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STEVE FAMBRO,
CEO AT FAMGRO FARMS

URBAN AG PRODUCTS

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Urban Ag Products 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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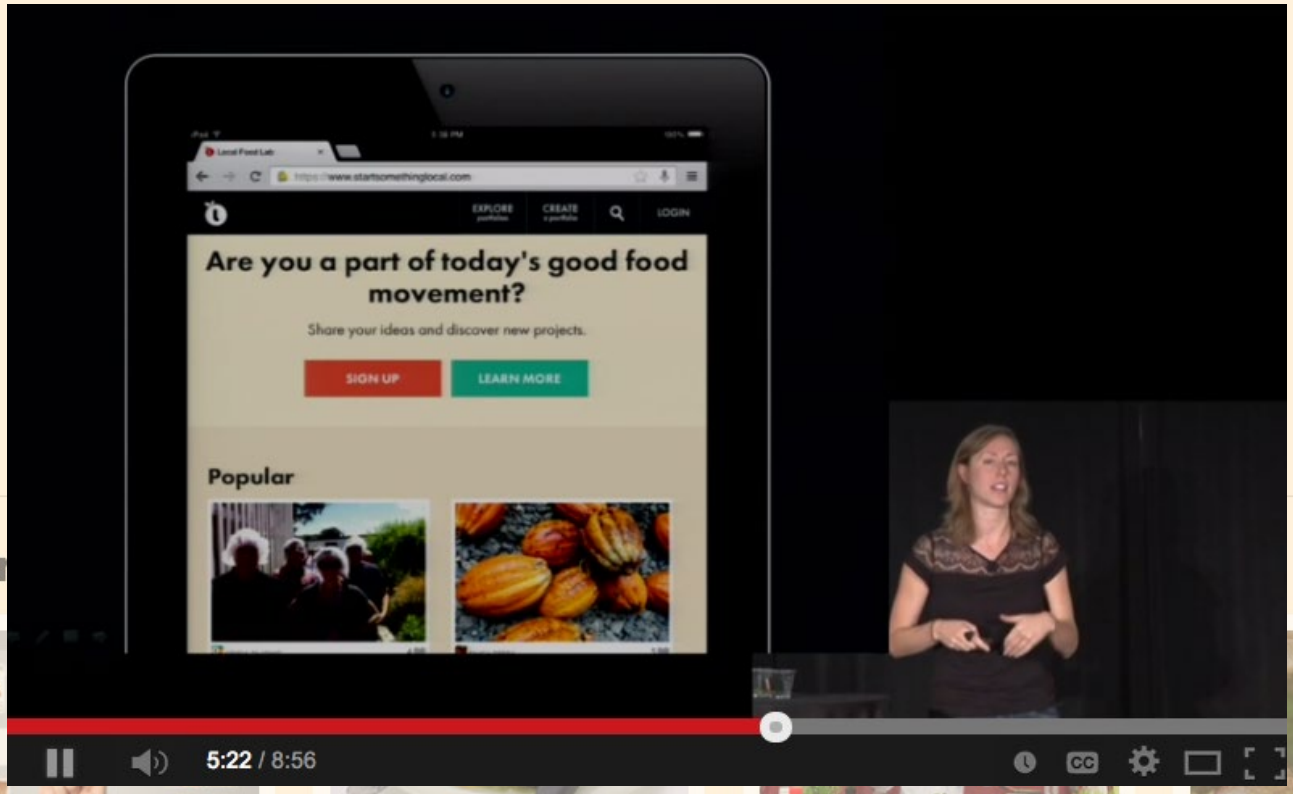

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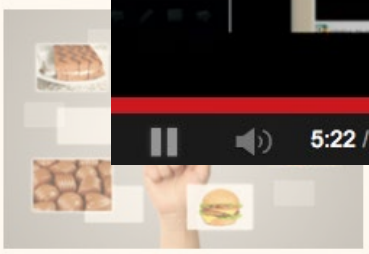

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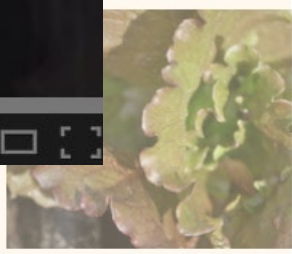

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VERTICAL FARM COMPETES WITH CONVENTIONAL AG

By David Kuack

Famgro Farms is using a vertical farm production system to successfully compete with conventional farming to produce healthier, better tasting food.

Steve Fambro, CEO at Famgro Farms in Oceanside, Calif., isn't your typical farmer. And his "farm" isn't the typical agricultural operation. It's located in a 10,000-square-foot building that was previously used to make surf boards.

Prior to starting Famgro Farms, Fambro, who is an electrical engineer by training, raised $30-$40 million to start electric car company Aptera Motors in 2006. While working at Aptera, Fambro and his wife converted to an organic lifestyle.

"After buying organic produce for a few years I started asking myself why are these products so expensive?," Fambro said. "I determined a large part of the cost of organic farming is the labor, including the weeding, tending to the plants, etc. I hypothesized that if we could think about things differently and design from the ground up with scale and automation in mind, then we could lower the cost of food. That was really the genesis of Famgro Farms."

BUILDING A BETTER PRODUCTION SYSTEM

Fambro, who left Aptera in 2009, started Famgro Farms in 2010. His goal was to produce a premium line of pesticide- and herbicide-free food.

"We don't sell hardware. We don't sell technology. We don't sell farms. We sell the best food consumers can buy," Fambro said. "We deliver on that promise of fresh, local, chemical-free, always in season and always available."

In order to realize his aspirations, Fambro said a completely new production platform had to be developed.

"We had to design and manufacture every component of it," he said. "Trying to use off-the-shelf products like

Steve Fambro, CEO of Famgro Farms, developed a vertical growing system that he said is more efficient than greenhouse and field food crop production. *Photos courtesy of Famgro Farms.*

Famgro Farms has reduced the number of crops it's producing and focused its marketing efforts on its Sweet Kale.

Famgro Farms promotes its products as being free of pesticides and herbicides.

lighting and hydroponic systems wasn't going to work.

"In systems engineering, which is my background, you have to think about everything from how is the electrical power delivered to the building to how it is delivered to the circuit boards. Looking at off-the-shelf components, they become a nightmare when connecting all of the parts in a system. From a system's engineering perspective, whether it is cooling, water-proofing or serviceability, all of it has been designed to work together."

Fambro said it took three generations of designing and building a vertical farm platform over a 2-year period to come up with an operable system.

"We are currently using the third generation platform and each one was radically different, better and cheaper than the previous platform," he said. "That's a rule of engineering, from concept to production usually takes three reps. "The vertical farm platform we developed has been designed to easily change between a substrate and a hydroponic system. The one we are currently using is a hydroponic system."

DECIDING WHAT TO GROW

Fambro said his company has grown about 100 different kinds of leafy greens, herbs, flowers and pharmaceutical plants in the vertical farming system.

"The platform is easily adapted for many different plants, both flowering and food crops," he said. "Right now our focus is just on food items. We went through a phase where we had to stop developing the platform. We proved that it worked and had to develop a brand around this locally-grown, chemical-free food."

Initially Fambro said his company began with too many crops.

"We would contact retailers and offer them five different kinds of basil," he said. "They didn't know which one to buy and they ended up not buying any of them. We pared our offerings down to something that we thought we could grow better than anybody else. The one crop we chose to focus on was kale. Our kale, which we have branded as "Sweet Kale", is tender and sweet. These characteristics are immediately observable to the consumer. The different kale varieties that we grow are as soft as lettuce.

Famgro Farms is growing some microgreens and herbs, but kale is its bread-and-butter crop.

We're also growing some microgreens and herbs, but the kale is our bread-and-butter crop."

Famgro Farms sells half of its produce to grocery stores and the other half to restaurants. Retailers of Famgro's products in southern California include Whole Foods Market, Barons, Cardiff Seaside Market and other local grocery stores.

ADDRESSING FOOD PRODUCTION ISSUES

Fambro said the businesses and consumers purchasing his company's produce are mindful of labels and environmental issues.

"Most of the lettuce produced in the U.S. is coming from California and Arizona," he said. "The biggest user of water in California is the agriculture industry. People identify with water use and conservation. They want to know if they can buy a brand that is mindful of the environment, mindful of using no chemicals and mindful of workers' rights. Customers care about those issues.

"The way we produce leafy greens in this country is broken. The system is so labor intensive. That method of production is not sustainable."

Fambro said his company has plans for expansion, but that expansion won't occur in California.

"We are in the heart of "America's Salad Bowl"," he said. "If we can compete here, and we do, then that is a real testament to how our company's technology works. We are able to compete with produce that is grown in fields 100 miles away. That whole value proposition becomes even more powerful the further away one gets from California. If we can compete with cheaper produce, more of which is being grown in Mexico, that validates our model.

"We are producing food and delivering it at the exact time and in the quantities that our customers want it. We are radically simplifying cold storage and the logistics. If you compare production systems, ours might use more electricity than greenhouse or field farming, but you have to consider the total energy use. That includes the energy used to create the fertilizers and other chemicals applied in field farming and the energy in the form of fuel used in tractors and other harvesting equipment. If you add all of that up, our vertical farming system is more efficient and more sustainable."

For more: Famgro Farms, (760) 476-1710; famgro.com; facebook.com/FamgroFarms.

David Kuack is a freelance technical writer in Fort Worth, Texas; dkuack@gmail.com.

POP CULTURE'S FOOD MOVEMENT


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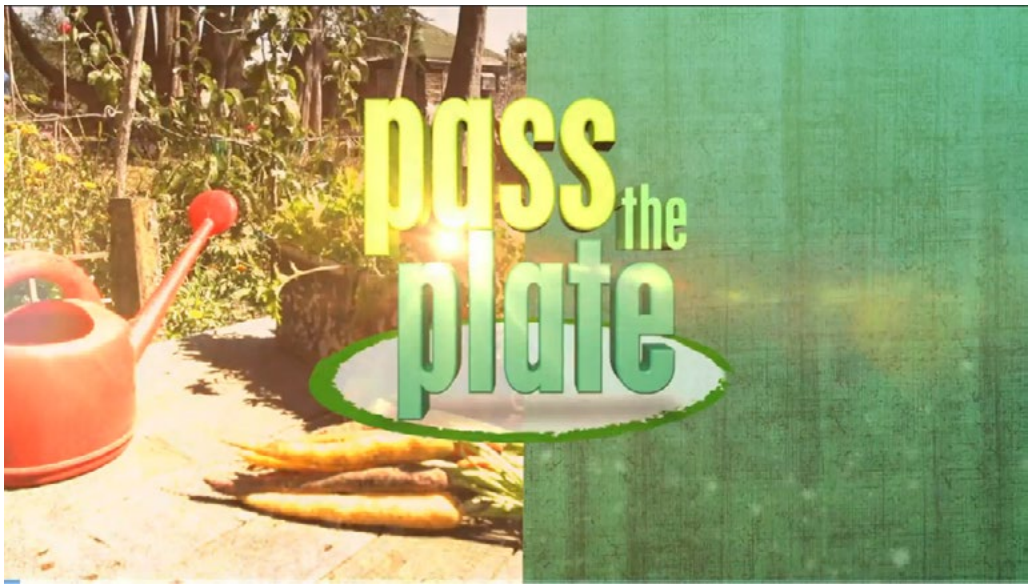
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WHAT IS SUSTAINABLE AGRICULTURE TO YOU?
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AIRSTREAMS VCAPCD HOUWELINGS TOMATOES

more research focusing on greenhouse food crops

By David Kruack

University researchers, some of whom previously focused on ornamental crops, are turning their attention to food crops as more growers look to replace or supplement flower crop production.

University of Arkansas horticulture professor Mike Evans said that he has seen a shift in interest by growers and students from greenhouse floral crops to food crops.

"As the ornamental side of the greenhouse industry has been undergoing consolidation with fewer but larger operations, we have seen an increased interest from the industry in growing greenhouse food crops," Evans said. "The number of emails and phone calls related to greenhouse food crops have greatly increased. Also, more students who are interested in greenhouse production want to learn about growing food crops. Here at the University of Arkansas we put in different kinds of soilless and hydroponic production systems.

"There are a lot of people conducting research and growing tomatoes, peppers and cucumbers in greenhouses. So I started looking at greenhouse food production and found the area of greens, in many respects has been neglected. There are people out there doing these crops, but if you look for referenced research or talk to people, there is a lot less solid research on greens. In the U.S. we have tended to be field-oriented when it comes to the production of greens. Most of our breeding work has been oriented towards field production."

Evans has started working with fellow university horticulture assistant professor and breeder Ainong Shi.

"We are interested in looking at new species of fresh greens and the breeding of greens," Evans said. "We are particularly interested in developing crops that can take Southern hot climates. By converting our facilities to focus on greenhouse food crops we are looking to become a central institution to study new species of greens, developing new crops, breeding new cultivars, and developing production protocols for these crops."

University of Arkansas professor Mike Evans is studying the production of greens in different kinds of soilless and hydroponic production systems. *Photos courtesy of University of Arkansas.*

With funding from the National Sustainable Strawberry Initiative, Mike Evans is studying greenhouse strawberry production in hanging baskets, Dutch buckets and using nutrient film technique.

Evans said one of focuses of the research is to find ways that growers can easily adapt to different types of food crops without having to change their production systems.

"We want growers to be able to use the systems they are currently working with," he said. "We are trying to find ways that growers can produce these crops without having to make any major monetary investments. In the future you may see more growers producing both ornamental and food crops together in order to be more diversified."

Stoked on strawberries

The National Sustainable Strawberry Initiative is a new competitive grants program of the University of Arkansas' Division of Agriculture Center for Agriculture and Rural Sustainability (CARS). The program has received $3 million in funding from the Walmart Foundation to support the expansion of sustainable strawberry production nationwide. CARS created and manages the grants program, awarding money to land-grant and other public universities with agricultural research and outreach programs.

Evans is working on several strawberry-related projects that received funding through the grants program. He is studying greenhouse strawberry production in hanging baskets, Dutch buckets and using nutrient film technique (NFT).

"I am looking at different substrates in those systems," Evans said. "Which substrates work well and don't work well. A large part of the project is meant to be education and demonstration. We are using the research project as a way to create a number of short videos that will be going onto our You Tube channel that is focusing on hydroponic soilless production of greenhouse strawberries. We want to create these videos

to help growers who may be interested in trying to produce strawberries. They can watch these videos to learn how to go about doing it."

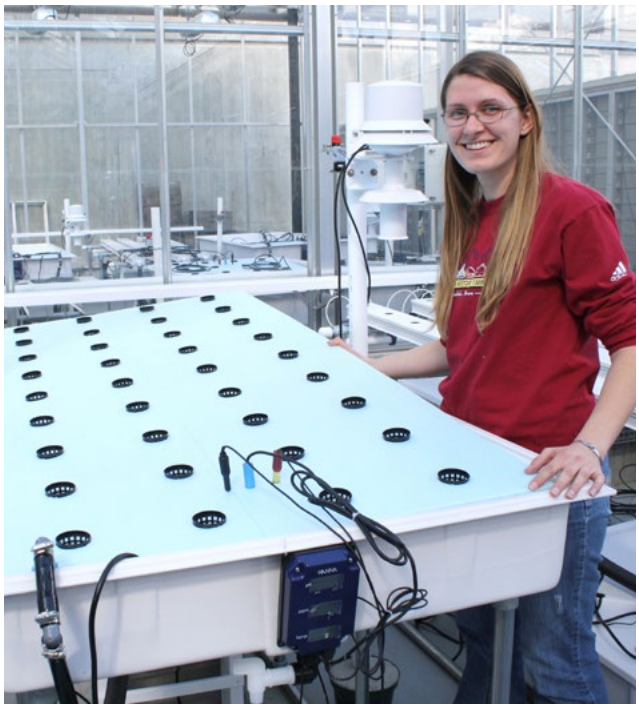
For more: Michael Evans, University of Arkansas, Department of Horticulture; (479) 575-3179; mrevans@uark.edu; hort.uark.edu/5377.php

Big on basil

Chris Currey, assistant professor at Iowa State University, is starting a research project with basil, which he said is one of the most popular culinary herbs. Currey said there are a wide variety of basils available, including Italian basils, Asian basils, citrus basils and specialty basils like the purple basils.

"I am going to be looking at expanding a wider palette of basils for production in greenhouse hydroponic systems, including nutrient film technique and trough systems," Currey said. "The research is primarily going to look at the Italian large leaf basils or the pesto basils (*Ocimum basilicum*). These are the sweet basils. We are trying to identify more types of basil that grow well in the greenhouse."

Currey is working with master's graduate student Kellie Walters to broaden the number of basil cultivars that can be grown.



At Iowa State University, assistant professor Chris Currey (above) and master's graduate student Kellie Walters (below left) are working to increase the number of basil cultivars that can be grown in greenhouse hydroponic systems. *Photos courtesy of Iowa State University.*

"We will be growing 36 varieties of basil including some of the sweet and specialty-type basils," he said. "We are going to be evaluating their productivity in hydroponic systems. We will first be trying to identify the common commercial varieties that grow well in these greenhouse production systems.

"We will also be looking at the production methods that help to improve yields. For culinary herbs we are more concerned with the yields. Herbs produced commercially for culinary purposes are usually sold in clam shell containers of a certain weight. The growers are selling biomass, which is related to weight."

Currey will be looking at the rate of development over a range of photoperiods, light levels, and electrical conductivity and pH of solutions for greenhouse production. He said he expects the temperature requirements will vary among the different varieties that will be trialed.

Currey said he hasn't yet decided if taste will also be evaluated.

"Taste is a discretionary measurement based on the person eating the basil," he said. "The

characteristics that measure flavor are much more subjective. The first thing we need to determine is how to improve production. If they taste good, but don't produce, then it's going to be a moot point. I haven't seen a lot of research that talks about taste or flavor because it can be difficult to quantify."

For more: Christopher Currey, Iowa State University, Department of Horticulture; (515) 294-1917; ccurrey@iastate.edu.

Climate challenges to greenhouse growing

When University of Arizona horticulture professor Chieri Kubota began working with greenhouse strawberries five years ago she said there were no grants available to work on the crop.

"At the time there were a few growers who were trying to produce hydroponic strawberries, but the production was not significant compared to the amount of outdoor production that was being done," Kubota said. "There was some high tunnel production, but the majority of outdoor production was being done in California and Florida."

Because of field production issues including seasonality, disease, soil fumigation, labor intensive production, Kubota looked at greenhouse hydroponics as a way to produce strawberries more sustainably.

Working with University of Arizona research specialist Mark Kroggel, the two scientists were able to get the plants to grow in the greenhouse but had difficulty getting the plants to produce fruit with commercially acceptable quality.

"The lack of fruit production was related to the climate conditions that we have here in Arizona," Kubota said. "Mark Kroggel and I applied for and received funding from the National Sustainable Strawberry Initiative. Our goal is to teach growers how to hydroponically produce greenhouse strawberries in a semi-arid climate like Arizona.

One of the goals of University of Arizona professor Chieri Kubota's strawberry research is to teach growers how to hydroponically produce greenhouse strawberries in a semi-arid climate like Arizona. *Photos courtesy of University of Arizona.*

“Our whole approach was to start with a production system that had already been proven to work well and that was widely used. We wanted to start with reliable technology because we wanted to develop a program and to teach others how to do it.”

One of the issues that Kubota and Kroggel have resolved was determining which substrate worked best for greenhouse production.

“Strawberry roots require a lot more oxygen compared to other greenhouse crops like cucumber and tomato,” she said. “If there isn’t an adequate amount of substrate porosity the roots don’t develop properly, which affects the overall growth and the fruit production. Strawberries also take up a smaller volume of water than other greenhouse crops such as tomato and cucumber so the root zone environment is largely affected by the chemical and physical properties of substrates. Strawberries can also have issues with pH that other crops don’t experience. We ended up choosing a substrate consisting of 50 percent perlite, 25 percent coconut coir and 25 percent peat moss.”

A physiological disorder of strawberry that Kubota found to occur in the semi-arid climate of Arizona was tip burn caused by calcium deficiency. Symptoms appear on the leaves and on the calyx and can lower the market value of the fruit.

One of the issues that Chieri Kubota and University of Arizona research specialist Mark Kroggel have resolved was determining which substrate worked best for greenhouse strawberry production.

"We determined that the plants require a high humidity at night to supply enough calcium by root pressure," she said. "We are testing an under bench misting system to raise the humidity during the night so that calcium is provided to the fruit. This technique has nearly eliminated the problem with calyx tip burn. The mist is supplied for three hours at night under the benches, so the water doesn't land on the plants. The next day the added moisture is evaporated so that the plants are not being grown under a high humid environment all of the time."

Kubota is also working with LED lights to determine their effect on grafted tomato and watermelon plants. She developed a new application of LED lighting to produce strong seedlings.

"When doing grafting the plants need to have a little more stretched growth. That stretched growth can be difficult to achieve," she said. "By providing the plants a small amount of light with specific wavelengths at the end of the day causes an extension of the stem. A few days after providing the light treatment the seedling has a good length of stem so that it is easier to graft."

For more: Chieri Kubota, University of Arizona, The School of Plant Sciences, Controlled Environment Agriculture Center; (520) 626-8833; ckubota@ag.arizona.edu; cals.arizona.edu/research/kubota.

David Kuack is a freelance technical writer in Fort Worth, Texas; dkuack@gmail.com.

Chieri Kubota is working with LED lights to determine their effect on grafted plants to produce strong seedlings that are easier to graft.

GROWING THE BEST ORNAMENTALS, VEGETABLES FOR DALLAS

Matt Ruibal, owner of Ruibal's Plants of Texas in Dallas, is looking to produce the best ornamental plants and vegetables for the local market. The company was started by his father in 1984 with a small retail stall at the Dallas Farmers Market selling bedding plants. Since then, the company has expanded to four retail locations, 300,000 square feet of greenhouses and 200,000 square feet of outdoor production used to grow annuals, perennials and vegetables.

Matt is committed to providing the local Dallas market with the best plants and vegetables by controlling the production. His customers value the products he is growing because of their quality and freshness.

For more: Ruibal's Plants of Texas, (972) 286-5270; www.ruibals.com.

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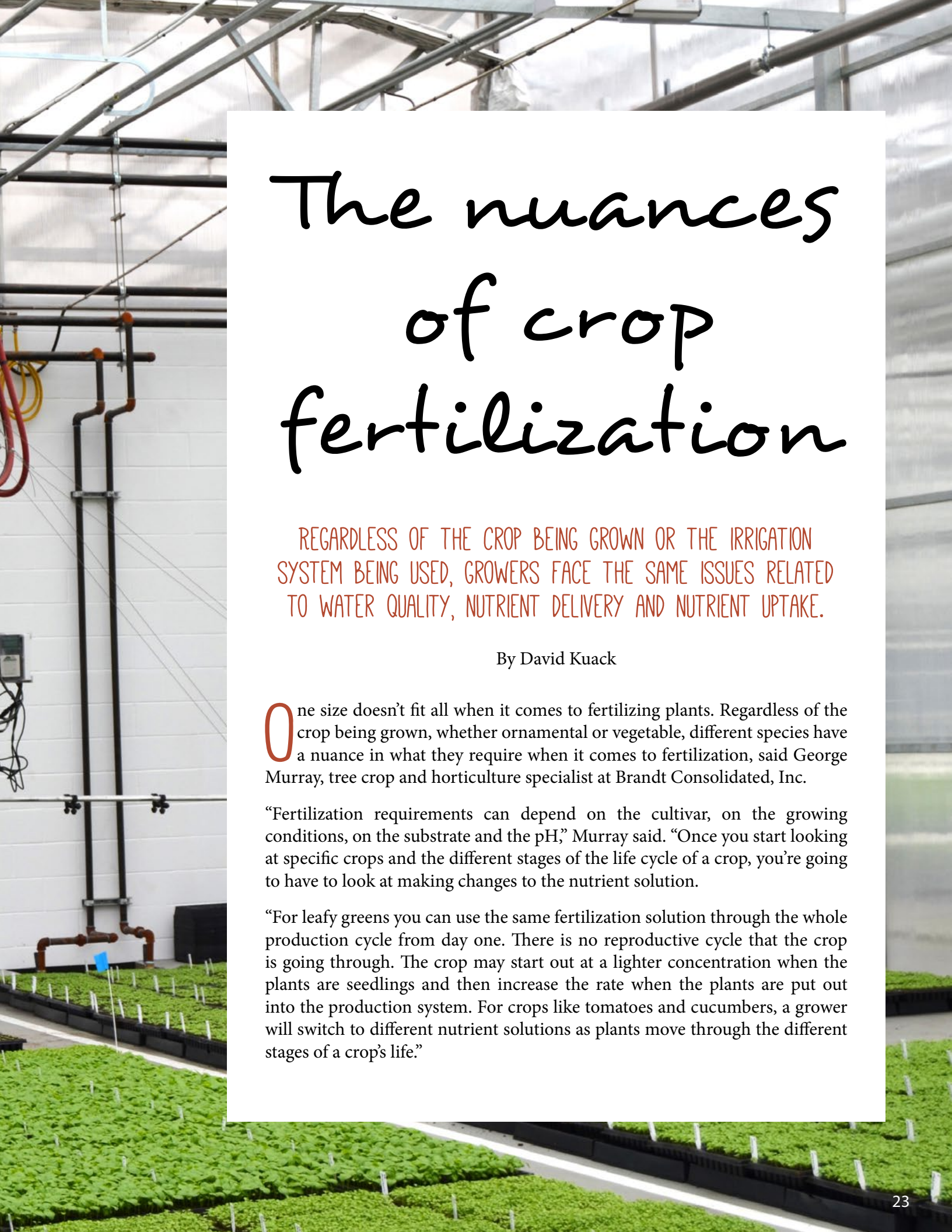
CUNY TV SPECIAL: FOOD REVOLUTION

BEND STUDENTS HARVEST BASIL FOR LOCAL MARKETS



The nuances of crop fertilization

REGARDLESS OF THE CROP BEING GROWN OR THE IRRIGATION SYSTEM BEING USED, GROWERS FACE THE SAME ISSUES RELATED TO WATER QUALITY, NUTRIENT DELIVERY AND NUTRIENT UPTAKE.

By David Kuack

One size doesn't fit all when it comes to fertilizing plants. Regardless of the crop being grown, whether ornamental or vegetable, different species have a nuance in what they require when it comes to fertilization, said George Murray, tree crop and horticulture specialist at Brandt Consolidated, Inc.

"Fertilization requirements can depend on the cultivar, on the growing conditions, on the substrate and the pH," Murray said. "Once you start looking at specific crops and the different stages of the life cycle of a crop, you're going to have to look at making changes to the nutrient solution.

"For leafy greens you can use the same fertilization solution through the whole production cycle from day one. There is no reproductive cycle that the crop is going through. The crop may start out at a lighter concentration when the plants are seedlings and then increase the rate when the plants are put out into the production system. For crops like tomatoes and cucumbers, a grower will switch to different nutrient solutions as plants move through the different stages of a crop's life."

SIMPLE VS. SOPHISTICATED

Murray said the way growers fertilize their crops can vary from simple delivery equipment to sophisticated automated systems.

"Some growers use very simple fertilizer delivery systems and others have very high tech systems that are computerized and automated," he said. "Bottom line, as long as you are able to control your parameters such as the parts per million and the nutritional output, basically the plant isn't going to know the difference. What will make a difference is the labor you are putting into it, the input costs, and the costs it takes to maintain the equipment or system. The input costs and the costs it takes to maintain the equipment or system. The plant doesn't know how the fertilizer is delivered and what kind of technology is used."

Murray said those growers who are using automated systems know the parameters that they need to be at and depend on the technology they've installed to replicate those set points.

"A grower has to be at a certain size in order to cover the overhead expenses, those fixed costs, for that technology," he said. "For the grower who prefers to grow by "feel," there are probably going to be times during the production cycle where there is over fertilization as well as under fertilization. These growers are also not going to know what their true costs are, both in materials and labor. Consequently, these growers may not make as much money as they could."

Murray said that technology can also have its limits.

George Murray said as long as growers are able to control parameters such as the parts per million and the nutritional output, plants aren't going to know the difference in the type of fertilizer delivery system.

"When trying to determine what is a causing a problem with a crop, in some cases, the grower who is growing by "feel" might have a better understanding of the science behind what problems to look for," he said. "The grower who is producing on a large scale with computer inputs may be too far removed from a crop to understand what is going on from a nutritional or disease standpoint. It's really a case by case situation."

IMPACT OF WATER QUALITY

Murray said the biggest problem growers have regardless of their irrigation system or level of greenhouse technology is water quality.

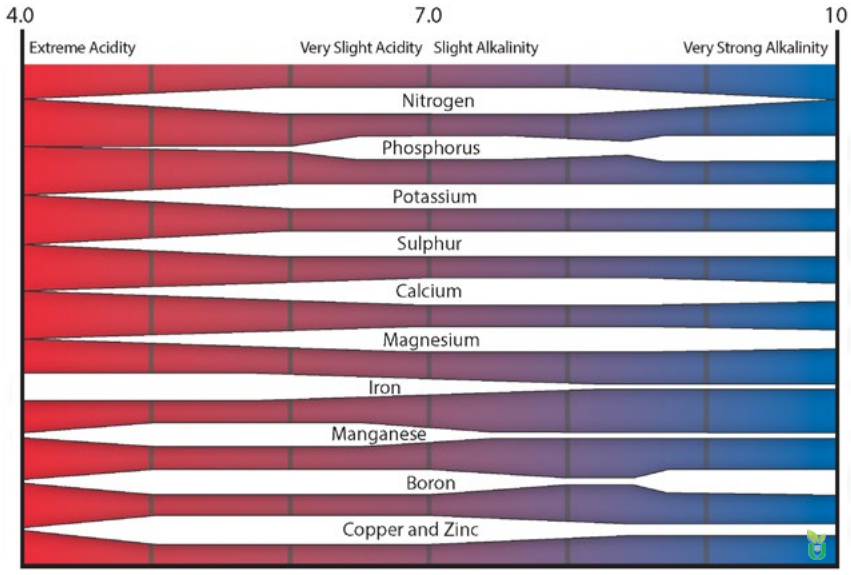
"The water pH dictates so much of what ends up in the plant and in what quantity," he said. "With a lot of the fertilizer mixes when there is a high water pH, the micronutrients are not going to be available to the crop. It is really important since growers are using a lot of nitrogen-based fertilizers which tend to raise the pH of the rhizosphere, which is the area around the plant roots. What are the nutritional sources as well and how do they react separately and to the environment? Sulfate-based micronutrients are not protected as well as EDTA-based micronutrients and will be less available to plants when the pH starts to climb.

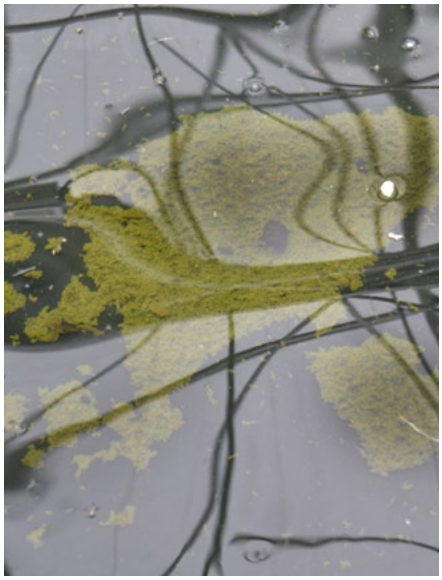
"Growers looking at installing a closed loop irrigation system need to first look at the quality of their water source. Water quality is going to affect what nutrients the plants are going to take up and how much they are going to take up. Sometimes nutrients are not in a format that is readily available to the plants."

George Murray said growers need to know:

- What nutrient levels are in the water.
- How much of the nutrients will have to be added.
- What nutrients are available to the plants that are in the water.
- How much of a nutrient is going to have to be added in.

"Growers who are using more of a traditional watering system like drip irrigation with a soilless growing medium, there is some buffering of the pH in that medium," he said. "Changes to the pH are going to occur a lot more quickly in hydroponic situations and symptoms of those changes also will appear more quickly. A closed loop system is kind of a double-edged sword. There aren't concerns with a poor substrate structure and those types of issues. But at the same time there aren't any buffers or safeguards either."





Water pH dictates so much of what ends up in plants and in what quantity. A high water pH can limit the micronutrients that are going to be available to a crop. Changes to the water pH are going to occur more quickly in hydroponic situations. Symptoms of those changes also will appear more quickly.

Growers looking at installing a closed loop irrigation system need to first look at the quality of their water source. Water quality is going to affect what nutrients the plants are going to take up and how much they are going to take up.

MAINTAINING A NUTRIENT BALANCE

Murray said once a grower has resolved any issues with water quality, then the nutrition-related factors the grower would be dealing are similar regardless of the crop grown or the type of irrigation system used.

"The amount of calcium in water tends to be relatively high," he said. "Phosphorus interacts with calcium, magnesium and iron in the soil. A concern is what happens to that interaction in a closed loop system without a substrate. Up until now most of the research that has been done with the phosphorus cycle has been done with phosphorus in the soil. What needs to be determined is how does phosphorus move in a closed loop system.

Murray said growers need to be sure that they maintain a balance of micronutrients and macronutrients.

"There are certain sites on the roots where certain micronutrients and macronutrients are taken up," he said. "Zinc, copper and nickel have the same uptake sites in the roots. If you have a higher percentage of one micronutrient and a lower percentage of another, say copper and zinc, if they are out of balance then deficiencies of one or the other occurs relatively quickly. From a closed system perspective, even though the soil may have been eliminated, the mechanics of the plant haven't been eliminated. The plants are still taking up nutrients through the roots in the same way. Although a closed loop system may be more efficient and sustainable, growers need to understand that they have not eliminated the hurdles of the plant genetics, and more specifically how certain micronutrients move through a plant's vascular system."

Even with a closed loop system, Murray said there are still opportunities for foliar applications of nutrients when crops are flowering and fruiting.

"Boron is important in cell wall formation," he said. "Boron can be in the water solution, but it can be immobile in the plants. Once boron is taken up by a plant, is it going to be where it needs to be when it needs to be there? Calcium deposition is also important in the formation of cell walls, especially in tomatoes. Just because there is calcium in the water doesn't mean that it is going to get into tomato plants at the right time and be in the right place."

For more: George Murray, Brandt Consolidated, Inc.; (812) 701-4076; George.Murray@brandt.co; brandt.co.

David Kuack is a freelance technical writer in Fort Worth, Texas; dkuack@gmail.com.

Although a closed loop system may be more efficient and sustainable, George Murray said growers need to understand that they have not eliminated the hurdles of plant genetics, and more specifically how certain micronutrients move through a plant's vascular system.

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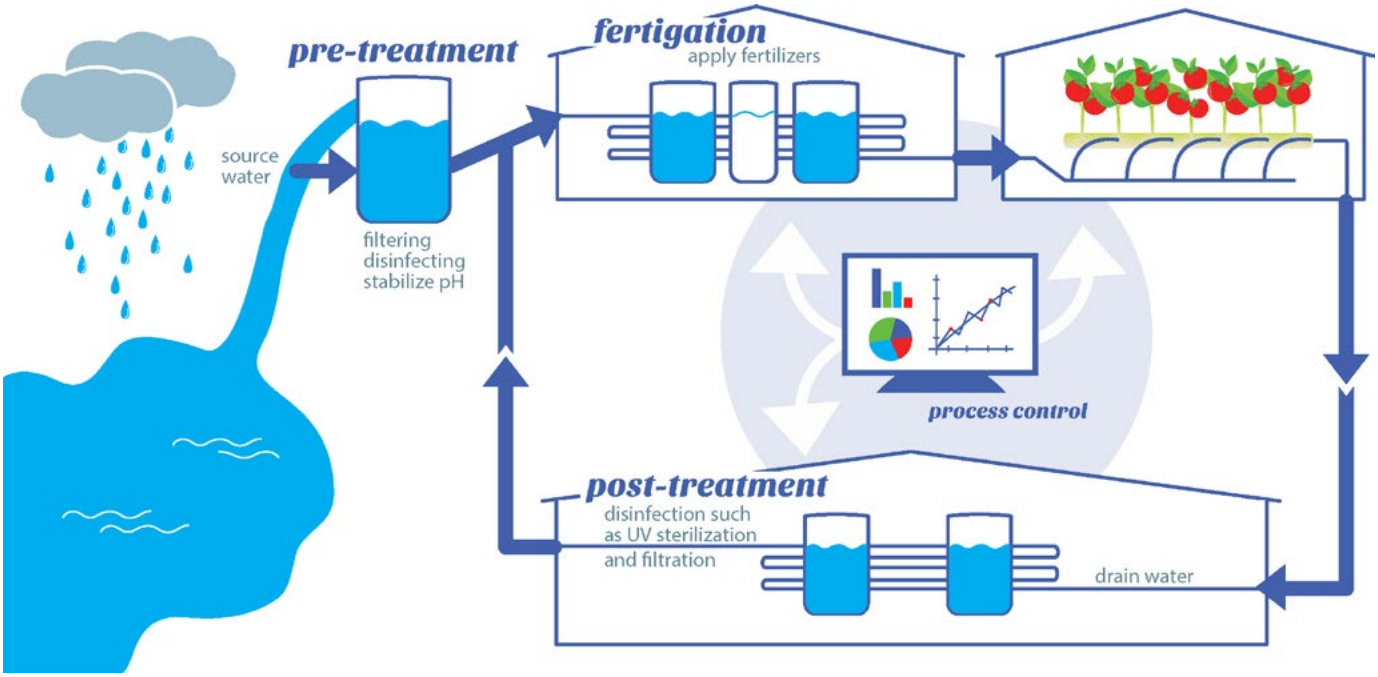

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After 10 years in the making, Whole Foods Market officially opened its doors to its first Brooklyn, NYC store on December 17, 2013

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Hort Americas is proud to be a supplier of LED Grow Lights (including the Philips GreenPower Horticultural LED line) as well as numerous other products important to the commercial hydroponic, horticulture and agriculture industries. Those products include lines like Smithers-Oasis Horticubes, Grodan Rockwool, Riococo Hydroponic Coir products, Bato products and Orchid Mixes and Substrates from Hort Americas and Slingerland.

To learn more about supplemental lighting such as LED Grow Lights, High Pressure Sodium and other horticultural lighting options please contact:

Hort Americas, LLC | 1304 West Euless Blvd., #200 | Euless, TX 76049 | 469.532.2383 | HortAmericas.com

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