforsustainableorganics.org](mailto:info@coalitionforsustainableorganics.org); <http://coalitionforsustainableorganics.org>.

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

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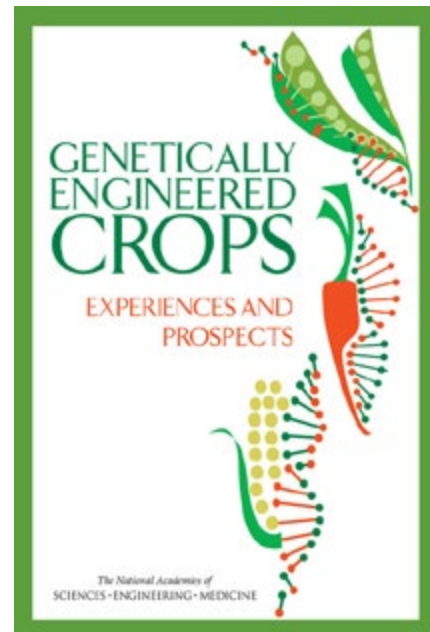


# Genetically Engineered Crops: *Experiences and Prospects*

Authors: Committee on Genetically Engineered Crops: Past Experience and Future Prospects; Board on Agriculture and Natural Resources; Division on Earth and Life Studies; National Academies of Sciences, Engineering, and Medicine

Genetically engineered (GE) crops were first introduced commercially in the 1990s. After two decades of production, some groups and individuals remain critical of the technology based on their concerns about possible adverse effects on human health, the environment, and ethical considerations. At the same time, others are concerned that the technology is not reaching its potential to improve human health and the environment because of stringent regulations and reduced public funding to develop products offering more benefits to society. While the debate about these and other questions related to the genetic engineering techniques of the first 20 years goes on, emerging genetic-engineering technologies are adding new complexities to the conversation.

Genetically Engineered Crops builds on previous related Academies reports published between 1987 and 2010 by undertaking a retrospective examination of the purported positive and adverse effects of GE crops and to anticipate what emerging genetic-engineering technologies hold for the future. This report indicates where there are uncertainties about the economic, agronomic, health, safety, or



other impacts of GE crops and food, and makes recommendations to fill gaps in safety assessments, increase regulatory clarity, and improve innovations in and access to GE technology.

<http://www.nap.edu/catalog/23395/genetically-engineered-crops-experiences-and-prospects>

# Importance of LEDs in Horticulture

Dr. Mark Lefsrud and Sadman Islam  
Associate Professor and Research Assistant  
William Dawson Scholar  
Bioresource Engineering, McGill University

**Can broad-spectrum radiation that is obtained from the Sun and traditional horticultural lighting sources (i.e. HPS and fluorescent tubes) really be substituted by LEDs?**

**Simply put, yes.**

LEDs in greenhouse vegetable production can better control the rate of photosynthesis, as well as many hormonal and morphological changes. By using the narrow bandwidth spectrum emitted from LEDs, plants can be provided with lights that correspond to the peaks of the photosynthetically active radiation (PAR) curve (Figure 1), where maximum plant growth occurs in the red (660nm) and blue (450nm) spectrum, and less growth in the green region. Furthermore, these peaks correspond to increased secondary metabolites concentrations in plants that are nutritious for humans. Along with higher electrical and lighting application efficiencies, LEDs represent an extremely economic and highly profitable lighting solution for greenhouse growers.

**Wavelength Selection:** Since the ideal wavelength range for plant growth is 420nm to 470nm (blue) and 600nm to 700nm (red), supplying them with broad-spectrum lighting is an inefficient use of energy (Papadopoulos and Pararajasingham, 1997). High power light emitting diodes (LEDs) are a versatile artificial light source offering a variety of advantages over traditional forms of horticultural lighting. Their small size, durability, longer lifespan, cool emitting temperature, and the option to select specific wavelengths for a targeted plant response, make LEDs more suitable for plant based uses than many other light sources. These advantages, coupled with new developments in wavelength availability, light output, and energy conversion efficiency, places us on the brink of a revolution in horticultural lighting (Massa et al., 2008).

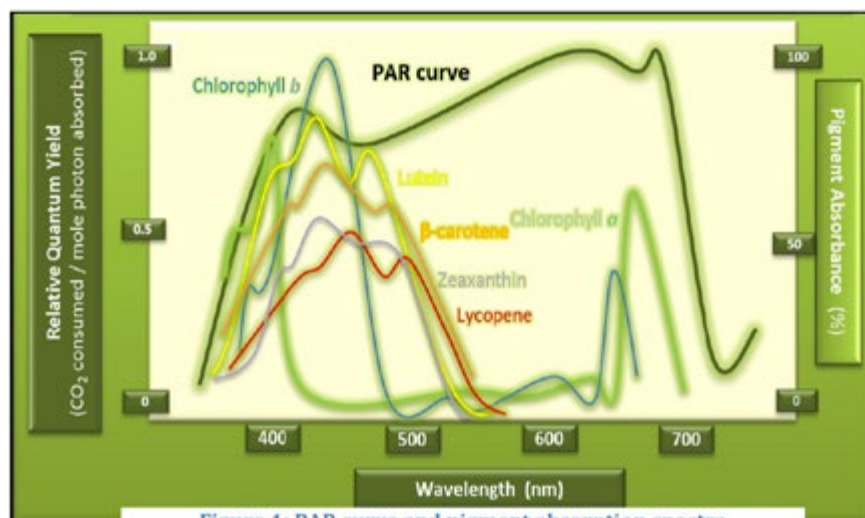


Figure 1: PAR curve and pigment absorption spectra



**LED Ratio:** By applying the PAR curve peaks, shining wavelengths of red light (660nm) can trigger phytochrome responses related to stem growth, photosynthetic structuring, the onset of flowering (photoperiodism), setting circadian rhythms, regulating germination of seeds, elongation of seedlings, and the size, shape and number of leaves. On the other hand, blue light (450nm) is known to trigger cryptochromes that are linked to the regulation of germination, elongation, photoperiodism (circadian rhythm), sensing of magnetic fields, normal chlorophyll and chloroplast development, and enzyme synthesis (Tamulaitis et al., 2005). However, the impacts of mixing different ratios of red and blue LED light intensities (x red: x blue) are still debated upon in the scientific community. While Son and Oh (2013), Lin (2000), Deram et al. (2014) and Goins et al. (1998) have said that high ratios of blue light (5:1) led to shorter stem length as well as greater flowering and fruit production, and exposure to increased red light (19:1) generates the highest plant biomass (excluding fruit), Massa et al. (2008) on the other hand states that increased levels of blue light is responsible for greater plant leaf production, without impacting flowering or fruiting. Moreover, in a study by Lee et al. (2015), blue light produced no statistical difference in leaf production, width or length but it did increase leaf thickness. White lights are generally used to monitor plant development as it provides a better view to the grower. While white LED light on its own is not as effective of a plant lighting source, supplementing white light with low levels of blue light to form warm white LEDs can increase stem elongation and leaf expansion, whereas high levels of blue light from cool white LEDs can result in more compact plants (Cope and Bugbee, 2013).

**Nutritional Impact:** LEDs can also impact the nutritional values of greenhouse produce. Lefsrud et al. (2008) demonstrated effects of differing wavelength and irradiance on pigment accumulation in kale. Hydroponic grown plants subjected to a range of PAR LED impacted the secondary metabolites

accumulated under the different treatments, including chlorophylls, lutein and  $\beta$ -carotene and glucosinolates (antioxidants). It was seen that metabolite accumulation concentrations varied between wavelength treatments, with accumulation peaks at 640 and 440 nm, which also corresponded with the two highest irradiance values. Similarly, Urbonavičiūtė et al. (2009) have noted that compared to HPS, LEDs can promote the synthesis of antioxidative compounds, such as vitamin C, phenolic compounds and carotenoids on certain plants such as wheatgrass, barley grass, and leafy radish.

**Irradiance:** Crop productivity is affected by the position of the light sources with respect to the photosynthetic surfaces as this affects the incident light intensity that they receive. Since the radiation energy intercepted by a surface from a point source is proportional to the inverse square of the distance between them (Bickford and Dunn, 1972), reducing that distance will have a large impact on the incident light level. Compared with intensely hot, high-intensity discharge emitters which have an efficiency of  $\approx 25\%$ , LED lamps operate at efficiencies of  $\approx 40\%$  which creates lower operational temperatures, more directed heat sinks and allows for the lights to be brought much closer to plant tissues. LEDs, therefore, can be operated at much lower energy levels to give the same incident photosynthetic photon flux at the leaf surface (Massa et al., 2008). This allows LEDs to be designed not only as overhead lights, but also as intercanopy lighting devices as well, ensuring maximum plant productivity and yield. Additionally, wide spectrum beams also have a tendency to bounce off greenhouse surfaces, leading to higher rates of diffusion and overall inefficiency. This is mitigated in overhead LED fixtures, as the light can be easily converged, and the effect is reduced even further in intercanopy LED use. Research from Cornell University on has shown that  $250\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  of light ( $\approx 22\text{mol}\cdot\text{m}^{-2}\cdot\text{day}^{-1}$ ) is ideal to maximize the production of lettuce in a greenhouse located in Northeast North

America (Brechner and Both, n.d.). The use of lamps that provide 150-250 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ , will meet these requirements as either overhead or intercanopy lighting. Moreover, Ouzounis et al. (2015) states that due to the precise light delivery mechanism of LEDs, overhead fixtures delivering at least 250 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  (up to 500 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ ) can reduce the growth time of greenhouse tomatoes and lettuce.

Much of our current understanding of LEDs has proven it to be a competitive light source for greenhouse applications. Although opinion in the scientific community is divided regarding the optimum red to blue wavelength ratios for pursuing different plant growth strategies, there is a large support for using higher levels of blue light (1:1) to promote early and increased fruiting whilst creating a more compact plant with thicker leaves. Meanwhile, a 6:1 ratio promotes leaf and fruit production, leading to a balanced growth. Mixing red and blue wavelengths at a 3:1 ratio is the most popular greenhouse practice to create a more neutral growth regime, with research supported by Schwalb (2013) who noted a transition point from a low to high photosynthesis rate for both tomato and lettuce at a 4:1 ratio. Based on studies from Ste. Anne-de-Bellevue (QC) and Cornell (NY), for greenhouse applications at least 250 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  is suggested for overhead LED fixtures with 70 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  to 125 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$  (Deram et al., 2014) of intercanopy lighting to supplement it.

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