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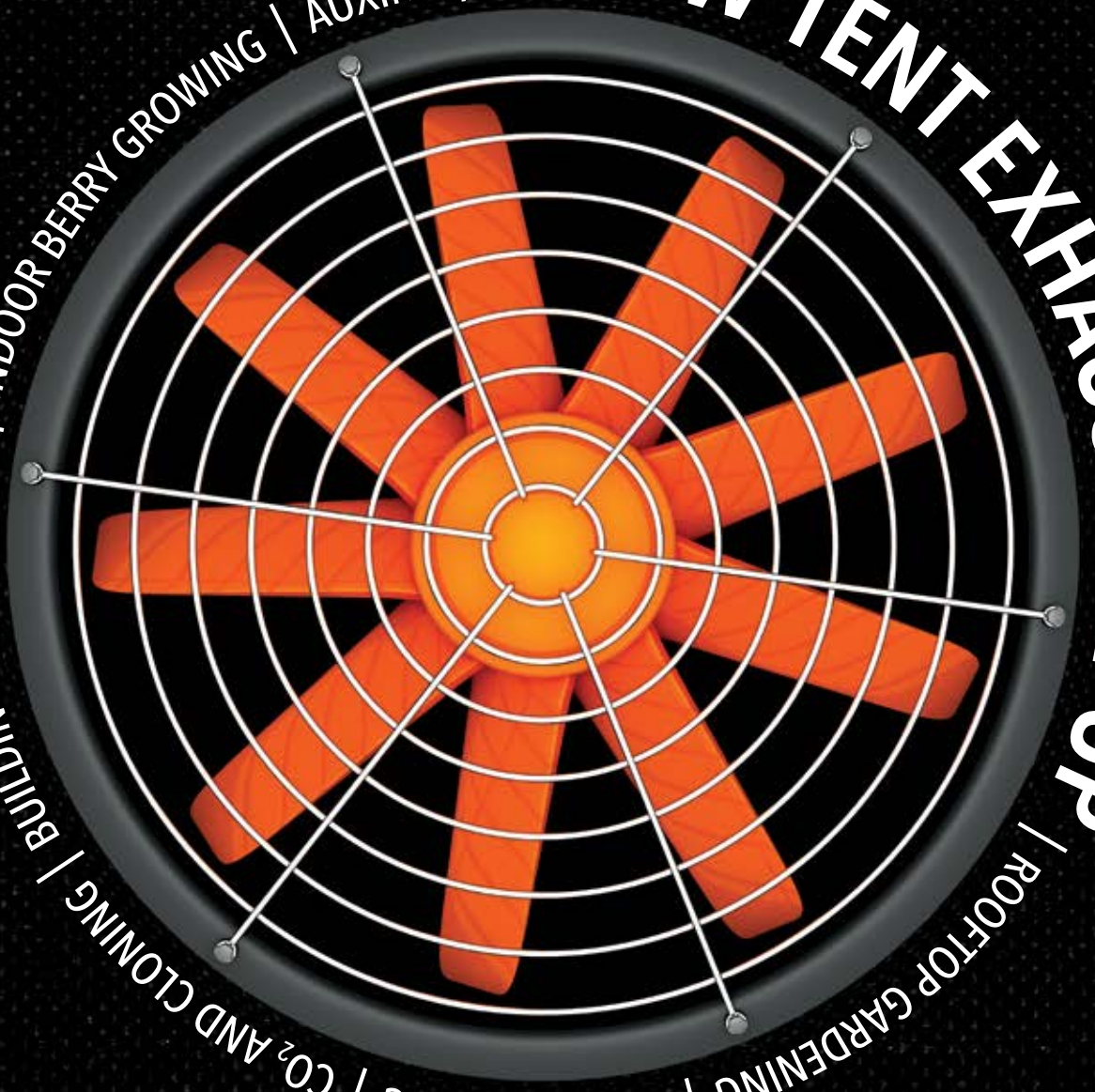

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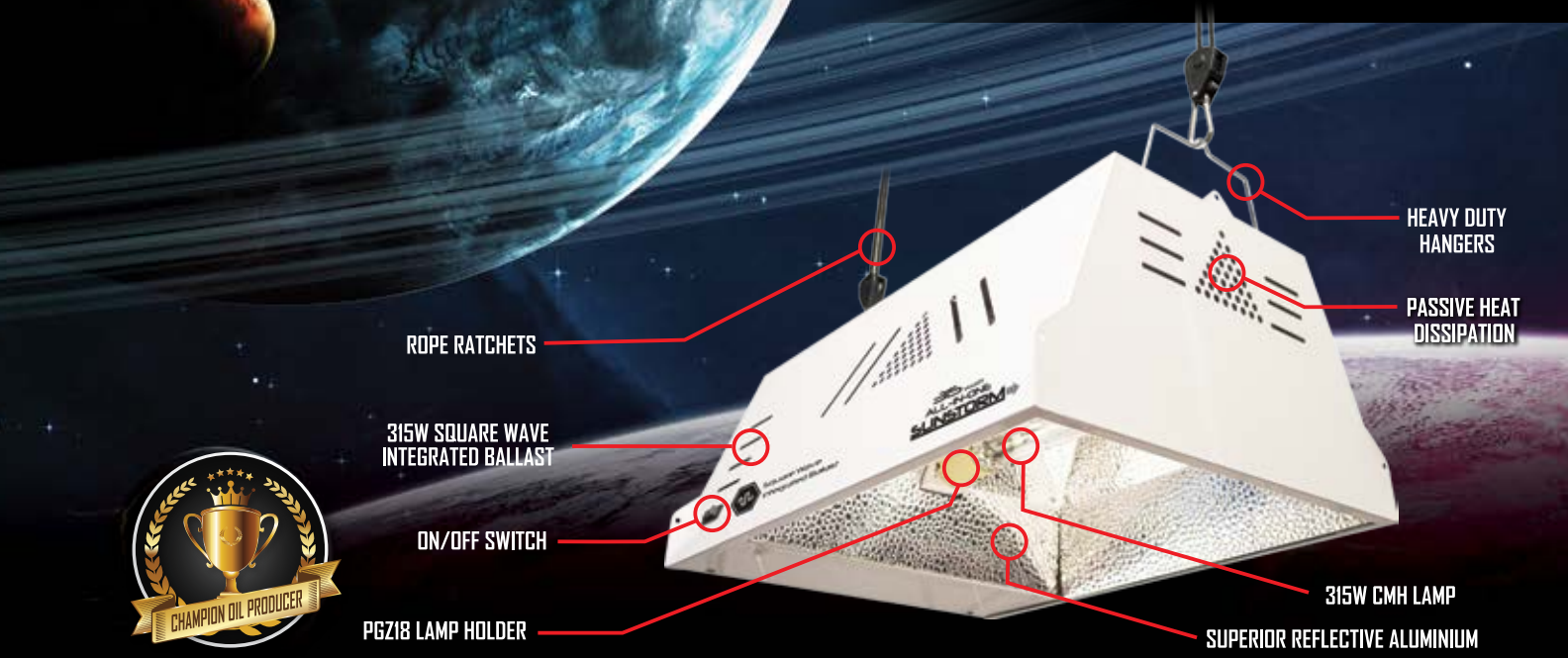

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FEATURES

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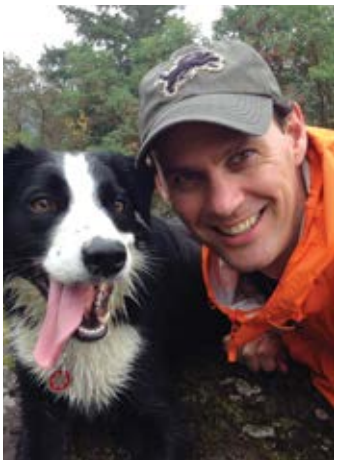
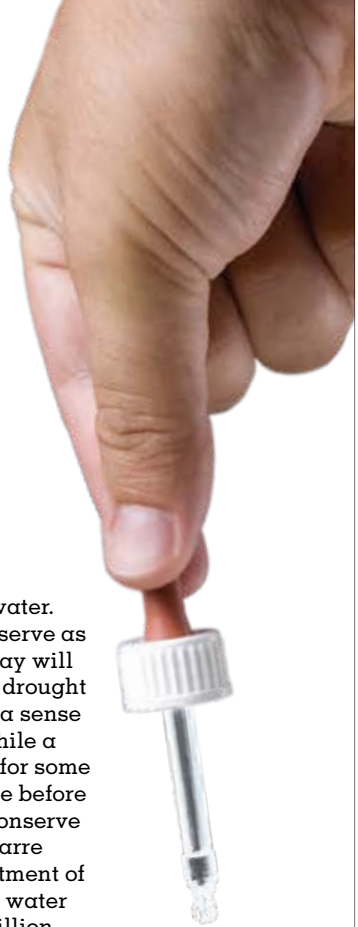


> “While water remains inexpensive and accessible for most, it still needs to be used wisely.”



It has been said that future wars will be fought over water. While that may seem a little extreme in 2017, it does serve as a reminder that good water conservation practices today will serve us well in the future. We only have to look at the drought conditions in California over the past five years to get a sense of what may happen if we don't heed the warnings. While a good mountain snowpack has provided drought relief for some areas in California, experts say it's just a matter of time before it returns. Needless to say, some unusual methods to conserve potable water have been introduced, including the bizarre "shade ball" approach used by the Los Angeles Department of Water and Power to reduce evaporation in its drinking water reservoir. The LADWP spent US$32 million to buy 96 million shade balls to cover the reservoir, with expectations of saving 300 million gallons a year, or enough water to serve about 8,000 people. Extreme times call for extreme measures.

As hydro growers, water conservation is an inherent trait, with typically only two to seven per cent of water loss experienced, mostly through evapotranspiration, a necessity for plant life. In hydroponics, every bit of water is reused over and over again. Compare that with traditional agriculture, which requires 20 times the water use of hydroponics due to evaporation, run-off, and other inefficiencies.

For home growers, there are a number of actions that can be taken to preserve water. While water remains inexpensive and accessible for most, it still needs to be used wisely. Water conservation is just one more reason why hydroponics continues to grow as an industry. As climate change dries out some areas and floods others, how we use and control water in the future will be vitally important.

MAXIMUM YIELD

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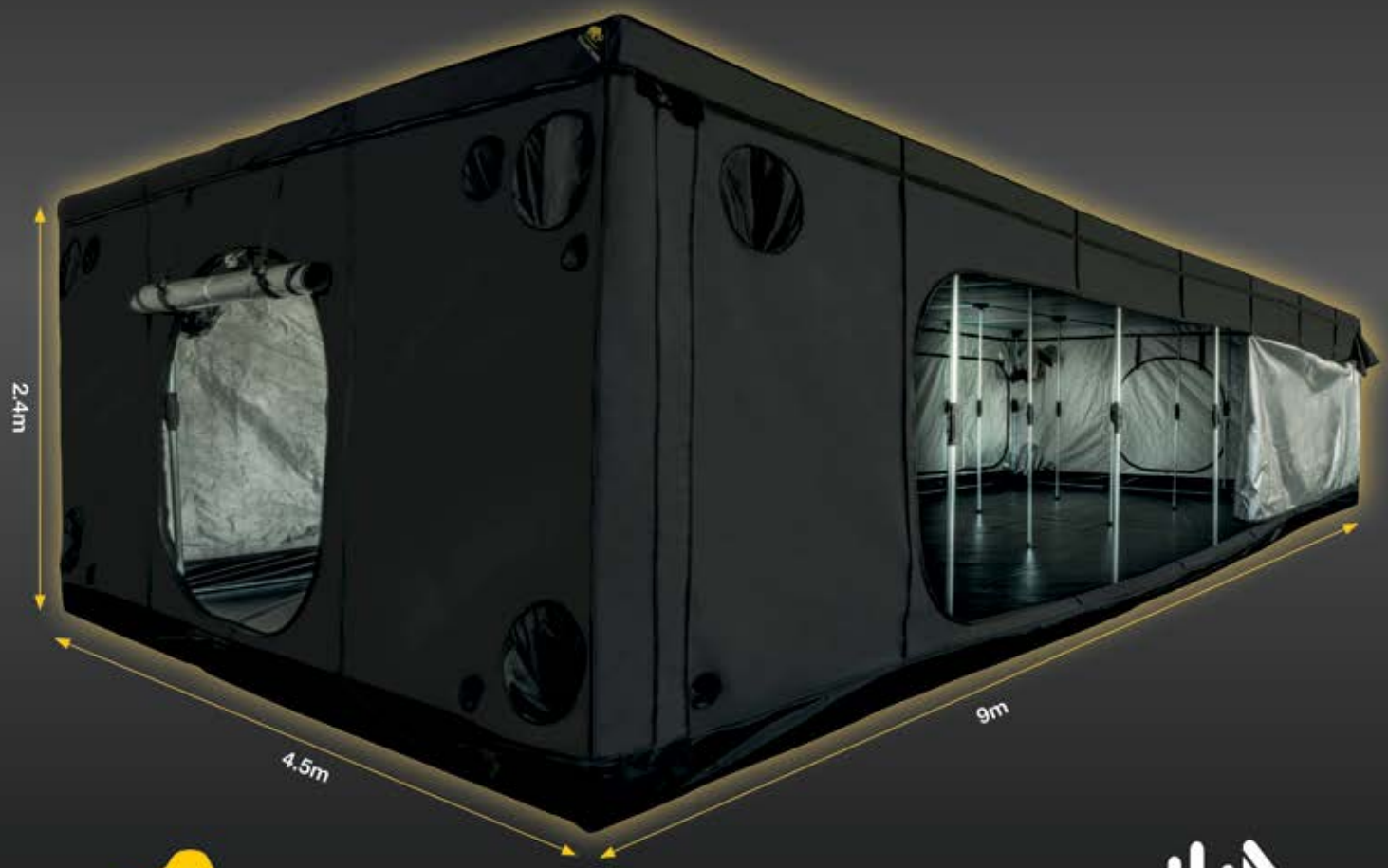

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The average North American city needs to dedicate just 10 per cent of its city limit area to urban farming to produce the entire recommended vegetable intake of its population.

The city of Burlington, Vermont, could meet nearly 110 per cent of its annual fruit demand with locally grown fruits if it implemented an urban farming set-up utilising available land and resources.

Urban Farm Facts via *@urbanvineco* Follow them for more!

Another school donation from *#greenmatters*, *#greenmattersmiddleboro*, and *#foxfarm #foxfarmsoil* to **Silver Spring Elementary School Project.** These kids are lucky to have amazing teachers who want to invest in their knowledge of plants.

@greenmattersmiddleboro

Grow Tip Tweets

Mycorrhizal fungi act as extensions of the root and allow the plant to find nutrients.

@MammothMicrobes

To see why aquaponic plants grow so fast, look at a sample of pond water with a microscope.

@Fishnure

Your containers should exclude light to prevent algae growth in the nutrient solution.

@HydroponicsEasy

Looks like this basil is handling its transplant quite well!

@moonlightgardensupply

Around the World

Matt from **Holland Hydroponics** showing off *Maximum Yield* in the UK.

KENT GRUETZMACHER is a Denver-based freelance writer and the west coast director of business development at Mac & Fulton Executive Search and Consulting, an employment recruiting firm dedicated to the indoor gardening and hydroponics industries. He is interested in utilising his Master of Arts in humanities to explore the many cultural and business facets of this emerging industry by way of his entrepreneurial projects.

RICH HAMILTON has been in the hydroponics industry for more than 20 years, working originally as a general manager in a hydroponics retail outlet before becoming an account manager at Century Growsystems. He enjoys working on a daily basis with shop owners, manufacturers, distributors, and end-users to develop premium products.

ERIC HOPPER'S past experiences within the indoor gardening industry include being a hydroponic retail store manager and owner. Currently, he works as a writer, consultant, and product tester for various indoor horticulture companies. His inquisitive nature keeps him busy seeking new technologies and methods that could help maximise a garden's performance.

DR LYNETTE MORGAN holds a B. Hort. Tech. degree and a PhD in hydroponic greenhouse production from Massey University, New Zealand. Lynette is a partner with Suntec International Hydroponic Consultants and has authored several hydroponic technical books. Visit *suntec.co.nz* for more information.

BRYAN TRAFICANTE is one of the co-founders of *gardeninminutes.com*, where he and his family have one mission: making it easier for people to build and grow great gardens. They're the inventors of the Garden Grid watering system, crafters of modular garden beds, and share their time-saving gardening advice on Facebook, Pinterest, and their blog, aptly named "Easy Growing."

BARBARA SHAW gardens, writes, and makes junk art in Oregon. She earned degrees in zoology, physiology, and journalism, and she writes about science, health, growing things, and energy management. She also delights in reading, cooking, photography, eco-travel, and has visited 60 countries. Married to a sports journalist, she embraces being a grandmother.

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Q

Can I use construction-grade expanded clay in place of brands like Hydroton when cultivating plants?

John

a

Hi John,

Thanks for this great question. In the pursuit of cultivating plants hydroponically, growers are constantly in search of ways to keep their cost of production low in order to maximise profits. There are certainly substitutions, alternative materials, and other components that may be used in place of brands marketed towards growers in order to keep production costs low. I would consider the following before deciding on your source material for expanded clay pebbles as a hydroponic grow medium.

Hydroton and other brands of expanded clay manufactured for use in hydroponics are thought to be of food-grade, lacking other foreign chemical contaminants and materials that may be found in construction materials. Anecdotal reports that can be found on various grow forums indicate construction-grade materials possessing a higher alkalinity. This would require further buffering and less predictability when soaking the medium and throughout your specific grow cycles. This alkalinity could be a result of exposure to limestone, concrete/cement, construction sand, mortar, and other materials.

Quite often, the construction-grade clay is manufactured or co-packed in diverse manufacturing settings that cater to other material manufacturers. You can be confident that when buying brands like Hydroton, the clay is manufactured in a dedicated environment free of contaminants. Beyond raising your pH, these contaminants may act to harm or entirely kill your crop at the drop of a hat with little time to remedy the situation. When buying in retail settings, the grower can also be confident of storage conditions of the clay and whether or not it has been exposed to other harmful chemicals. I would never buy a bag of expanded clay that was sitting next to a dusty bag of mortar mix.

Another thing to consider would be the cation exchange capacity (CEC) of your source of clay medium. Clay manufactured for hydroculture is made to specific parameters suitable for growing plants, with a mostly inert quality. Construction-grade clay may possibly be fired at lower temperatures, resulting in a higher, lingering CEC. This attribute, if not kept in check, could very well lead to phytotoxicity. As mentioned in the article, the clay is pretty well inert, but even with Hydroton, one still needs to flush accumulated salts from the medium once in a while. I fear this issue could become compounded with higher-CEC clay.

Standards in particle size are also important. Construction-grade clay may be either too small or too large. If too small, the macro pore space may be too tight and thus result in compacted medium with less aeration. If the pebbles are too large, which is common with construction-grade material, pore space may be too open and would require more diligent control of your irrigation flood cycles (if using ebb and flow).

From what I can see on some manufacturer's websites, construction-grade clay may also be of a higher thermal conductivity than that of hydroculture clay. What this means is that, should you experience fluctuations in reservoir temperature, whether you are using ebb and flo, DWC, or other hydroponic culture, the clay would then act to hold and store whatever water temperatures it is exposed to. If you are gone for a couple days and your HVAC system suddenly fails, you may experience a surge in high water temperatures. A higher thermal conductivity in your medium would ensure the roots may be more prone to things like pythium, botrytis, gnats, and other pesky problems.

With all this being said, I do believe in trial and error and further experimentation. I encourage you to trial both options. At the very least, you may benefit from monitoring a smaller identical set-up with construction-grade expanded clay. If you are able to mitigate the potential issues discussed above, then the lowered cost of production would only serve to make you a smart and savvy grower.

Happy cultivating,
Zach Zeifman

Zachary Zeifman discovered his love for gardening while working for Homegrown Hydroponics/Dutch Nutrient Formula. Zach now owns and operates Soulgarden Farm, where he grows sustainable hydroponic and traditional soil crops. During the winter, Zach helps homeowners design and build hydroponic gardens to grow food year-round.

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– water-research.net

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Connecting Queensland Agriculture with the World in 2017

TropAg2017, the world's leading tropical agriculture and food science conference, will showcase Queensland agriculture innovations and technologies in Brisbane on 20-22 November 2017. Announced by the Hon. Bill Byrne MP, Minister for Agriculture and Fisheries on 23 November, the highly successful AgFutures conference will be incorporated into TropAg to showcase the state's latest developments and applications in digital and data platforms, robotics, satellites, and biotechnologies. AgFutures 2016 was hosted by the Department of Agriculture and Fisheries in Queensland and attracted more than 300 delegates. Agriculture is big business in Queensland, and the state has a global reputation for producing clean, green, and quality produce. "Queensland has a number of fundamental advantages for growing food and fibre," says Minister Byrne. "This includes our tropical climate, which allows us to grow a wide variety of produce, our counter seasonal production, which allows us to service valuable northern hemisphere markets."

- hydroponics.com.au

Feeding Cows Seaweed Can Fight Climate Change

In the climate change fight, scientists are always exploring new ways to tackle our emissions problems. One recent suggestion is to, well, make cows fart and belch less. Researchers from James Cook University in Queensland released a study in 2016 that appeared to support what other scientists had previously discovered: Adding seaweed to a cow's diet in small amounts—just two per cent of total feed—may cut the animal's methane emissions by more than 90 per cent. Once in our atmosphere, this super-insulating gas has a warming effect that is 84 times more potent than CO_2 over the first two decades after release. Estimates suggest that methane is about 23-25 times more damaging over a 100-year period than the equivalent amount of CO_2. This approach has also been tested in sheep, with similar positive results.

- care2.com

Company Aims to Reduce Farm Accidents

Brutal farm accident statistics are seeing government resources directed to the rural sector, with South Australian company Safe Ag Systems emerging as a key player. The company, co-founded by Yorke Peninsula farm owner Caroline Graham and her daughter, Safe Ag Systems chief executive Katy Landt, is targeting figures showing the industry was number one for workplace fatalities in Australia. Landt says the company had created a cloud-based system to help agribusiness develop and maintain workplace safety, with emergency response plans for accidents ranging from a snakebite to a bushfire or a machinery injury. "The regulatory focus is on agriculture at the moment, we are the number one industry," says Landt. "Agriculture employs 2.6 per cent of the workforce, but we account for 24 per cent of workplace deaths nationally—that's why the regulatory bodies have turned their attention to agriculture."

- adelaidenow.com.au

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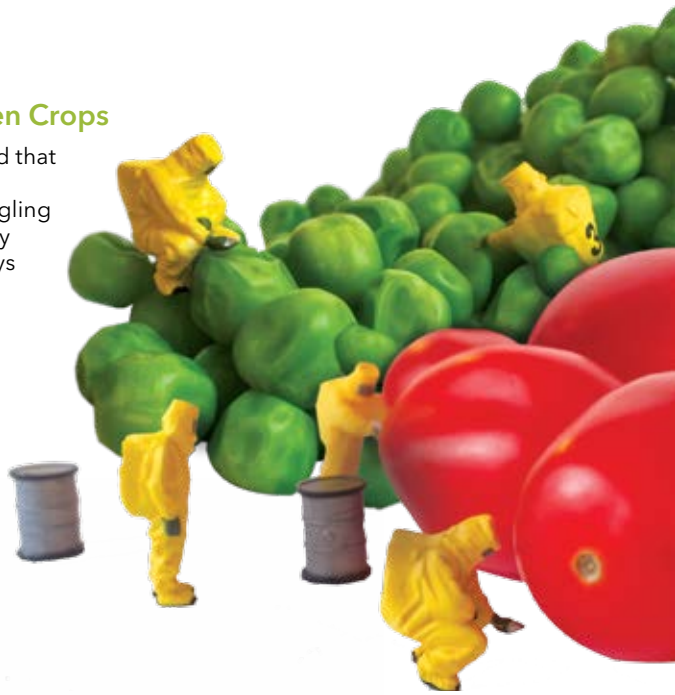
Tasmanian Farmers Use Drones for Irrigation Efficiency

Tasmanian farmer Will Bignell is busy preparing his Bothwell property for the arrival of water from a new irrigation scheme. In a matter of months, he is expecting to benefit from the Southern Highlands Irrigation Scheme. The $3-million project will funnel excess water from the Shannon River to 27 properties across the district. To maximise his return on investment, Bignell says using precision agricultural techniques is extremely important. This includes using drones to create detailed terrain, drainage, soil variability, and irrigation maps. The data allows Bignell to pinpoint where on his farm the extra water would be most useful, so he has set-up an on-farm wi-fi network and will eventually control irrigators on the site via his mobile phone. "From anywhere in the world, I can control every sprinkler on it," he says.

- abc.net.au

Biosecurity Issues Threaten Crops



A Western Australian farmer is concerned that the current border control focus on major law enforcement issues such as terrorism or drug smuggling may undermine Australia's strict biosecurity laws. Pingelly farmer and Grain Producers Australia director Ray Marshall says he was worried at media reports showing a massive rate of seizures of illegal imports potentially damaging to the Australian agricultural industry, such as grains and legumes. "At Perth airport alone last year, there were 890 kilograms of undeclared grain seized," says Marshall. "That is a huge worry. The grain could be the host to bring in diseases such as karnal bunt, which would have a potentially devastating impact on the grains industry." Marshall says the industry was seeing first-hand the impact exotic pests could have with damaging pest species like the Russian wheat aphid and the tomato potato psyllid, both detected in Australia for the first time in the past 12 months.

- farmweekly.com.au

Farmers Turn to Hydroponics, Aquaponics, Greenhouses to Meet Growing Demand

Australia is rapidly becoming a world leader in protected cropping as farmers look for creative ways to grow more food using less land and resources. Protected cropping is one of the fastest-growing areas of food production in the country, with almost 30 per cent of all Australian farmers growing produce in some form of a soil-less culture system. Protected Cropping Australia chairman Robert Hayes says the efficiencies of protected cropping were the biggest drawcard. "It's the best way to use your water. We don't waste any fertiliser at all, there's zero discharge effectively in to the environment, and we can have a much better control of our quality," he says. "We are in business 52 weeks of the year." The biggest challenge facing the industry is the cost and security of energy in Australia. Major power outages across South Australia in 2016 left areas of the state without power for days, hitting some producers in the power-reliant protected cropping industry hard.

- abc.net.au

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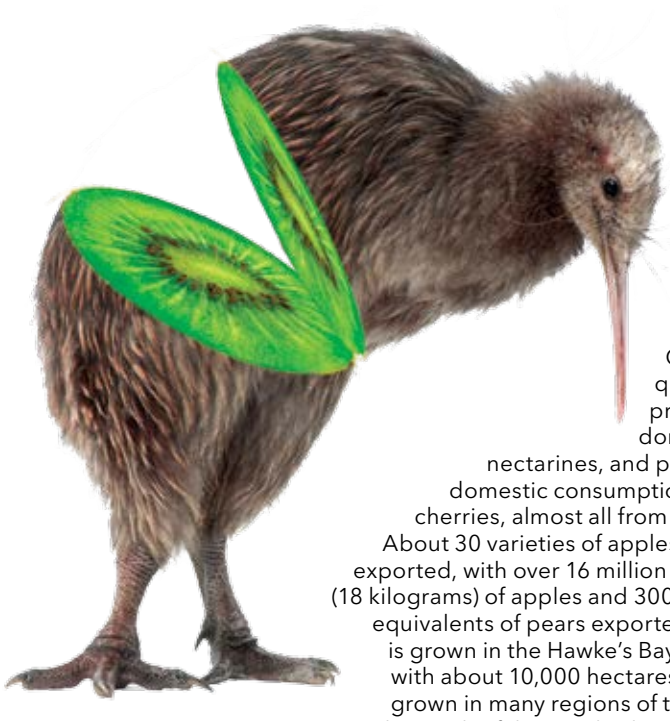
Outback Pub Serves Up Meals From Aquaponic System

The historic North Gregory Hotel in Winton is not the sort of place where patrons would expect fresh, locally grown barramundi and greens, but thanks to an outback aquaponics system, the pub is doing just that. The sound of running water heralds an unusual sort of outback organic garden at the pub, which hosted the first public performance of Waltzing Matilda in 1895.The closed loop system works well in the outback because no water is wasted and the plants do not need fertiliser. Ben Casey, manager of the North Gregory Hotel, says that people were often intimidated by aquaponics, but it is a relatively simple system. "Aquaponics is fantastic—it's the lazy man's gardening," he says, adding the system allows the pub to grow varieties they are unable to buy, and has saved thousands of dollars on produce.

- abc.net.au



Horticulture in New Zealand

There are about 400 growers of stone fruit who utilise 3,000 hectares of land, mostly in the Hawke's Bay and Otago regions. Three quarters of the fruit produced is consumed domestically. Peaches, nectarines, and plums are produced for domestic consumption, and apricots and cherries, almost all from Otago, are exported. About 30 varieties of apples and pears are exported, with over 16 million tray carton equivalents (18 kilograms) of apples and 300,000 tray carton equivalents of pears exported annually. Most pipfruit is grown in the Hawke's Bay and Tasman regions, with about 10,000 hectares planted. Kiwifruit is grown in many regions of the North Island and in the north of the South Island, but is most concentrated in the Bay of Plenty. There are 2,700 kiwifruit growers, with over 13,000 hectares planted. Over 80 million trays of kiwifruit are exported annually, about one-quarter of the world's production. Kiwifruit is New Zealand's largest horticultural export by value.

- wikipedia.org

Innovative Food Waste Business Succeeds at National Competition

Sustainable agriculture business Goterra took second place in the New Business Idea category of the Kick Start fast-pitch competition at TEDxSydney 2017. Goterra was awarded $10,000 for its performance in the competition, which is run by St George Bank. Goterra is an innovative business that turns food waste into livestock feed using insects, producing a product that is comparable to fish and soybean meals. Four million tonnes of food waste are produced each year in Australia alone, and Goterra helps to reduce and recycle this waste by creating a sustainable and affordable livestock feed for Australian farmers. The St. George Kick Start competition showcased brilliant business ideas from six start-ups and six small-to-medium-sized enterprises, with the overall winner and runner-up from each category awarded a share of $100,000 to bring their ideas to life.

- farmingahead.com.au

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Living Soil Dry Organic Amendments and Tea Mixes

Living Soil Arcadian Kelp Meal is a dry amendment that can be used in combination with Organic Neem Meal to amend, top dress, or create very effective botanical nutrient and integrated pest management teas. Activated biochar of the highest quality made from pecan and walnut shells, and inoculated with nutrient solubilsing microbes and premium malted barley is also available to create powerful enzyme teas. Available in many sizes from one to 1,000 kilograms.

PreGrow vGrip Sprayer

Repetitive spraying can be a pain. Users of aerosol sprayers might experience hand pain, numbness, tingling, and weakness. That's where the PreGro vGrip comes in handy. The ergonomic trigger maximises spray comfort with zero finger fatigue. It easily snaps onto most standard aerosol heads, including the PreGro Sprayer—the garden sprayer solution for eco-conscious individuals. It is portable, lightweight, and ideal for handling all jobs big and small in the garden or greenhouse. Whether spraying commercial or homemade gardening treatments, the vGrip handle—attached to the PreGro Sprayer—keeps fingers away from caustic chemicals. The grip trigger works just as well, even when wearing gardening gloves. Manufactured using recycled plastics, vGrip is made in the USA.

Autopilot CO2 Monitor and Controller with Memory

The Autopilot CO_2 Monitor and Controller with Memory is an affordable way to monitor, control, and record CO_2 levels over an extended period of time. This easy-to-use controller allows growers to track and record a room's CO_2 levels over minutes, hours, or up to seven days. It features a fully customisable parts-per-million deadband and CO_2 setpoint, allowing for programming flexibility. The unit's memory feature truly gives growers an edge in fine-tuning their growrooms. A remote CO_2 sensor probe with photocell and 15-foot data cable allows for readings from various growroom locations. Green LED lights indicate the unit's status at all times. This is a great device for the grower who wants to optimise CO_2 levels without hassle.

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Reiziger Bloom Food A&B

There's a formula for hydroponic success. Reiziger is formulated from the original recipes used at the legendary Seed Bank of Holland. To help them master their craft, Dutch breeders and growers swear by Bloom Food A&B for maximum flower and fruit yields with a full, round taste. From Reiziger's heritage of expertise, this element-rich formula gives plants the minerals they need to thrive. To achieve greater yields, this formulation is tailored for fast-growing flowering annuals in any hydroponic system. The fast-acting formula feeds through roots and leaves to promote aggressive and prolonged flowering, bud set, and formation. Search for the ship on the gold bottle.

Hurricane SHO Oscillating Wall Mount Fan 16

Hurricane continues to be the fan of choice among indoor growers. With more than 35 different fans offered currently and more on the way, Hurricane fans allow growers to tailor the proper fan to their grow space precisely. Hurricane's new SHO Oscillating Wall Mount Fan 16 pushes 30 per cent more air than Hurricane's Classic or Supreme fans. This new and improved design includes a powerful 75W motor along with an all-new polymer blade. This Super High Output 16-inch fan has 2,540 CFM and 1,500 RPM to create an air velocity of 267 m^3/min. The fan has three speed settings, 90-degree oscillation, and adjustable tilt. There's a versatile control of the speed settings and oscillation by using a turn switch or pull strings. Hurricane's SHO fan is rugged, with a metal grill and a black powder-coated finish. Comes with a six-foot power cord.

Living Soil No-Till Organic

Living Soil contains all the nutrients required for thriving plant growth without the need for added fertilizers. Living Soil does not contain any manures, animal by products, or chemicals and is made from 100 per cent organic, nutrient dense, locally sourced plant-based ingredients. Inoculated with a wide variety of beneficial nutrient solubilising and root protecting microbes and made with the highest quality humified compost, worm castings, and amendments in Australia. Get more nutrient-dense plants with increased terpenes and medicinal values. The product contains Canadian sphagnum peat moss, humified worm castings, volcanic rock, ylad humus compost, activated pecan and walnut shell biochar, munash rockdust, zeolite, malted barley, ag-lime, natural gypsum, kelp meal, neem meal, mycorrhizae, and added nutrient solubilising bacteria.

Dr. Earth Flower Girl—Bud & Bloom Booster (3-9-4)

Dr. Earth's Flower Girl is a premium dry fertiliser that helps elevate yields and increase essential oil content of prized crops. Flower Girl is CDFA organic, OMRI Listed, and Non-GMO Project Verified, with carefully selected high-quality ingredients that plants need to thrive. It contains ocean-caught fishbone meal, valley-grown alfalfa meal, humic acids from leonardite, and cold-water kelp that naturally creates more abundant harvests. Additionally, they include a powerhouse blend of MycoApply Certified beneficial microbes that brings the soil to life. This blend of organic nutrition and TruBiotic beneficials encourage multiple fruit/flower sites, maximum blooms, and ensure that flowers contain flavourful essential oils. Dry fertilisers are easy to use indoors and outdoors by mixing into the soil before planting, scratching into the soil as a top dress for established plants, or in a fertiliser tea applied to the root system and as a foliar spray. Flower Girl will supply high levels of vital nutrition, improve overall soil texture, water retention, and continually enhance the soil with each application.


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West Coast Biodegradable Solutions Trifecta Crop Control

Trifecta Crop Control harmonises with the balance of nature by utilising nano-emulsion, colloidal-based technologies. It's safe, non-toxic, GMO-free, and plant-derived. Trifecta Crop Control is semi-systemic and delivers superior resistance to mildew, mold, and soft-bodied pests by using specific essential oils for their various terpenes and triglycerides. They all prevent and eliminate the pathogens in different ways. Certain terpenes create cell lysis, which destroys fungal spores; others break down the eggshells and chitin of the pests, while certain triglycerides suffocate them. Through theses modes of action, Trifecta Crop Control ends the life cycle of various pathogens. This safe, non-toxic product prevents and rids crops of mildew, mold, and pests. It also leaves no trace of residue or residuals on (or in) the plants under a microscope, 48 hours after application.

Living Soil Complete Starter Kit

This No-Till Organic Living Soil Kit contains all you need to get growing the healthiest, most vigorous nutrient-dense plants. Comes complete with Geo Pots, Living Soil, Sunday IPM Kit, mychorrizae, cover crop seeds, planting top dress mix, and coarse mulch. Available in 1x50-Litre (1x 50-L Geo Pot), 200 L (4x50 L Geo Pot), or 400 L (8x50-L Geo Pot). Available at leading hydroponic and specialty indoor garden stores.

Reiziger Grow Booster

The art of transformation. Reiziger Grow Booster is the first hydroponic grow booster for craftsmen tailored to the needs of all short cultures. Born from nature, made in Holland, Dutch craftsman insist this precious and effective natural liquid produces astonishing results with the power to transform plants and quickly increase biomass while amplifying aromatic compounds. In a short time, plant vigour improves, lushness is restored and greater yields achieved. Formulated with a high concentration of powerful botanical ingredients, this transformational liquid empowers the plant with the energy it needs to fortify its natural defence process to help elevate the production of aromatic compounds and terpenes, which directly benefit colour, aroma, and resin production. Search for the ship on the gold bottle.

Grower's Choice Digital 315W CMH Complete Fixture

Grower's Choice is proud to introduce its new Digital 315W Ceramic Metal Halide Complete Fixture, which was launched at the GrowX trade show in San Jose. Utilising cutting-edge 50/60-Hz low frequency square-wave technology, this fixture can maintain lumen output higher than 90 per cent at over 10,000 hours while maintaining the initial spectrum, ensuring both reliability and efficiency. The Grower's Choice CMH Fixture is capable of operating at either 120V or 240V, making it ideal for home and commercial applications. Their Smart-Dim technology allows growers to dim and super-charge the lamp, depending on the grower's specific needs. Grower's Choice offers the broadest range of 315W lamps, including the 3,100K full phase, 3,100K-R red enhanced, 4,200K day light, and 10,000K finishing.

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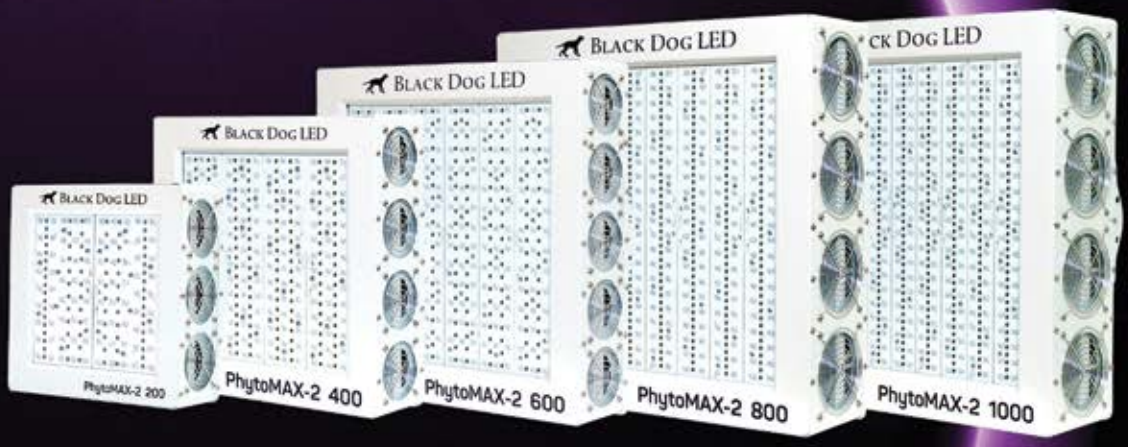

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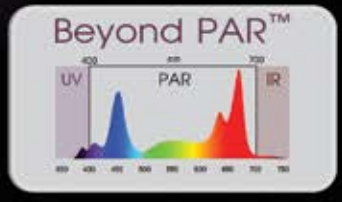

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G8LED 600W Bloom Only Light

A new light for 2017, the G8LED 600W Bloom Only Light is designed for a flowering station and provides coverage for 20 square feet (5x4 feet) of flowering coverage or six to 10 mature plants. This light is the recipient of the 2017 Best New Light Award and is a true substitute for a 1,000W HPS bulb. The 90W Red Flower Boosters are not required when using the G8LED 600W Bloom Only Light. This light is a larger version of the G8-450 Bloom light, with a power draw of 380 watts. The diodes are made in the USA and come with a two-year full warranty.

Phantom CMh 315W Ballast

The Phantom CMh 315W ballast is a remotely operated, low frequency, square-wave digital ballast designed specifically for the 315W high intensity ceramic halide lamp, which can be used with equal effectiveness for both vegetative and flowering growth. It features internal RF shielding, multi-aspect protection circuitry, and 277V operation. Like all ballasts in the Phantom family, the CMh 315W ballast is silent, reliable, and energy efficient. It can easily be wall-mounted near the reflector or up to 50 feet away using the optional lamp cord extensions. It includes an eight-foot pre-wired AWG power cord with EMI suppression.

Titan Controls Zephyr 5

Cooling control has long been essential equipment for indoor gardeners. Titan Controls Zephyr 5 is an easy-to-use control that delivers the functionality necessary to moderate room temperatures affordably. The six-foot remote temperature probe has a wide cooling range from 4-42°C (it will display in Farenheit too). Plug your fan into the Zephyr 5, and then plug Zephyr 5 into an outlet and establish your set points that trigger when your fan goes on and off—it's that easy. Large easy-to-read LED display. Displays current temperature.

Neudorff HydroWorxx Mite and Insect Killer

There's nothing worse than meticulously caring for your garden, eagerly awaiting your harvest, only to discover, too late, that pests are paying it just as much attention. Neudorff, the German market leader for pest control and plant care products, have now introduced their high-efficacy pest control product line for urban growers and organic gardeners. Dual active ingredients work to control a long list of insects and mites, including aphids, caterpillars, fungus gnats, mites, scale, spider mites, thrips, whiteflies, and more, HydroWorxx Mite and Insect Killer stands out from the pack. If you've ever noticed distorted or dead leaves before you've noticed pests, you might be at odds with destructive thrips. Thrips can cause your ornamentals to turn into aesthetic nightmares. They can lower marketability and yield of your commercial crops. Perhaps worse, they can spread plant diseases. This OMRI Listed solution enlists the help of dual active ingredients canola oil and pyrethrins (derived from chrysanthemum flowers).

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GROW TENT SET-UP:

POSITIONING EQUIPMENT

BY KENT GRUETZMACHER

The use of grow tents is on the rise, but their confined space can create equipment set-up challenges. Kent Gruetzmacher offers his insight on how to choreograph essential grow equipment in your tent.

The use of grow tents for indoor gardening has been on the rise over the years with small-scale, hobbyist gardeners. Generally speaking, indoor horticulturalists use grow tents because they are easy to set up, require few materials, and are low-impact on living space. Yet, when using grow tents, cultivators sacrifice some of the flexibility that is enjoyed when operating within a traditionally built-out growroom. This is largely because the size of grow tents usually mirrors the size of a garden canopy per 1,000W—as seen in a 4x4-foot grow tent. Point being, this canopy-to-tent sizing schematic makes it difficult to position equipment, such as lights and exhaust, and leaves little room for working within the allocated grow space.

Also, as grow tents are erected by an interior metal frame and have walls, ceilings, and floors made of canvas, their infrastructure presents further challenges for situating equipment efficiently.

Regardless of spatial and material constraints within grow tents, clever indoor gardeners can figure out ways to situate their equipment in a fashion that is both expedient and functional. This process is made easier by the convenient holes and ports that are built into tent walls for electrical access as well as airflow and exhaust. These things being noted, for hobbyist gardeners out there, here are a few tips for situating equipment in a grow tent.

"AS GROW tents are held up by an interior metal frame and have canvas walls, ceilings, and floors, their infrastructure presents further challenges for situating equipment efficiently."

Exhaust and Carbon Filters

Perhaps the most essential equipment element, as well as the most difficult to situate in a grow tent, is that of an exhaust and carbon filter. For hobbyist gardeners using a 4x4-foot or 4x8-foot tent for flowering, it's a practical idea to run a carbon filter, air-cooled hoods, and inline fan in one exhaust system. Combining all of these elements will help counteract the spatial constraints present in grow tent cultivation. For grow tents of the aforementioned sizes, there are relatively small, lightweight carbon filters that can be easily hung to the interior of a tent frame with the same materials used with lighting. It should be noted, as heat rises one should always strive to hang the carbon filter as near the tent ceiling as possible—the exhaust will simultaneously pull hot air out of the tent and "scrub" the air for smell by way of the carbon filter.

When situating the inline fan for the exhaust system, it should be hung off the ceiling support of the interior tent frame while being simultaneously positioned next to one of the exhaust ports on the wall. These exhaust ports are generally made to fit six- to eight-inch pieces of ducting and feature a bungee-like material that can be synched down on the inline fan or ducting to create a relatively tight seal for light leaks. Also, wire, rope, or retractable cordage mechanisms work nicely for hanging the inline fan on the tent frame. When the carbon filter, hoods, and inline fans are properly situated within the grow tent, connect them all with ducting. With this schematic, the inline fan pulls the fragrant, hot ambient air out of the tent canopy area while simultaneously cooling the hoods—to finally exhaust both to the exterior of the grow tent.

The geographical locale as well as seasonality of the indoor cultivation operation in question will greatly influence a gardener's choice concerning expulsion options for the hot air expelled from a grow tent through the exhaust system. In the cooler fall, winter, and spring months, exhausting a grow tent directly into a home will likely be a welcome source of heat. However, in the warm summer months as well as in tropical climates, the added heat of exhausting a grow tent directly into one's home can make for a rather uncomfortable living situation due to excess warmth. That being said, grow tent gardeners can opt to position their set-ups near a window as to exhaust the hot air directly out of living spaces. But, this option can easily eliminate much of the operational discretion that most tent cultivators value. To solve this predicament, one can counteract the added ambient temperature resultant from grow tent's exhaust with a home's AC system—this can prove quite costly in the heat of summer.

"THE USE of double-ended high pressure sodium lights is discouraged in most grow tent cultivation scenarios because these lights put off an extreme amount of heat and they don't come with air-cooling options."

Wall Fans

As seen with traditional indoor growroom operations, proper airflow and circulation are an essential element in a successful tent-grown crop. However, while in a retro-fitted, wood frame room one can simply hang wall fans on a wall, canvas tent walls don't provide this infrastructure. However, one can get smaller clip-on fans that can simply be attached to the tent frame. Secondly, simple free-standing circulating fans can be used in grow tents without the hassle of trying to situate them upon a wall (if the square footage of the operation allows for this option).

Lighting

As seen with traditional growroom set-ups, a good place to start planning a grow tent's interior organisation is with lighting. This is because the type of lights one uses for their indoor garden directly influences their options for air-cooling as well as exhausting. For example, the use of double-ended high pressure sodium (HPS) lights is discouraged in most grow tent cultivation scenarios because these lights put off an extreme amount of heat and they don't come with air-cooling options (aside from some brand new, relatively untested models). That being said, fluorescent, LED, and air-cooled HPS lights can be simply hung from the roof of the interior frame of a grow tent using ropes, chain, or retractable cordage mechanisms. However, air-cooled HPS lights should be hung in a position which will function in conjunction with an exhaust system.

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by Barbara H. Shaw

Let's go Up on the Roof

With nearly half of all humans living in urban areas, and many cities beginning to amend their codes and regulations to allow the construction of roof gardens, people around the world are warming up to the idea of creating outdoor oases on their rooftops.

Though in its infancy in some locales, rooftop growing is a well-developed practice in other places. In India and Singapore, tiny, high-tech rooftop farms in the range of 50 square metres provide profitable jobs for housewives and retired workers. Roofs can be ideal for hydroponic growing, too. Some mini-farms are now so high-tech that one acre can produce 635 tonnes of produce using aeroponic methods. Each year, more rooftop growers advance to productive commercial-size operations like this.

The simplest roof gardens feature pots and containers. Balconies and other small spaces allow for garden towers or bees and chickens. Sloped roofs are still an option for living turf, though this super low-tech method is best suited to small outbuildings as it's possible some modern homes couldn't support the weight of thick turf. Alternatively, there are also living roofs, which are extensive areas of growing media less than 15 centimetres deep and planted with sedums, succulents, and hardy native plants. Such a living roof will add less than 23 kilograms (kg) per square foot to the roof's weight.

A crop roof, on the other hand, is an intensive production zone with deeper growth medium, and it will add 36-54 kg per square foot. If you have difficulty getting the media deep enough for crops directly on the roof, planting boxes can easily be constructed. Some tropical hardwoods and oily woods, like redwood and cedar, contain aromatic oils that resist rot. Longer lasting boxes can be built with synthetic materials or with a wood frame and corrugated metal liners. Whatever you decide, though, nix toxic treated lumber around food plants.

One low-tech, low-cost growing space for shallow-root plants is manufactured roof troughs (aka gutters). Buy three-metre lengths with end caps, long support nails, and hollow ferules that keep those nails in place for mounting. Inexpensive, larger-diameter pipes with drilled holes for plants are used in many higher-tech growing operations. (Note that toxic chemicals leach out of PVC pipe, so don't use that.)

Pros and Cons

No matter which type of rooftop growing you're talking about, they all serve a variety of functions, including:

- A planted roof provides forage for small wildlife, birds, and insects. Native plants feed native insects and birds. Large areas of plantings contribute to fresher air and CO_2 absorption. Plus, a roof is up out of reach from animals and troublemakers.
- A living roof lasts many decades when done right. The sun's high-energy ultraviolet (UV) rays break molecular bonds and destroy building materials fast. Living roofs prevent UV from reaching the waterproof layer. Plus, not having to rip off, dispose of, and replace a roof every 15 or 20 years saves an immense amount of money, energy, and materials over the life of the structure.
- Soil or planting mix dampens sound and provides good insulation. Plants give shade and, when they transpire, cool by evaporation. This reduces the urban heat island effect that contributes to making town centres hotter than surrounding areas. Thus, a living roof helps limit the advance of climate change and plays an integral role in sustainable design.

> "DESPITE some manageable drawbacks, any nearly flat roof can be gardened."

- It's sunny up high where there is less shade. Most crops, from asparagus to zucchini, demand hours of daily sunlight to mature. In a city, the top of a building may be the one available place that's not shaded by tall structures for much of the day. In a forested area, a roof might be the largest sunny spot around.
- Heavy flows of storm run-off, excluded from sewage treatment, pick up urban pollutants when water rushes over hard, contaminated surfaces to flood streets before it drains to streams. A living roof allows stormwater to be absorbed where soil organisms can break down toxins and the outflow drains away gradually.
- In big cities, where space is at a premium, rooftop gardens are coveted getaway spots, attractive to potential renters as a social spot or spirit-building retreat.

Now for the downside:

- Winds are fiercer up high and can rip away your work. The sun may be so intense you need shading.
- It's tough to carry everything up there and haul produce back down.
- As with any garden, somebody must pay for water, seeds and starts, amendments, support structures, etc. and it requires commitment to regular care and maintenance.
- You will have failures.

Getting Started

Despite some manageable drawbacks, any nearly flat roof can be gardened. Also, there's no best way to go about it. Each good solution is unique to your goals and the local situation. Whatever you decide to do, start with a budget.

Then check building codes and local laws. Seek out those who have roof gardens near you for valuable advice and a chance to see what's working. Read a lot. The best book out there is *The Rooftop Growing Guide* by Annie Novak. Get clear about what you want to achieve. Scale drawings provide a reality check and help others envision your ideas.

There are a few things to focus on, however:

Ownership

If you don't own the rooftop, have interested parties—owners, managers, and tenants—buy in. Including an outdoor relaxing area gives non-gardeners a stake in the project. Talk about your plans. Present your drawings and budgets. Offer assurances or signed agreements.

Weight Issues

A damaged building really kills your budget. Have a knowledgeable person check the structure beneath the roof. The lowest-risk area to add weight to is near perimeter walls. There, forces transfer straight down through walls with high compression strength. Check engineering tables for density of different materials. Soil is heavy. A 1.9-square-metre garden with growing medium 25 centimetres deep weighs between 590 and 816 kg. To lighten, loosen, and increase water-holding of any grow mix, add up to half perlite or vermiculite. Study your mix options to select the right one for your project.

Waterproofing

The essential waterproof layer is also a plant barrier, protecting the structure from determined roots. Heavy-duty black pond liner and thermoplastic membrane products are two options. Use quality materials. Compromises will cost you. Also, a soft layer of acoustic insulation placed below it reduces damage from boots and tools.

Good Drainage Without Soil Loss

Whether planting all over or in grow boxes, you need to drain off rain, melt, and irrigation water. However, you don't want to lose your soil or growing media. A raised rim at the upper edge and sides of your sloped rooftop garden prevents soil loss. The lower edge is trickier. To contain the soil on the bottom edge, some simple designs include a built up or spread out barrier of gravel or rocks. We used commercial-grade landscape cloth over the rim of treated lumber. This creates an edge-strainer that allows excess water to escape under the soil-holding rim of treated lumber.

> "WHETHER planting all over or in grow boxes, you need to drain off rain, melt, and irrigation water."

Irrigation

If you want to go automated, go for buried drip systems, perforated hoses, or, for the ambitious, a computer-controlled precision method. Overhead spray systems, on the other hand, are inefficient at getting water to roots. While hand watering isn't automated, it has the advantage of allowing you the time to observe your plants more closely so you catch problems early.

You've talked with people who know, checked out a number of books, websites, and other resources for design ideas. You've done all the prep and preliminaries to get the roof ready, have your plans drawn and approved, borrowed a truck, and have a crane or friends lined up to carry stuff. You've chosen the grow mix and gotten starter plants and seeds. Now, it's time for action. Have fun! MY

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BOUNTIFUL BERRIES

THE HYDROPONIC WAY

Growing ripe, fresh berries brimming with flavour is one of the most exciting challenges of indoor gardening, says Lynette Morgan. Find out how to get yours started so you can soon eat them straight off the plant. | by Dr Lynette Morgan

The trick to successful indoor berry crops is understanding the physiology and natural life cycle of the plant so that flowering, pollination, and fruiting all go according to plan. While hydroponic strawberries are not an uncommon crop and relatively easy to grow, other berry crops require a little more investment in time and effort. However, they are highly rewarding. Hydroponic blueberries, cranberries, and raspberries can all be produced on a limited scale with soilless greenhouse cultivation—many in high tunnels to extend the harvest season and improve fruit quality—but they can also be grown indoors.

Hydroponic Strawberries

For those new to berry production, strawberries are the ideal crop with which to gain some experience. The plants are readily available, small, compact, and available in a range of different fruiting types and cultivars that produce fruit relatively quickly. Strawberry varieties fall roughly into two different categories: the short-day and day-neutral types.

Most of the outdoor strawberry types are short-day varieties. These initiate flowers under the shorter day lengths (less then 14 hours) and cool conditions of winter in temperate climates. They then flower and fruit as temperatures warm up in spring.

Day-neutral varieties are often used by greenhouse and hydroponic producers, as they can be manipulated to crop out of season if sufficient warmth and light are provided. Day-neutral strawberry varieties are given an artificial "chilling" period to initiate flower and then induced to flower and fruit with warmer temperatures. Hydroponic growers can buy chilled runners or plugs (called "frigo" or "pre-conditioned" plants), which have had a period of four to eight weeks under refrigeration (1-3°C). Or, growers may chill their own stock by wrapping the clean runners or small plants in damp paper and plastic, and placing them in a refrigerator for four to six weeks. Either way, the artificial chilling replicates the cold conditions of winter, which is especially great for those in tropical locations or where winters are very mild. Once planted out into the warmth and light, the plants resume their spring growth pattern of foliage development. They flower relatively quickly, followed by fruiting.

Pre-chilled plug plants are a great to rapidly establish a hydroponic strawberry crop.

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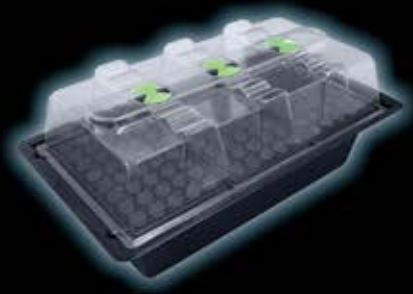

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Strawberries and other berry crops grown indoors require pollination assistance.

Growers can propagate their own new strawberry planting stock from runners produced on mature plants.

"WITH A SUITABLE, HIGH INTENSITY LIGHTING SET-UP, STRAWBERRIES CAN BE GROWN IN VERTICAL STACKS OR TOWERS, WHICH MAKE AN IMPRESSIVE DISPLAY WHEN IN FRUIT."

While pre-conditioned runners or plugs are available almost year-round in some regions, this type of planting stock is raised pretty much exclusively for outdoor gardeners and thus is often only available in spring. Indoor growers therefore may need to consider raising their own planting stock if they want to produce berries out of season. Strawberry plants are relatively easy to propagate from runners produced at the end of the fruiting season, and there has been a recent development of large fruited types that can be raised from seed.

Hydroponic systems for strawberry production are diverse. With a suitable, high intensity lighting set-up, strawberries can be grown in vertical stacks or towers, which make an impressive display when in fruit. However, care needs to be taken on the lower levels of vertical systems, where light and air flow are often restricted, resulting in lower yields and increased occurrence of fungal pathogens.

The strawberry plant is particularly sensitive to moisture and crown/root rot is the number one cause of strawberry plant deaths. Beginners are advised to try their first strawberry crop in a free-draining, media-based system, such as perlite or a 50/50 coconut fibre/perlite combination. Even rockwool cubes can work, provided they are well-drained. This way, the plant can be easily positioned with the crown just above the surface of the media. Drip irrigation systems are preferred, as ebb and flow can cause salt buildup around the crown, which also leads to problems.

Strawberries can be grown well in nutrient film technique (NFT), aeroponics, and various modifications on these systems, but plants need to be well supported so they don't slip down into the nutrient flow. Only clean plants—i.e. not those coming from soil—should be used so that root rot pathogens are not introduced into the system. Solution warming is useful at 20°C, particularly when starting new plants that have recently been given a chilling treatment.

The recommended EC levels for hydroponic strawberries vary depending on the environmental conditions and growing system. EC levels in NFT are recommended to be between 1.4-1.8 mS cm^{-1}, while levels of 1.4-3.0 are more common for those in media. A minimum EC of 1.8 is necessary during the harvest period to maintain good fruit quality from all systems. Running EC and potassium levels at moderately high levels is one way of concentrating both sugars (brix levels) and the aromatic volatiles that contribute to the distinctive strawberry flavour and aroma.


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Freshly harvested raspberries are fragile and best eaten immediately after picking.

"WHILE STRAWBERRIES MAY BE THE SIMPLEST FOR NEW GROWERS TO MASTER, THE MORE CHALLENGING BLUEBERRIES, RASPBERRIES, AND CRANBERRIES SHOULD NOT BE OVERLOOKED AS INDOOR FRUIT. IF GROWN WELL, THEY CAN BE NOT ONLY BE HIGHLY PRODUCTIVE BUT A REAL TASTE SENSATION."

One of the main considerations when growing strawberries and other berry crops hydroponically is pollination; outdoors, this is carried out by bees, other insects, and the wind. Indoor growers can manually pollinate strawberry flowers with a small hair dryer on a cold setting directed at each individual flower, or by gently brushing the inside of each open flower with a small brush. Hand pollination needs to be carried out every day immediately after the first flowers open to ensure good fruit set as the pollen only remains viable for two to three days after the flowers open.

Cranberries, Blueberries, & Raspberries

Blueberries, cranberries, and raspberries are less commonly grown in a hydroponic set-up than strawberries; however, they are suited to soilless production and benefit from the protected environment of an indoor garden. Cranberries are naturally a bog plant with long, trailing stems bearing fruit. For this reason, they are ideally grown in an elevated system, three to four feet above the floor, were the stems can trail directly downwards. Dwarf blueberry cultivars, which have been bred to grow in containers, are now widely available and can produce high yields of good quality fruit. Dwarf varieties grow to around two to three feet in height and can be pruned to control size. For those with limited space, dwarf blueberries are the most suitable crop as raspberry canes require more vertical space to develop and leaf out. Raspberry canes grow upright. They are tied into place with fruit-bearing stems trained into position and pruned to keep the canopy open for air movement and disease prevention.

Raspberries are categorised into two main types: primocane (fall bearing or everbearing types) and floricane (summer bearing). For hydroponics, primocane types are recommended, as these produce fruits at the top of first-year canes over a long harvest season. They also require less growing space and support than floricane types.


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Hydroponic strawberries ready to be plucked from the plant.

Hydroponic raspberries take up more space than other berry plants and need to be tied up to support the canes.

> "A MINIMUM EC OF 1.8 IS NECESSARY DURING THE HARVEST PERIOD TO MAINTAIN GOOD FRUIT QUALITY FROM ALL SYSTEMS."

As with strawberry plants, these berry crops are more suited to containerised, drip-fed, substrate-based hydroponic systems. This is both to ensure over-saturation of the root system does not occur, and to facilitate the ability to move the plants when they require chilling or become too large for the space available.

Berry crops don't require high levels of heat and will grow in similar conditions as many other fruiting plants. Temperatures of 22-23°C during the day and 20-21°C at night are ideal. For maximum fruit quality and sugar levels, the light requirements are similar to those of tomatoes and capsicum, and plants benefit from a long day length to push up the daily light integral.

Nutrition for all berry crops is similar. A well-balanced vegetative formulation is required in the early stages after initial bud break, followed by a bloom or fruiting formulation that is high in potassium once fruit set has occurred. For acid-loving blueberries and cranberries, pH levels can be run somewhat lower than other crops, around 5.0-5.5. However, they will still grow well in mixed crop systems where pH is maintained at normal levels of 5.8-5.9.

With all three crops, the cycle of flowering and fruiting is triggered by environmental conditions. Like strawberries, chilling is required during the plant dormancy phase to initiate the flowers for a good level of fruiting. For smaller indoor gardeners, the simplest methods of providing chilling for berry crops is to move the containerised plants outdoors in winter. Dormancy occurs during this time, so the plants don't require nutrients and only a minimal amount of water. The number of chilling hours required by berry plants is somewhat dependant on species and cultivar; however, raspberries and blackberries usually need 200-800 hours below 7°C and blueberry plants 500-600 hours below 7°C. Some "low chill" varieties can need 200 or less chill hours. There are also several low chill varieties of berry plants developed for warmer areas and these need 200 or less chill hours (these are also ideally suited to indoor growing). Nurseries often list the number of chill hours required for each variety they sell. Once the chilling requirement has been met, plants can be moved back into the indoor garden where warmth and light will bring them into active growth long before outdoor crops have started to stir. As a result, flowering and fruiting should occur much earlier in the indoor garden. Also, berries that are protected from birds, insects, and the elements also tend to be larger, of excellent quality, and high-yielding.

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"FOR THOSE WITH LIMITED SPACE, DWARF BLUEBERRIES ARE THE MOST SUITABLE CROP, WHILE RASPBERRY CANES REQUIRE MORE VERTICAL SPACE TO DEVELOP AND LEAF OUT."

Another important aspect of indoor berry growing is the requirement for pollination assistance. As with strawberries, these blueberry, cranberry, and raspberry flowers require pollination to set fruit. Greenhouse growers can purchase small portable hives of bees to carry out pollination, but a small indoor garden will require manual pollination. With blueberries, it can be an advantage to have two different cultivars and to cross-pollinate between these.

Harvesting of berries is one of the most rewarding tasks of an indoor hydroponic garden. Ideally berries should be left to fully ripen and colour on the plant before harvest. This ensures the full flavour profile and aroma have developed. Perfectly ripe berries are soft and fragile, raspberries need careful handling and should be eaten as soon as possible after harvest.

Hydroponic berry cropping indoors has become a somewhat new trend, made more feasible by the development of dwarf, compact cultivars and varieties with low chill requirements. While strawberries may be the simplest for new growers to master, the more challenging blueberries, raspberries, and cranberries should not be overlooked as indoor fruit. If grown well, they can be highly productive and a real taste sensation. MY


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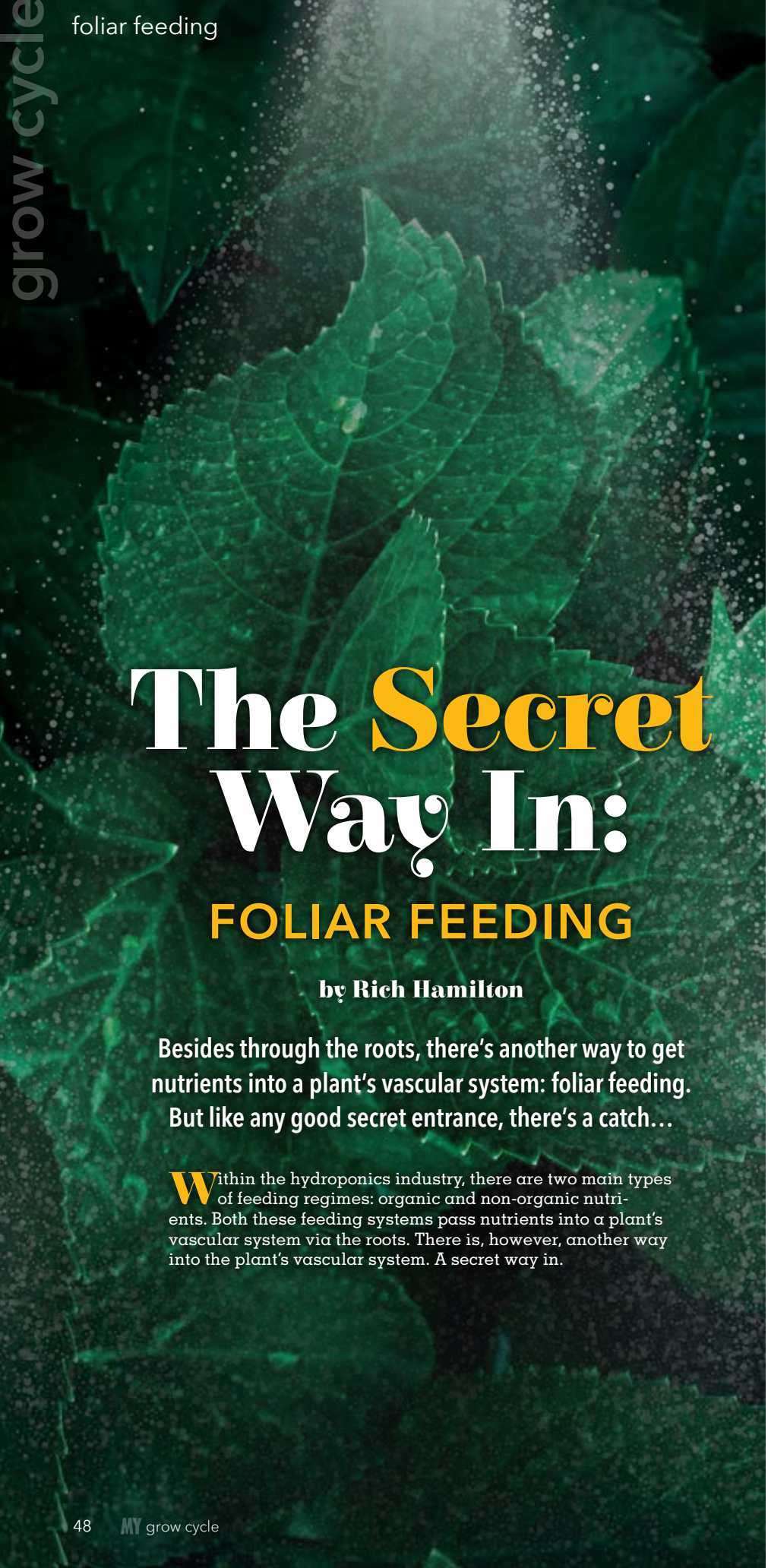

The Secret Way In:

FOLIAR FEEDING

by Rich Hamilton

Besides through the roots, there's another way to get nutrients into a plant's vascular system: foliar feeding. But like any good secret entrance, there's a catch…

Within the hydroponics industry, there are two main types of feeding regimes: organic and non-organic nutrients. Both these feeding systems pass nutrients into a plant's vascular system via the roots. There is, however, another way into the plant's vascular system. A secret way in.

This secret way is foliar feeding. A commonly overlooked method used in vegetative and flowering stages, foliar feeding allows for nutrients to pass into the vascular system through direct leaf and stem absorption. This can be a powerful ally to supercharge your plants for bumper yields. However, there is a catch. If it is not carried out correctly, it can have such a detrimental effect on your plants that they could be dead within 24 hours.

So, let's have a look at the dos and don'ts of foliar feeding in the vegetation and flowering stages of your plant's life.

The Don'ts

DON'T USE A FOLIAR SPRAY WHEN YOUR LIGHTS ARE ON

If you are growing in an environment with a powerful artificial light source, the last thing you want to do is to cover your plant in a liquid while the light is on. The plant cannot absorb the freshly sprayed liquid fast enough. The first thing that's going to happen is that the liquid will act as a lens, amplifying the heat from the lights and burning the leaf. Second, the plant will choke. Usually, when a plant gets too hot, its stomata open to release heat, gas, and water to cool down. However, it will not be able to breathe or self-regulate if the leaf is covered in a liquid that is causing its surface to burn.

DON'T USE A FOLIAR SPRAY IF IT WILL BE DETRIMENTAL TO YOUR GROWING ENVIRONMENT

Foliar feeding increases the humidity within the growing environment. This is great while your plant is in its vegetative stage, but it can be a problem when your plant is in flower. During the flowering stage, your humidity is already high. Environment is such an important factor in modern hydroponics that I personally wouldn't do anything to mess it up.

DON'T USE AN OVERLY CONCENTRATED FOLIAR SPRAY

When using a foliar spray, make sure you read the instructions twice and stick to the dilution rates on the label. In fact, I'd even recommend over-diluting the foliar spray just to make sure that you don't use a mix that could be too strong for your plant (after all, all plants are different).


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> “**The deficient** plants can be directly treated with a foliar spray without jeopardising the other plants’ feeding schedule.”

The Dos

DO USE A FOLIAR SPRAY AT LIGHTS OUT

The best time to use a foliar spray is at lights out. When a plant enters a dark period, its leaves take around 15 minutes to relax. It’s during this time—right after the lights turn off and before the leaves relax—that the stem and leaves are in their most effective absorption period. Spraying your plant at this point also means that it has the maximum amount of time to absorb the nutrients. If you were to spray your plants too close to lights on, the plant could still be wet when the lights come on. This would have the same negative effects on the plant as if the foliar spray was applied when the lights were on as discussed previously.

DO USE PROPER TECHNIQUE WHEN FOLIAR SPRAYING

Cover the plant’s leaves and stem with a light spray. Remember, less is always more, as your plants need to absorb all this liquid before the lights come back on. If the leaves are dripping wet, you have used too much. It may take you a few attempts to get it right. A great tip is to use a foliar sprayer that can be adjusted to expel a fine mist. Again, the finer the mist, the better it will be for the plant to absorb.

There are also spray bottles that can be used upside down, which is great for getting into tight spaces and spraying the bottom of leaves.

DO USE FOLIAR ABSORPTION TO YOUR ADVANTAGE

Foliar sprays are great for tackling nutrient deficiencies. For example, if your plant starts to show signs of calcium and magnesium deficiency while you are running a nutrient-rich feeding regime, you could look to use a cal-mag foliar spray at lights off every five days to rectify the issue. This way you don’t have to change your standard feeding regime. This is especially useful if there are multiple plants in your system and only a few are showing signs of a deficiency. The deficient plants can be directly treated with a foliar spray without jeopardising the other plants’ feeding schedule.

There is a great range of foliar nutrient feeds out there. Some reduce internode spacing in the vegetative stage by creating more branches, some increase the number of flowering sites while the plant is in the flower stage, and some help with the overall health of your plant by combatting deficiencies, pests, and diseases. The list goes on.

So, the next time you grow, consider using the secret way in to help take your plants to the next level.

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2: Perfecting feeding – NutSystems feed plants as and when the plants need feeding. They are either fed by a timer (Wilma) or via a constant mist (X-Stream and Oxypot). Plants are never over or under-watered and they can take nutrient solution up little and often. The result is far fewer deficiencies, much faster growth and bigger yields.

WHICH NUTSYSTEM SHOULD I CHOOSE?

Wilma Dripper System – Best Seller

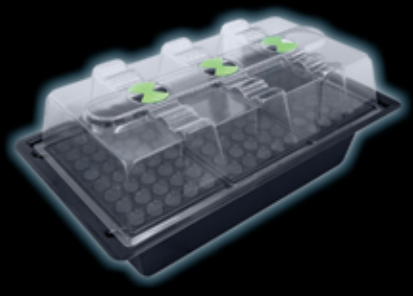
The Wilma has 4 or 8 pots and a reservoir below the pots. Nutrient solution drips from the reservoir into the pots several times per day. Any run-off drains straight back into the reservoir to ensure roots have superb access to oxygen.

The grower sets the timer to decide how often the dripper turns on and how long it runs for.

Oxypot DWC System – Best for new hydroponic growers

The Oxypot suspends roots in the system's misting chamber which is constantly oxygenated by an air pump. Just keep the misting chamber topped-up and it's impossible to get the watering wrong because the roots take-up what they need, there's no timer to set with this one.

The Oxypot uses just 1 litre of pebbles per plant.



X-Stream aeroponic propagator – Best for cuttings

For those who grow from cuttings this is an essential piece of kit. It maintains ideal moisture levels. The cuttings hang in the misting chamber and are constantly sprayed with a heavy mist.

The mist produces rapid growth and prevents drying-out and root-rot. Growers report near 100% strike rates!

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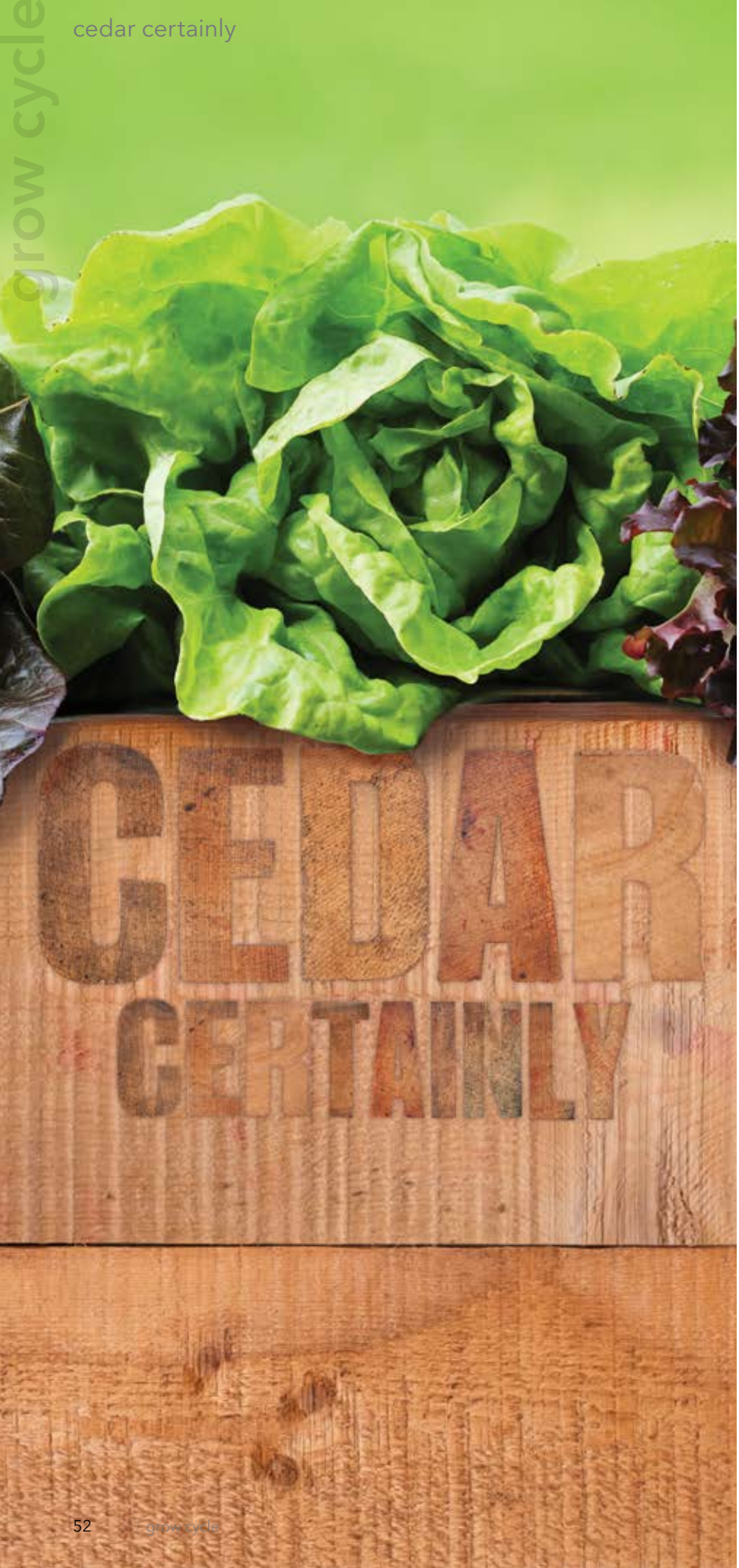

by Bryan Traficante

There are options, but when it comes to building a raised garden bed, nothing beats cedar. Bryan Traficante explains why he is **sold on cedar.**

If you are looking for a raised garden bed, it's important to consider the material it is made of. Although plastic and metal are viable options, a perennial favourite is wood. Wood comes in a variety of options, but there are particular species known to be rot-and insect-resistant; perfect for outdoor projects. Cedar is not only naturally rot-and insect-resistant, but also durable with a great track record of withstanding the elements.

ROT- AND INSECT-RESISTANT TRAITS

Cedar, like other rot-resistant species, has its own natural complex chemical compounds known as extractives that protect it against rot. Rot is caused by mold, termites, and other organisms feeding on the wood. To defend against these invaders, rot-resistant trees such as cedar create extractives that discourage rot and promote longevity.

The wood's ability to minimise decay and repel insects can depend on the amount of extractives within the wood. The outer wood, known as sapwood, has less extractives and may not last as long as the inner wood, known as heartwood. Cuts of wood from the heartwood will generally last longer and be more resistant to the environment.

Rot and insects are a wood's worst enemy, so choosing a species that is resistant will help your raised garden bed last longer.

DURABILITY

Cedar wood is durable thanks to its excellent density. Wood density is a measure of how close the grain is compacted. Hardwoods, like oak, have a high density and are generally heavier. Cedar is categorised as a softwood, and is lightweight by virtue of its low density. Its density means it can maintain a constant level of moisture which helps it last longer.

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The weight of soil in your raised bed garden exerts significant outward pressure. Materials like plastics and composite boards can bow and flex while cedar will maintain its integrity. Durability in wood is important for outdoor projects because hearty wood can withstand pressure and utilisation.

THE BEAUTY OF CEDAR

Cedar is durable and rot-resistant, but what about its aesthetic features? It turns out cedar isn't only effective, but it's pleasing to the eye as well. Cedar has natural tannins that vary the wood's colour and shade, and has varying grain patterns, which can look like stripes.

> **CEDAR, LIKE OTHER** rot-resistant species, has its own natural complex chemical compounds known as extractives that protect it against rot."

The colours can range from brown to red to nearly white, and sometimes all within the same board. Rich striations throughout the grain gives it a warm personality that looks right at home in the outdoors. Cedar can make an effective garden bed and look great doing it.

CEDAR FEATURES

Beyond colour, cedar also has some physical variations that complement its strong usability. Cedar will have some knots, but these are not negative imperfections. Knots are simply unique grain striations where tree limbs used to grow from. They can add character to the boards and create natural visual artistry.

Cedar wood has another physical trait; it can "check." Most woods are subject to this natural process. Checking can range from very slight slivers to cracks running the full length of the log into the heart of the wood. As wood releases moisture, checking can occur across or through its annual growth rings.

This is a normal result of wood seasoning and occurs only on the surface of the wood. In fact, these characteristics can add to the natural beauty. Checking is completely normal and won't affect the integrity of the wood or the strength.

In short, cedar wood is a practical and aesthetic choice when you're looking for a garden bed that will last and withstand the elements. It is a light-weight, durable, and rot-resistant wood making it ideal for raised bed gardening.

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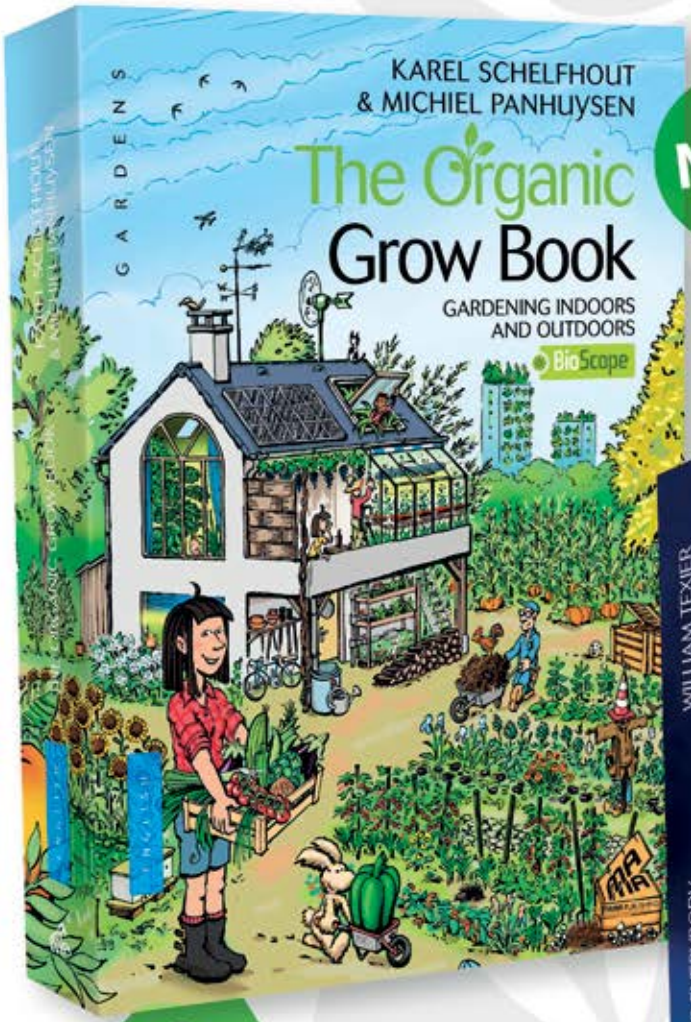

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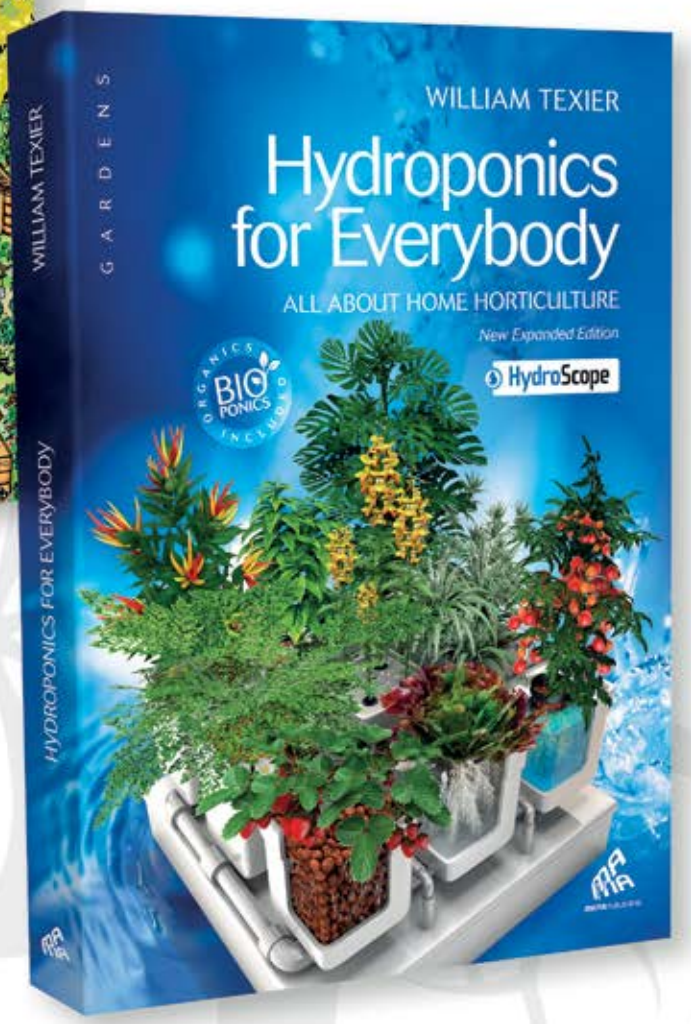

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GROW 'EM UP:
Benefits of CO_2 for Cloning

by Eric Hopper

Are plants in the cloning stage too small to benefit from enriched CO_2? Eric Hopper doesn't think so. He explains why using CO_2 during the cloning stage reduces pathogens and gives young plants a better chance at survival.

Many indoor horticulturists are reaping the benefits of enriched CO_2 levels in their vegetative and blooming rooms. Increased CO_2 levels can maximise the rate of photosynthesis and, in turn, increase the rate of growth. It is common for growers who supplement CO_2 to see not only faster growth but also larger yields. When done correctly, and everything else is equal, a growroom enriched with CO_2 will simply outperform a growroom without it.

However, while most growers agree that there are definite benefits of CO_2 enrichment in the vegetative and blooming rooms, there is an ongoing debate about the benefits of CO_2 in a cloning area. Some growers argue that the plants in the cloning stage are too little to benefit from enriched CO_2, while others argue all plants, regardless of size, benefit from CO_2. Carbon dioxide enrichment during the cloning stage, when done correctly, can increase the speed at which a plant creates roots, as well as increase success rates by eliminating or reducing potential pathogens.

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"PERHAPS THE BEST SOLUTIONS FOR ADMINISTERING CO_2 TO CLONES ARE THE CO_2 PADS SPECIFICALLY DESIGNED FOR CLONING CHAMBERS."

FASTER ROOTING

Increased CO_2 levels in the cloning area are beneficial when supplied to the cuttings' leaves. So, if a grower is using an aeroponic or mister-type cloning machine, the CO_2 should be added to the area where the leaves are and not to the area where the roots are (or will be). When the leaves have access to enriched CO_2 levels, photosynthesis can occur at a faster rate. The sugars created in this process are important fuels that provide the cuttings with the energy they need for making roots. In other words, raising the CO_2 levels increases the speed at which these valuable sugars can be produced. If the sugars needed for energy can be produced more quickly, the cuttings can, in turn, create roots more rapidly. Faster rooting means young plants can be transitioned into the vegetative stage and acclimated to a new environment sooner. Generally speaking, the faster the clones can develop roots, the higher the overall success rate of cloning.

REDUCED TRANSPIRATION

One of the main reasons why cuttings are kept in a high-humidity environment is because, without a root system, the cutting's leaves become the main source of water control and retention. Without a high-humidity environment, the cuttings from some plant varieties would transpire moisture to the point of wilting, and possibly death, from lack of water. A high-humidity environment reduces the cutting's need for transpiration and protects the cutting from losing too much moisture.

To better understand the relationship between transpiration and CO_2, we can look at an enriched CO_2 environment's impact on the plant's stomata. Plants absorb CO_2 through the open stomata on their leaves. Transpiration occurs when the stomata are open as well. As mentioned, transpiration leads to loss of water, which is another significant part of the photosynthesis process. So, to conserve water, plants will automatically regulate the amount of time the stomata are open. When an indoor horticulturist enriches his or her cloning environment with CO_2, there is more CO_2 available for absorption when the stomata are open. In other words, the plant can absorb more CO_2 while trying to limit water loss through transpiration. Some experiments have shown that when provided with an increased amount of CO_2, plants will not open the stomata as wide, thus reducing the amount of transpiration. This is a huge benefit for cuttings without roots in the cloning stage. Any reduction in transpiration is a large advantage for rootless clones. Overall, increased CO_2 levels will increase the efficiency of a plant's water use which, for clones, can mean the difference between wilted foliage and good structural integrity.

INCREASED RESISTANCE TO MOLDS, FUNGI, AND BACTERIA

It just so happens that the ideal environmental conditions for cloning (warmer temperatures and increased humidity levels) are also the conditions conducive to many pathogens. Powdery mildew, root rot, and grey mold are just a few of the nasties that find the cloning area's environment perfect for setting up shop. Enriching a cloning area with CO_2 is one of the most effective and safest ways a grower can prevent pathogens from attacking the otherwise susceptible cuttings. It is believed that CO_2 is an effective anti-fungal due to its ability to alter intracellular pH levels. In other words, an enriched CO_2 environment during the cloning stage can actually alter the pH of the leaf's surface, making it impossible for particular fungi

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to become established. A closer look at many of the products designed to treat or prevent molds in the garden will reveal that most of these products are effective because they alter the pH of the leaf's surface. When it comes to reducing pathogens in the cloning area, prevention is key. Enriched CO_2 levels can prevent problems before they occur and allow a grower to increase his or her overall success rate.

"ENRICHING A CLONING AREA WITH CO_2 IS ONE OF THE MOST EFFECTIVE AND SAFEST WAYS A GROWER CAN PREVENT PATHOGENS FROM ATTACKING THE OTHERWISE SUSCEPTIBLE CUTTINGS."

METHODS FOR ADMINISTERING CO_2 TO CLONES

There are a few different ways a grower can increase the CO_2 level in the cloning area. Carbon dioxide burners, compressed CO_2 tanks, or mycelium bags can all be rigged to enrich CO_2 levels during the cloning stage. However, too much of a good thing can be bad. When using a CO_2 system designed for a large area, a grower should be cautious to avoid the CO_2 levels getting too concentrated. For clones, CO_2 levels between 1,000-1,300 ppm should be the maximum. Levels above this can be counterproductive as the available oxygen gets displaced by CO_2. The roots (or potential roots) need some oxygen to develop and thrive. Growers who choose to use CO_2 burners or compressed tanks with injector systems need to have a CO_2 monitor/controller so the CO_2 levels can be kept in check.

Perhaps the best solutions for administering CO_2 to clones are the CO_2 pads specifically designed for cloning chambers. These pads can be placed directly into a standard propagation tray and dome and are activated by the humidity within (or when the clones are misted with water). The CO_2 pads are made from natural chemicals which, when exposed to humidity, begin to release CO_2. Since the pads are made specifically for propagation trays and cloning, they are designed to release the correct amount of CO_2 for that stage of growth. In fact, CO_2 pads made for cloning propagation trays usually put the CO_2 levels between 450-1,200 ppm. This level of CO_2 is ideal for the cloning stage because there is enough to increase the rate of photosynthesis (creation of sugars) and prevent certain pathogens from establishing, but not so much that root growth will be inhibited. Pads in the clone area may need to be replaced every few days to ensure a consistent level of CO_2 throughout the entire rooting process.

Of all the stages of growth in a perpetual indoor garden, the cloning stage is the most difficult for horticulturists to master. When success rates in the cloning stage are suffering, the entire perpetual garden suffers. This is why it is so important for horticulturists with perpetual gardens to have consistent results in the cloning stage. One of the best ways a grower can increase his or her success in cloning is to implement CO_2. When done correctly, increased CO_2 levels will give the plants the ability to create more sugars (fuel) at a faster rate. With those sugars, the plants are able to produce roots more quickly. Regardless of the benefits brought on by faster rooting, the protective nature of CO_2 enrichment is a good enough reason for horticulturists to add CO_2 to the cloning stage. The prevention of possible pathogens automatically increases success rates and eliminates potential glitches which could otherwise inhibit the flow of a perpetual garden. Considering the multifaceted benefits, the addition of CO_2 in the cloning stage could be one of the most influential factors affecting the early stages of a perpetual garden. MY


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- Patent pending genetics
- Made in the USA
THE ORIGINAL CO2 BAG
THE ExHale
HOMEGROWN CO2
exhaleco2bags.com
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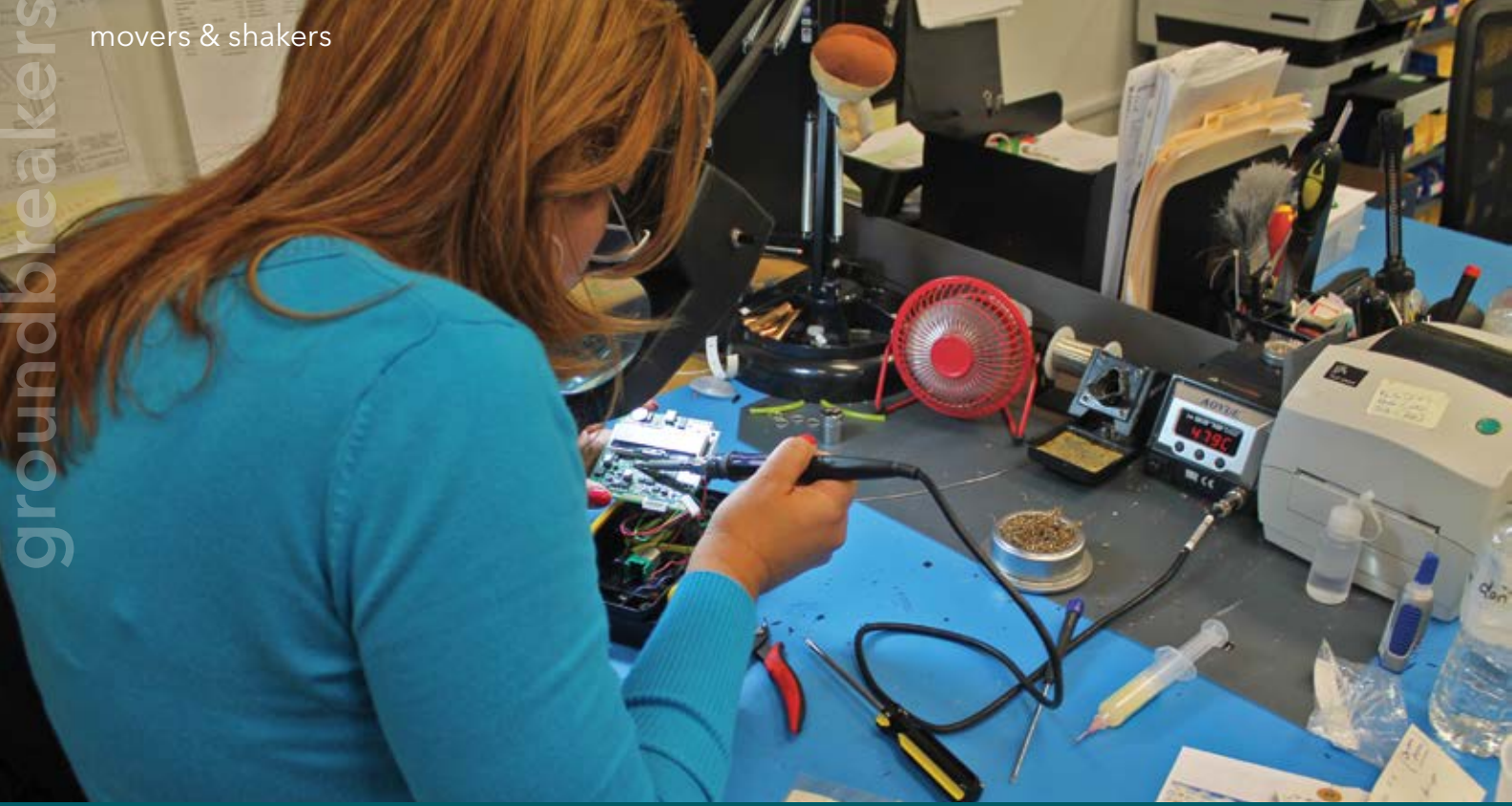
www.domegarden.com.au +61 3 9282 1988



Achieving Milestones: **CO2Meter**

CO2Meter is a team of gas measurement specialists based in Florida that have been designing and manufacturing gas detection and monitoring devices for almost 10 years. In addition to offering portable and fixed devices, the company also offers sensors for OEMs that can be incorporated into their designs. While CO2Meter services a variety of industries, including the agricultural, food and beverage, HVAC, and science sectors, the company has seen a lot of new potential in the indoor gardening market. Here's what they've learned along the way.

Before starting CO2Meter, CEO Irene Hicks led international teams in the fields of gas detection—mainly the mining industry—and president Ray Hicks owned and operated several businesses in the robotics and optics sectors. Together, the pair saw a gap in the devices offered for gas detection and monitoring for carbon dioxide (CO_2), so they used their combined business experience to create their own company in a new business segment.

CO2Meter was established in 2006 in Ormond Beach, Florida, in a small garage. It has since grown to occupy more than 743 square metres of warehouse space. "Our growth is a direct result of the increased use of and education surrounding carbon dioxide, especially when it comes to indoor growing. This space is where micro-brewing was 15 years ago," says Josh Pringle, vice-president of business development.

These days, CO2Meter offers more than 100 different devices and 35 types of sensors for a variety of gas-monitoring applications. The numerous devices provide options for a variety of gases to measure, data logging, portability features and monitoring different gas concentrations. "Our expert technical representatives assist customers in selecting the best device for their needs," says Josh, adding that 35 per cent of sales have been international, reaching more than 100 countries in the last
24 months. "With approximately one-third of our business shipping internationally, CO2Meter is uniquely positioned to not only offer solutions for gas detection and monitoring, but for learning from our global partners so that we make future product enhancements and technological advances. All our new devices begin with the feedback of our customers needs and wants."

CO2Meter.com
CO2 Measurement Specialists

Address:
131 Business Center Dr. Ormond Beach, FL 32174

Phone:
1-386-872-7669

Web:
co2meter.com

Years in Business:
9

CO2Meter's most popular product for indoor growers is the RAD-0501, a day/night CO_2 controller that can be used in greenhouses, growrooms and other places such as grow tents where elevated CO_2 levels are used to maximise plant growth. Growers simply set minimum and maximum CO_2 levels on the RAD-0501 and the device will maintain optimal CO_2 levels from tanks, burners, or generators. When the minimum CO_2 level is sensed, power is supplied from the RAD to the CO_2 generator or regulator via the built-in European 110-240 VAC 5A piggyback power cord. This will operate all devices in Europe. The RAD-0501 also has a built-in photo sensor that overrides the CO_2 control and shuts off the CO_2 when it senses darkness. "Photo-sensor control such as this saves dollars and energy by ensuring growers are only supplying CO_2 during the light cycle when it is needed," explains Josh. "Best of all, this CO_2 monitor and controller is easy to install and use. Simply mount the unit inside a greenhouse (all cables and hardware are included), plug it into a standard wall jack, plug in your CO_2 generator or regulator and the RAD-0501 is ready to maximise your yields."

CO2Meter's unique business philosophy is a large part of their success. "We are uniquely positioned to use our experience in multiple industries to drive innovation and success for our customers throughout the business segments we service," says Josh. "We define ourselves as cost-effective. We believe every device that ships is our next opportunity to satisfy a customer and build a loyal brand following. The ideals of great devices, at good prices, with premier customer support, are hallmarks that the company will always follow."

Most of CO2Meter's growth has to do with its many strengths, which include quality devices, superior technical knowledge and support, unwavering integrity, and the ability to offer cost-effective solutions for growers of all levels. It's all lead Josh and the rest of the team to learning a lot along the way. "In this business, I've learned a lot. The three major things that stand out the most are: 1) Accurate, quality gas measurement devices do not need to cost tens of thousands of dollars; 2) Most people want a solution but do not know how to find or create one; and 3) Education is the key component for the industry moving forward."

Along with its physical location and number of product offerings, the team at CO2Meter has also grown immensely, with 15 full-time and two contract employees now onboard. Growing the team is something Josh considers one of his proudest moments so far. "Growing the business and adding employees is always frightening and rewarding, but finding, training and retaining good people, which is an important factor in any business, makes anything possible. When the team is trained properly, motivated to succeed, and has a clear vision for the future, most business problems don't even appear."

Other proud moments CO2Meter has had so far include landing major corporate customers or achieving sales milestones, but Josh says the proudest moments are always the ones that happen when customers contact them to tell them how well a device worked, or that one of their devices saved their life. "It's hard to beat those moments," Josh says. "I think one of my favourite moments on the job is the phone call I received from a middle-school student. He and his mom called to share some news with me about the science fair project he had been working on. He was measuring the CO_2 change in plant growth and I had spent some time helping them purchase the correct sensor for the project, as well as offering some guidance about the set-up and design. He called to tell me he had won a Google Prize for his experiment. Not only was it a great feeling to know he had succeeded, but more importantly, at that point I realised students today are studying the effects of gases and will be able to affect change in the future."

For growers and entrepreneurs entering this sector who are just starting out, Josh has the following advice to share: "Things change every day in this business segment, whether you are trying to control CO_2 for growth, or you've been instructed by a fire marshal to have a life safety device in your facility to monitor for hazardous levels of CO_2. Be open about your business. Lean on others to help you understand the pitfalls in business that you can avoid. Accept that you aren't an expert in everything and that you can learn from others. The only constant is change, so be flexible and willing to learn."

"When the team is trained properly, motivated to succeed, and has a clear vision for the future, most business problems don't even appear."

Top: Josh Pringle at recent trade show events.

Bottom Left: Melyssia Santiago, CO2Meter director of sales, with Andy Sistrunk of Persimmon Hollow Brewing.

Professor's Nutrients Pty. Ltd.
CONTACT: **Ricky Ciappara (sales manager)**
PHONE: **0488 448 554**
professorsnutrients.com.au
info@professorsnutrients.com.au

FROM A SINGLE NUTRIENT TO AN EXTENSIVE HYDROPONIC RANGE, DISCOVER HOW A LOCAL MELBOURNE COMPANY IS NOW STOCKED IN OVER 80 STORES AUSTRALIA–WIDE, AND STILL GROWING.

First established in the early 1990s as Dr. Indoors, Professor's Nutrients quickly became a favourite in the hydroponic scene. With word spreading rapidly and demand growing, supplies were short and hard to source. That's when the team from Professor's stepped in, keeping the original formula, but changing the name to Professor's Nutrients and adopting modern mixing technology and equipment to generate more accurate and consistent results to meet the growing demand, both locally and internationally.

Coming from a retail background within the hydro industry, the team at Professor's found the general feedback from customers was that they were unhappy with the number of products needed throughout their growing cycle. Customers were becoming disappointed that multiple products were required to do one job, let alone with the costs associated to purchase these products. The team could also see that customers were paying more for products that were manufactured overseas, due to shipping and storage overheads.

PROFESSOR'S NUTRIENTS

Top: Sales manager Ricky Ciappara holds Professor's Nutrients Go Roots, Australia's most concentrated root enhancer. **Above:** The team at Professor's Nutrients is proud of an ever-evolving product line.

The team at Professor's Nutrients had a simple goal—create a range that guaranteed powerful results, was of premium quality, and straightforward to use.

Initially, they started with a single two-part nutrient, which can be used by any indoor or outdoor grower, with any type of system, and in any grow medium. They were getting great feedback and constantly being asked if there were any other products available from the Professor's range. They wanted to make a complete hydroponic range that not only worked but was also compatible with any other feeding program. More importantly, it was also created for Australian growers, with Australian conditions in mind. With a lot of patience and hard work, the team had dedicated many years studying and field testing each product to achieve
the best outcome. Until a product showed exceptional results, it was not given the tick of approval.

Over the years, the brand has evolved to include a range of high-quality additives for maximum performance, ranging from a single nutrient and to products designed for propagation, deficiency prevention, and root growth, as well as vegetative and flowering boosters and enhancers.

> "**THE TEAM AT** Professor's Nutrients had a simple goal–create a range that guaranteed powerful results, was of premium quality, and straightforward to use."

The team has developed two impressive products for the propagation stage—Cloning Accelerator and Starter Soak, both aimed at giving your plants the best possible start. Go Green has taken the industry by storm, rated as one of the most effective repairer of plant deficiencies on the market. This was closely followed by the release of Go Roots, formulated with fulvic and humic acids and a systemic fungicide, which allows for massive root growth and protection against root disease. Go Roots stands to be Australia's most concentrated root enhancer on the market, making it the most cost effective available. Plants need a boost? They've also got you covered in the vegetative stage with Grow Fast, a nitrogen-based product that accelerates your plants growth, and in the blooming stage, with Flower Boost and Extreme Boost, which are scientifically proven to increase your yield.

"The hydroponic industry is constantly evolving, and we like to keep up to date with what is current by aiming to have products which are on point and relevant," says Ricky Ciappara, sales manager. "What makes our team at the Professor's unique is our willingness to work with and listen to the growers. Once each product has been lab tested and created, our team is actively involved in ensuring each product delivers superior results. As you continue to garden, our team will continue to research and develop, bringing new and exciting products to your local retail store."

The team at Profesor's Nutrients says it agrees that the biggest reward and most satisfying aspect of manufacturing is receiving positive feedback, and that anyone in retail can sell a product, but what brings the customers back are products that work."

distributors

retail stores listed alphabetically by state

ACT

South Pacific Hydroponics
#2 - 84 - 86 Wollongong St.
Fyshwick ACT 2609
(02) 6239 2598

South Pacific Hydroponics
70 Oatley Crt.
Belconnen ACT 2617
(02) 6251 0600

NEW SOUTH WALES

24/7 Hydroponics
151 Wine Country Dr.,
Nulkaba NSW 2325
(02) 4990 4291
admin@simplydvine.com.au

99 Trading
57 Hoskins Avenue, Banks Town
NSW 2200
(02) 9790 1525

Accent Hydroponics
Unit 1/5 Clerke Place,
Kurnell NSW 2231
(02) 9668 9577
accenthydroponics.com

ASE Hydroponics
Factory 10/45 Leighton Pl.
Hornsby NSW 2077
(02) 9477 3710

Ballina Hydro
3 Ray O'Niell Cres.
Ballina NSW 2478
(02) 6686 7321

Criscete Hydroponics and Organics
Unit 2/15 Kam Close
Morisset NSW 2264
(02) 4973 5779

Dubbo Hydro & Tobacconist
42c Victoria St.
Dubbo West NSW 2830
(02) 6885 1616

Earth & Colour Vertical Gardens and Hydroponic Supplies
1/43 CorporationCircuit, Tweed
Heads South NSW 2486
(07) 5523 9565
earthandcolour.com.au

Favgro Hydroponics Growers
107 Glenella Rd.
Batehaven NSW 2536
(02) 4472 7165

Felanza - Hydroponics
140 Princess Hwy.
Arncliffe NSW 2205
(02) 9556 1494

General Hydroponics
7/14 Sunnyholt Rd.
Blacktown NSW 9676
(02) 9676 8682

Grow Your Own
Unit 6/34 Alliance Ave
Morisset NSW 2264
(02) 4973 5179

Holistic Hydroponics Pty. Ltd.
Unit 21/322 Annangrove Rd.
Rouse Hill NSW 2155
+61 (04) 8803 8807

Home Grown Aquaponics
8A-8B 13 Hartley Dr.,
Thornton NSW 2322
(02) 4028 6388
home-grown.net.au

Hong Hung
D5 303 The Horsley Dr.,
Fairfield NSW 2165
(02) 8764 1083

Hyalite Kingsgrove
1/4 Wirega Ave.
Kingsgrove NSW 2208
(02) 8068 5896

Hyalite Moorebank
6/376 Newsbridge Rd.
Moorebank NSW 2170
(02) 9824 3400

Hyalite Villawood
2/21 Birmingham Ave.
Villawood NSW 2163
(02) 9723 7199

Hydro Experts
34/2 Railway Parade
Lidcombe NSW 2141
(02) 8041 7959
info@hydroexperts.com.au
hydroexperts.com.au

Hydro Masta
100 Station Rd.
Seven Hills Sydney NSW 2147
(02) 8812 2845

Hydro Place
1/68 Nelson St.
Wallsend NSW 2287
(02) 4965 6595

Hydro Shop Pty Ltd
Unit 1/5-7 Channel Rd.
Mayfield West NSW 2304
(02) 4960 0707

Hydro Supplies
57 Flinders St.
Darlinghurst NSW 2010
(02) 9326 0307

Hygrow Horticulture (Greenlite)
252 Oxford St.
Bondi Junction NSW 2022
(02) 9369 3928

Indoor Sun Shop
745 Victoria Rd.
Top Ryde NSW 2112
(02) 9808 6511

Indoor Sun Shop
Unit 2/109 Junction Rd.
Moorebank NSW 2170
(02) 9822 4700

International Fans
PO Box 120
St. Mary's NSW 2760
(02) 9833 7500

Kyper's Tools and Hydroponics
Stuart & Tincogan Sts.
Mullumbimby NSW 2482
(02) 6684 4928

Lismore Hydro
1/106 Canway St.
Lismore NSW 2480
(02) 6621 3311

Lismore Hydroponics
Rear of 28 Casino St.
South Lismore NSW 2480
(02) 6621 3311

Lux Cuttings
Shop 2/273 Anzac Parade
Kingsford NSW 2032
(02) 9663 0473

North Coast Hydroponics
2/5 Wallis Ave.
Toormina NSW 2452
(02) 6658 7932
northcoasthydro.com.au

Northern Lights Hydroponics
6/46 Through St.
South Grafton NSW 2460
(04) 3110 5882

Northern Nursery Supplies Pty Ltd
14-16 Nance Rd.
Kempsey NSW 2440
(02) 6563 1599

Nowra Hydro
68 Bridge Rd.
Nowra NSW 2541
(02) 4423 3224

Nutriflo Hydroponic Systems
19/5 Daintree Pl.
Gosford West NSW 2250
(02) 4323 1599
nutriflo.com.au

Outside in Hydroponics & Organics
2/595 Main Rd.
Glendale NSW 2285
(02) 4956 5676

Parkview Plants
250 Princess Hwy.
Nowra South NSW 2541
(02) 4423 0599

Port Pumps and Irrigation
20 Uralla Rd.
Pt Macquarie NSW 2444
(02) 6581 1272

Quik Grow
510a Great Western Hwy.
Pendle Hill NSW 2145
(02) 9636 7023

Quick Grow
823 King Georges Rd.
S. Hurstville NSW 2221
(02) 9546 8642

Quik Grow Pty Ltd
490 Parramatta Rd.
Petersham NSW 2049
(02) 9568 2900

Richmond Hydroponics
Unit 3/84 Bells Line of Rd.,
North Richmond NSW 2754
(02) 4571 1620
richmondhydroponics.com.au

Simple Grow
Hassall St. & Windem
Wetherill Pk NSW 2164
(02) 9604 0469

South Pacific Hydroponics
84-86 Wollongong St, Fyshwick
NSW 2609
(02) 6239 2598

Sydney Garden Supplies
187 Waterloo Rd., Greenacre
NSW 2190
0414 609 241

The Grow Shop
5/5 Forge Dr.
Coff's Harbour NSW 2450
(02) 6651 9992

The Petshop Boyz
Unit 1/ 5-7 Channel Rd.,
Mayfield West NSW 2304
(02) 4960 0708
petshopboyz.com.au

TN Hydroponics
1/43 Chadderton St,
Cabramatta NSW 2166
(02) 9724 5692

Tweed Coast Hydroponics
2/58 Machinery Dr.
Tweeds Head South NSW 2486
(07) 5524 8588

Uncle Wal's Gardenland
31 Cres. Ave.
Taree NSW 2430
(02) 6550 0221

VN Hydro
8 Robert St.
Belmore NSW 2192

Home Grown Aquaponics
13/8a-8b Hartley Dr.
Thornton NSW 2322
(02) 4028 6388

Warrawong Hydroponics Centre
Shop 2B - 72 Cowper St.
Warrawong NSW 2502
(02) 427 48001
warrawonghydro@hotmail.com

Westside Lighting & Electrical (Ezi Range)
PO Box 274
Mascot NSW 1400
1 800 661 475

Wollongong Hydroponic Centre
318 Crown St.
Wollongong NSW 2500
(02) 4225 8773

NORTHERN TERRITORY

Darwin Hydroponics
5/8 Andrews St,
Berrimah NT 0828
0478 735 165
darwinhydroponics.com

Katherine Hydroponics Centre
17 Rundle St.
Katherine NT 0850
(08) 8972 1730

Top End Hydroponics
1785 Leonino Rd.
Darwin River NT 0841
(08) 8988 6076

QUEENSLAND

A Happy Medium Hydroponics
Unit2/10 Central Crt.
Browns Plains QLD 4118
(07) 3809 3322

Advanced horticultural Supplies - Gold Coast
6/68 Blanck St.
Ormeau QLD 4208
0435 255 856
adhs.com.au

Advanced Horticulture Supplies - Noosaville
Shop 3 11 A Venture Dr.
Noosaville QLD 4566
(07) 5641 1256
adhs.com.au

Allgrow Hydro
13 - 58 Bullock Head St.
Sumner Park QLD 4074
(07) 3376 7222

Aqua Gardening
Shop 3/73 PIckering St.
Enoggera QLD 4051
(07) 3354 1588

Aquatic Oasis
Unit 2/33 Smith St.
Capalaba QLD 4157
(07) 3245 7777

Billabong Hydroponics
Lot 1 Billabong Crt.
Childers QLD 4660
(07) 4126 3551

D-Bay Hydroponics Shop
5/404 Deception Bay Rd.
Deception Bay QLD 4508
(07) 3204 8324

E.T. Grow Home
Unit 1/4 Windmill St.
Southport QLD 4215
(07) 5591 6501

Eye Lighting Australia Pty Ltd
PO Box 306
Carole Park QLD 4300
(07) 3335 3556

Frans Hydroponics
Shed 3 1191
Anzac Ave. Kallangar QLD 4503
(07) 3285 1355

Gold Coast hydroponics
42 Lawrence Dr.
Nerang QLD 4211
(07) 5596 2250

Grow Hydro
22 Mining St.
Bundamba QLD 4304
(07) 3816 3206

H2 Gro Pty Ltd
2 Sonia Crt.
Raceview QLD 4305
(07) 3294 3253

Home Grown Hydroponics
4/9 Barnett Pl.
Moledinar QLD 4214
(07) 5571 6666

Hyalite Varsity
5/11 John Duncan Crt.
Varsity Lakes QLD 4227
(07) 5593 7385

Hydrocenter Hydroponics
26 Spencer Rd.
Nerang QLD 4211
(07) 5527 4155

Hydroponic Roots & Shoots
Lot 3 Herberton Rd.
Atherton QLD 4883
(07) 4091 3217

Hydroponics & Garden Supplies
93 Cook St.
Portsmith QLD 4870
(07) 4035 5422

Hydroponics Today
PO Box 785
Stanthorpe QLD 4380
(07) 4683 3133

Indoor Solutions
Unit 2/79 Oxford Tce.
Taringa QLD 4068

J&K Hydroponics
387 Progress Rd.
Wacol QLD 4076
(07) 3271 6210

KY Garden
3/31 Argyle PDE
Darra Brisbane QLD 4076
(07) 3375 9098

Logan Hydroponics
13/22, Allgas St.
Slacks Creek QLD 4127
(07) 3299 1397
loganhydroponics.com.au

North Queensland Hydro Supplies
Shop 2B/20-22 Fleming St.
Townsville QLD 4810
(07) 4728 3957

Northern Hydroponics
383 Mulgrave Rd.
Cairns QLD 4870
(07) 4054 5884

NQ Hydroponics
31 Casey St.
Aitkenvale QLD 4814
(07) 4728 3957

Pioneer Hydroponics
194 Doyles Rd.
Pleystowe QLD 4741
(07) 4959 2016

Simply Hydroponics Gold Coast
42 Lawrence Dr.
Nerang QLD 4211
(07) 5596 2250

Slacks Creek Hydroponics
#13/22 Allgas St.
Slacks Creek QLD 4217
(07) 3299 1397

Sunstate Hydroponics
7/10 Fortune St.
Geebung QLD 4034
(07) 3265 3211

Sunstate Hydroponics
10/13 Kerryl St.
Kunda Park QLD 4556
(07) 5445 3499

Town & Country Hydroponics
Shop 1/8585 Warrego Hwy.
Withcott QLD 4352

Tumbling Waters Hydroponics
2 Clarkes Track
Malanda QLD 4885
(07) 4096 6443

Walsh's Seeds Garden Centre
881 Ruthven St.
Toowoomba QLD 4350
(07) 4636 1077

SOUTH AUSTRALIA

Adelaide Hydro
Shop 3.267 Goodwood Rd.
Kings Park SA 5034
(08) 7230 5907
adelaidehydro.com.au

Advanced Garden Supplies
3/8 Bredbo St.
Lonsdale SA 5160
(08) 8382 1191

Amazon Aquariums & Gardening
Unit 5 16 Research Rd.
Pooraka SA 5095
(08) 8359 1800

Ascot Park
753 Marion Rd.
Ascot Park SA 5043
(08) 8357 4700

Barry's Hardware
Saints & Main North Rd.
Salisbury Plains SA 5109
(08) 8281 4066

Back Street Traders
Unit 6/8 Lindsey Rd.
Lonsdale SA 5160
(08) 8322 4383

Bloomin' Hydroponics
5/535 Martins Rd.
Parafield Gardens SA 5107
(08) 8281 6395

Bolzon Home & Garden
103 Tolley Rd.
St Agnes SA 5097
(08) 8265 0665

Chocablock Discount Variety Store
15-17/1220 Grand Junction
Hope Valley SA 5090
(08) 8396 3133

Complete Hydroponics
1581 Main North Rd.
Salisbury East SA 5109
(08) 8258 4022

Country Hydro
434 Saddleback Rd.
Whyalla SA 5600
(08) 8645 3105

D & W Dependable Hardware
45B Kettering Rd.
Elizabeth South SA 5112
(08) 8287 6399

Every Thing Hydro
Shop 2/494 Main North Rd.
Blair Athol SA 5084
(08) 8260 3335

Festive Hydro
2 Kreig St.
Evanston Park SA 5116
(08) 8523 5100

Fulham Gardener Nursery
597 Tapleys Hill Rd.
Fulham SA 5024
(08) 8235 2004

Future Garden Concepts North
Shop 2 21-23 Kreig Rd.
Evanston Park SA 5116
(08) 8523 5100

Futchatec Distribution
4 Symonds St.
Royal Park 5014
(08) 8447-1122

Glandore Hydroponics
644 South Rd.
Glandore SA 5037
(08) 8371 5777
www.glandorehydro.com

Greener than Green
52 - 54 Cliff Ave.
Port Noarlunga South SA 51
(08) 8386 2596

Greenhouse Superstore Lonsdale
35 to 37 Aldenhoven Rd.
Lonsdale SA 5160
(08) 8382 0100

Greenhouse Superstore Royal Park
4 Symonds St.
Royal Park SA 5014
(08) 8447 5899

Gro Pro Hydro
3 Kelly Rd.
Willaston SA 5118
(08) 8522 7761

Ground-Up Service Nursery
3 Copinger Rd.
Pt. Pirie SA 5540
(08) 8264 9455

Gully Hydro
32 Famechon Cres.
Modbury North SA 5092
08 8264 9455

Hackham Garden & Building Supplies
32 Gates Rd, Hackham SA 5163
(08) 8382 4754

Harvest Time Hydroponics
Shop 3/146-148
Findon Rd. Findon SA 5023
(08) 8244 0222

Hindmarsh Hydroponics
39a Manton St.
Hindmarsh SA 5095
(08) 8346 9461

Highland Grow & Flow
14/1042 Grand Junction Rd.
Holden Hill SA 5088
(08) 8395 4455

Hong Kong Hydro
13 Research Rd.
Pooraka SA 5095
(08) 8260 2000

Hush Hydroponic Wholesalers
25 Charlotte St.
Smithfield, SA 5114
(61) 8 8254 1585

Hydro Heaven
Kane Motors-Hunt Rd.
Mount Barker SA 5251
(08) 8391 1880

Hydro Sales & Service
1 Salisbury Cres.
Colonel Light SA 5041
(08) 8272 2000

Hydro Technics
321 South Rd.
Croydon SA 5008
(08) 8241 5022

Hydro Technics North
22 Peachey Rd.
Elizabeth West SA 5113
08 8252 7988

Hydro Warehouse
181 Seacombe Rd.
South Brighton SA 5048
(08) 8377 1200

Hydro Wholesalers
181 Seacombe Rd.
South Brighton SA 5048
(08) 8377 1200

Hydro World
40 Folland Ave.
Northfield SA 5085
(08) 8262 8323
hydroworld.com.au

Koko's Hydro Warehouse
Unit 2/2 McGowan St.
Pooraka SA 5095
(08) 8260 5463

Larg's Bay Garden Supply
239 Victoria Rd.
Largs Bay SA 5016
(08) 8242 3788

Martins Rd. Hydro
5- 353 Martins Rd.
Parafield Gardens SA 5107
(08) 8283 4011

Mitre 10 Dr. In
152 Hanson Rd.
Mansfield Park SA 5012
(08) 8445 1813

New Age Hydroponics
135-137 Sir Donald Bradman Dr.
Hilton SA 5033
(08) 8351 9100
newagehydro.com

Owen Agencies
17-19 Railway Terr.
Owen SA 5460
(08) 8528 6008

Palms & Plants
175 Salisbury Hwy.
Salisbury SA 5108
(08) 8285 7575

Professional Hydro
4/522 Grange Rd.
Fulham Gardens SA 5024
(08) 8353 0133

Professional Hydro
Shop 5/645 Lower North East Rd.
Paradise SA 5075
(08) 8365 5172

Professional Hydroponics
113 Maurice Rd.
Murray Bridge SA
(08) 8532 3441

Rob's Garden Centre
Shop 3/364 North East Rd.
Windsor Gardens SA 5087
(08) 8369 2498

Seaton Hydroponics
129 Tapleys Hill Rd.
Seaton SA 5023
(08) 82682636

Soladome Aquaculture & Hydro
44 Chapel St.
Norwood SA 5067
(08) 8362 8042

South Coast Hydroponics
6/25 Gulfview Rd.
Christies Beach SA 5165
(08) 8384 2380

State Hydroponics & Homebrew Supplies
174 Semaphore Rd.
Exeter SA 5019
(08) 8341 5991

Tea Tree Gully Hydro
32 Famechon Cres.
Modbury North SA 5092
(08) 8264 9455

Two Wells Hardware
86 Old Port Wakefield Rd.
Two Wells SA 5501
(08) 8520 2287

Urban Grow Solutions
1/111 Main Sth Rd.
O'Halloran Hill, S.A 5189
(08) 8322 0040

Waterworld Home & Garden Supplies
9 Aldershot Rd.
Lonsdale SA 5160
(08) 8326 2444

Warehouse of Garden
89 Helps Rd.
Burton SA 5110
(08) 8280 3314
warehouseofgarden.com.au

West Garden Centre
Peachey Rd.
Elizabeth West SA 5113
(08) 8255 1355

TASMANIA

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10 facts on...

AUXINS

by Philip McIntosh

Among the first plant hormones to be discovered, **auxins** serve a variety of roles within plant activities and development.

AUXINS ARE A family of plant hormones with diverse roles in plant morphogenesis including phototropism (bending toward light), cell expansion, root formation, and bud development.

AUXINS WERE THE first plant hormones to be discovered and studied. Charles Darwin found that coleoptiles (the sheaths around the leaves of young grass plants) would bend toward light. By shading various parts of coleoptiles, Darwin found that the source of the bend response was located in the tips of the coleoptiles.

OTHER WORKERS EXPANDED upon Darwin's work and the discovery of the first auxin, indole-3-acetic acid (IAA), is credited to the Dutch botanist Fritz Went who worked in the 1920s and '30s.

IT IS NOW known that IAA is produced in the growing tip of a plant shoot and diffuses downward through the stem. Providing the tip of the plant (the apical meristem) is intact, IAA suppresses the development of axillary buds and branching growth below the tip.

WHICH IS WHY cutting off the main stem (topping) of a plant increases bushiness by allowing the axillary buds below the tip to be released from their IAA-induced dormancy to begin growing.

ALONG WITH THE naturally occurring auxins, there are numerous synthetic auxins that are structural analogs of IAA.

ONE OF THE more notorious synthetic auxins is 2,4-dichlorophenoxyacetic acid, more commonly known as 2,4-D. 2,4-D was one of the compounds (in combination with 2,4,5-T) in Agent Orange, used by the United States as a defoliant during the Vietnam War.

2,4-D IS STILL used today as an herbicide. Compared to grasses, broad-leafed plants such as dandelions are much more susceptible to large doses, so it is an effective weed killer for use on lawns.

ALTHOUGH IAA IS the principle auxin produced by plants, there are a few others. One of particular note is indole-3-butyric acid (IBA), the active ingredient in most rooting powders and cloning aids used to stimulate root development in cuttings.

AS IS USUALLY the case with plant hormones, auxins interact with other hormones in complex ways. For example, the auxin-cytokinin ratio has diverse regulatory effects on plant growth and development.

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