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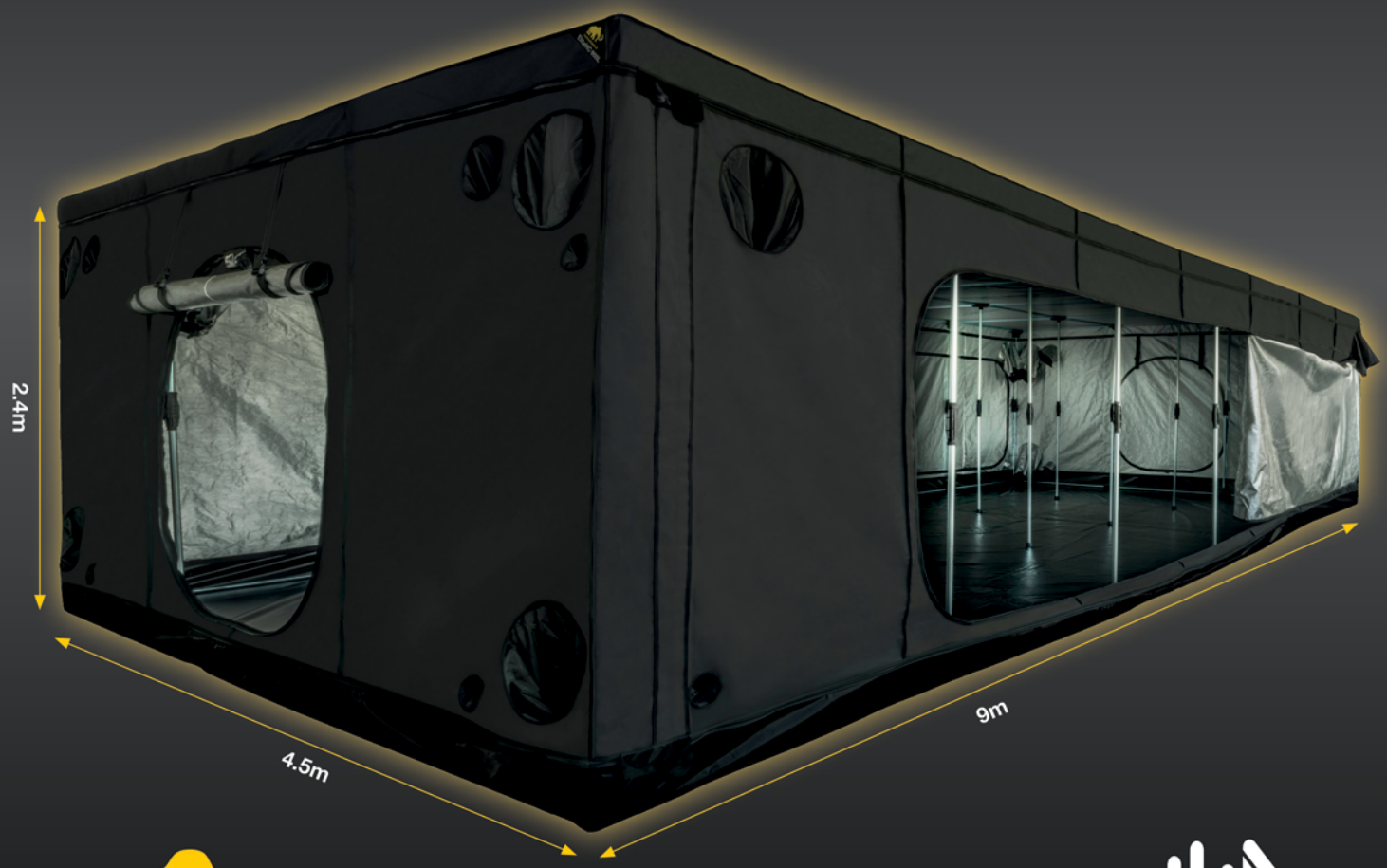

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“Many of our readers are creative and industrious, are conscious of our environment and strive to leave a small footprint on our planet, are active and social, and like to know where their food comes from and how healthy it is."

from the **EDITOR**

TG **Toby Gorman**

Our recent reader survey gave us some great insight into who reads *Maximum Yield*. From the feedback we regularly receive on social media, emails, and letters to the editor, we felt we already had a good idea of who was in our community. Reader surveys, however, help us understand you better. It helps guide our content, decide which expos to attend, where to send our publications, and, most important, who you are and what you like. From the results we gathered — thanks to all of you who participated — we discovered a few things we already suspected, such as whether you prefer digital or print, what you grow, and how you grow it. We also discovered a few things we didn't know.

Turns out, many of our readers are creative and industrious, are conscious of our environment and strive to leave a small footprint on our planet, are active and social, and like to know where their food comes from and how healthy it is. Sixty per cent of you grow vegetables hydroponically, 42 per cent grow herbs, 36 per cent grow leafy greens, 30 per cent grow fruits, 11 per cent grow microgreens, and less than one per cent grow citrus fruit. Somewhere in there are a lot of growers who like to try new things to grow.

Did we mention many of our readers also like beer? In this issue, we identify one crop to consider for the adventurous grower — hops. As contributor Lynette Morgan states, hops grow very well hydroponically, and while it has been overlooked as an indoor crop, that might be changing.

"Despite seeming to be an odd specimen for greenhouse or indoor cropping, hops have, in fact, become one of the new, innovative options for growers looking to produce a niche market product," says Morgan in her article "How to Grow Fresh Hydroponic Hops" on page 64. "For those who have a liking for craft beers or inkling to brew their own, growing a few hop plants can be a viable option as well as a fascinating new crop to experiment with."

Also in this issue are "How to Build Your Own Hydroponic System" on page 54, and "Shedding Light on Multi-Tiered Indoor Gardens" on page 48. Or visit *maximumyield.com* for everything you need to grow: oranges, leafy greens, hops, or whatever it is your heart desires.

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Featured Contributors

Eric Hopper has more than 10 years of experience in the hydroponic industry as both a retail store manager and owner. He continuously seeks new methods and products that could help maximise garden performance. Eric resides in Michigan where he and his family strive for a self-sufficient and sustainable lifestyle.

Kent Gruetzmacher, MFA, is a Colorado-based freelance writer and the director of business development at Mac & Fulton Talent Partners, an employment recruiting firm dedicated to the indoor gardening and hydroponic industry. He is interested in utilizing his MA in Humanities to critically explore the many cultural and business facets of this youthful, emergent industry by way of his entrepreneurial projects.

Contributors

Sara Elliott
Nancy Hamilton
Rich Hamilton
Philip McIntosh
Monica Mansfield
Dr. Lynette Morgan

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Check out Nancy Hamilton's article on page 70 for more information.

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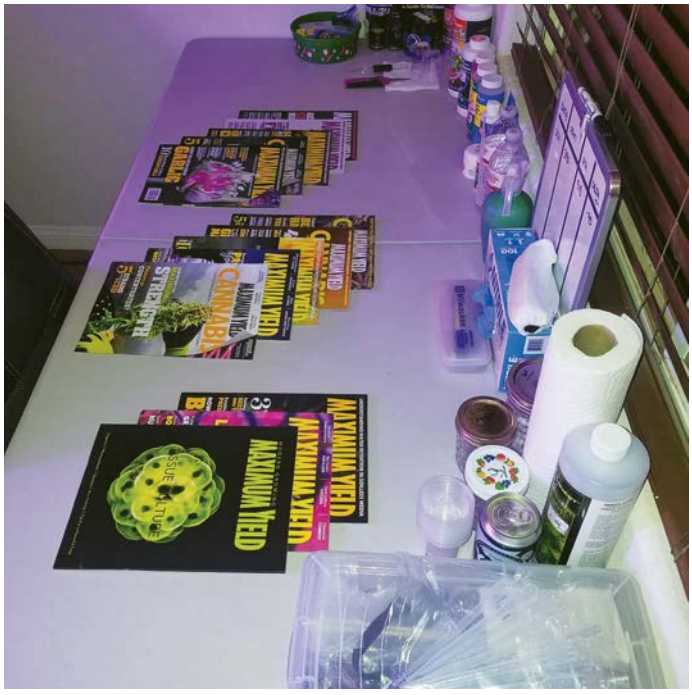
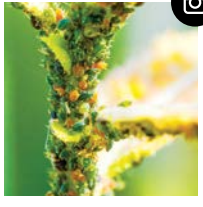


@gardening4gains
This is a dream greenhouse for me – strawberry fields forever.

@MikeBaptist6
Your magazine is outstanding for ANY garden. Love your stuff.



@rejuicenating
It's a shame to get sick plants, awesome tips!

@johnnyveganics
Where I learned everything.

Article Archives

Can't recall that great gardening recommendation from a few months ago? Look it up online. We have hundreds of indoor gardening articles available at *maximumyield.com*.

Ask the Experts

Stumped by something strange happening in your garden? Fill out our Ask the Experts form and we will find you answers.

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ask a **GROWER**

Q I have some Cherry Wine hemp seeds. Do you think with the right nutrients and love I can make these seeds produce THC or will it just grow hemp?

@syrinalynn, via Twitter

A Generally, all strains of cannabis require a specific range of temperature and humidity — about 21-24°C and 40 per cent humidity — for optimal growth. They also all have a range of lighting requirements over their different phases of growth. They need mild light at the beginning and strong photosynthesis photon flux density during vegetative growth and flowering. During the flowering phase, supplemental ultraviolet-B (UV-B) stimulates the creation of the phenols and terpenes that are transformed into cannabinoid acids, which are stored in the secretory reservoir of the trichomes.

While these conditions will grow great weed, they can't change the strain's genetic code. The strain you are discussing — Cherry Wine — is specifically bred to be a cannabidiol (CBD) strain. Hemp is generally a tall-growing, high-CBD, and high-cannabigerol (CBG) type of cannabis. It has different genetics than your typical sativa, which is usually high in tetrahydrocannabinol (THC), and indica, which is usually high in CBD. Cherry Wine hemp has a potency of 15-25 per cent CBD and 0-0.3 per cent THC. Judging from this THC/CBD output, sativa genetics were never bred into this strain. So, you cannot make this strain produce THC because the genetic code to make THC is not available in any meaningful amount.

Dr. Strangebud

DS **Dr. Strangebud** (aka Augustus Dunning) is the CEO of Eco Organics and is a physicist, chemist, and an inventor. He is the former systems ops designer for the International Space Station and a former regional manager of liquid, solid, and electric propulsion systems for Pratt and Whitney space propulsion, Edwards AFB, NAWC, and JPL.


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FACTS

How the Dutch Innovated Greenhouse Tomato Growing

Arguably the most popular greenhouse-growing product, tomatoes and greenhouse practises of today owe a big nod to the Dutch, going back to the mid 1990s. The Dutch pioneered indoor tomato-growing techniques that led to varieties that travel well and are extremely flavourful. Growers in the Netherlands pioneered the pelleting system that coats seeds in a protective layer, making it easier for mechanical seed dispersal. Additionally, methods of priming (triggering then stopping the germination process) tomato seeds came from the Dutch, who were among the first greenhouse growers to incorporate geothermal energy to save costs. Horticultural tech companies such as Priva developed automated, climate-control, and water-dosing systems that synchronise variables such as air vents, CO_2 dosage, heating, cooling, and ventilation. Interestingly, nearly 80 per cent of the world's tomato seeds come from the Netherlands.

– qz.com

Why Time Slows Down Under Influence of Cannabis

The feeling of time slowing down for consumers after using cannabis has interested researchers for years, but there are no clear-cut answers as to why this happens. Studies have shown that a brain network called the thalamo-cortico-striatal circuit is key to how we perceive time. This collection of brain areas also contains many cannabinoid receptors. So, when THC from cannabis floods the brain, it could disrupt the normal functioning of these receptors, resulting in distorted time perception. Research done by Deepak D'Souza, a professor of psychiatry at Yale, showed that these time-distorting effects were particularly strong amongst those who rarely consumed, with medium and high doses leading to temporal overestimation and all doses resulting in temporal underproduction. Meanwhile, frequent tokers (two to three times a week or more) experienced no significant repercussions on their time perception regardless of the amount of THC in their systems.

– leafly.com

Record-Holding Watermelon Equivalent of Two Beer Kegs

With summer right around the corner, plenty of people will be enjoying watermelon under clear blue sunny skies. Chances are, when you head to the market, you won't see a watermelon as big as that grown by Chris Kent. Kent, who is from Sevierville, TN., holds the record for producing the world's largest watermelon which weighed in at a hefty 350.5 pounds in Oct. 2013. According to the Watermelon Board, the average watermelon weights 20 pounds, so Kent's giant equalled 17.5 melons. Kent grew the massive melon from seeds he bred himself and cultivated his melon outdoors, but watermelon can be grown indoors and will do well in just about any hydroponic system as long as there's room to support the big vines. Perlite makes a good watermelon-growing medium, however, growers may prefer something heavier, like clay pellets, pea gravel, or silica stones.

– Maximum Yield Staff

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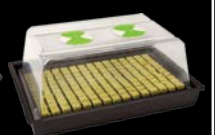
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Blueberry Demand Surging Due to 'Superfood' Status

It's an antioxidant, a superfood, and now, blueberries are the top choice among berry consumers. A study by the California-based US Highbush Blueberry Council shows blueberry consumption in the US on a per capita basis grew 600 per cent between 1994 and 2014. Dollar sales of blueberries across grocery stores (including fresh and dried blueberries) hit $1.3 billion in the latest 52 weeks (ending Dec. 29, 2018), according to the latest data from New York-based Nielsen on total US food stores. Fresh blueberry dollar sales are up 8.8 per cent and unit sales are up 2.8 per cent from the previous year, says Sarah Schmansky, vice-president of Nielsen's growth and strategy fresh/ health and wellness team. It also should be noted fresh blueberry dollar sales have increased each year since January 2016. While they're not the easiest berry to grow, blueberries can successfully be cultivated hydroponically.

– freshplaza.com

White Widow: Arguably the Best-Selling Cannabis Strain

While it's hard to empirically nail down the best selling or most popular cannabis strain, White Widow comes out at the top of many lists. It's a worldwide top seller that's known for its potency. The mostly indica-dominant (60 per cent indica/40 per cent sativa) hybrid first produced by Dutch veterans Green House Seeds and made public in 1994 is a cross between Brazilian sativa and South Indian indica landraces. It usually boasts THC levels in the 20-26 per cent range and is a former winner of the prestigious Cannabis Cup. Another reason for White Widow's global popularity is how resin-rich it is and rightly so, as it was bred to be a resin producer. White Widow's genetics have been used to influence many other popular strains including White Rhino, White Russian, and Blue Widow. It's easy to spot with its frosty white, bright trichomes.

– marijuanabreak.com

Agriculture Ministers to Promote Field Digitalisation

In order to help ensure continued global food supply, the ministers of agriculture from 74 nations pledged to promote digitalisation of the field as part of a common strategy for sustainable agricultural development. Given the world's population has doubled in the past 50 years, using technology in the field should contribute to increased agricultural production, particularly in rural areas where more efficient development is required to help boost production. The ministers were in Berlin for the Global Forum for Food and Agriculture (GFFA). "The Government of Spain is fully aware of the importance of promoting digitalization in the rural world, advancing competitiveness and sustainability, as well as overcoming the digital divide between rural and urban areas," says Spain's Minister of Agriculture Luis Planas. The goal is for broadband internet to reach 90 per cent of the population in the next two years, particularly in rural areas.

– freshplaza.com

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New Tests Show Most Kale Samples Contain Pesticides

While Kale is one of the healthiest foods, tests done by the USDA (the first on kale since 2009) show that more than 92 per cent of conventionally grown samples contained residues from two or more pesticides. Some had traces from 18 different chemicals. Kale made the "Dirty Dozen" list (at No. 3) published by the Environmental Working Group's "2019 Shopper's Guide to Pesticides in Produce." Nearly 60 per cent of kale samples tested positive for DCPA, or Dacthal, a herbicide used to control grasses and broadleaf weeds, the EWG noted. The group says the US Environmental Protection Agency has classified DCPA as a possible human carcinogen. The European Union has banned its use on crops since 2009. Strawberries continued as the worst for pesticides, followed by spinach. Test data from the USDA showed almost 70 per cent of produce sold in America contains pesticide residues, according to its analysis.

– fooddive.com

Avocado Seeds Show Anti-Inflammatory Properties

Penn State researchers have identified an extract from avocado seeds that exhibits anti-inflammatory ability. The discovery represents a potential source for new anti-inflammatory compounds that might be developed as a functional food ingredient or use in pharmaceuticals. "The next step, before we can draw further conclusions about the anti-inflammatory activity of this avocado seed extract, will be to design animal model studies," says Joshua Lambert, co-director of Penn State's Center for Plant and Mushroom Foods for Health. "For example, we can look at a mouse model of ulcerative colitis where we formulate the avocado seed extract into the mice diet and look at whether it is able to reduce inflammation." Lambert believes the study lays the groundwork for more research because it provides evidence there are bioactive compounds in avocado seeds that have anti-inflammatory activity. "The level of activity that we see from the extract is very good," says Lambert.

– sciencedaily.com

The Bard Enjoyed Smoking Weed

William Shakespeare was a toker, according to a study from a South African university. The University of the Witwatersrand was loaned 24 tobacco pipe fragments from Shakespeare's Stratford-upon-Avon property by the Shakespeare Birthplace Trust. Testing using gas chromatography mass spectrometry was used on the fragments and eight tested positive for cannabis and two had remnants of Peruvian cocaine. The research team concluded the Bard hit the bong during his illustrious writing career. Shakespeare's "Sonnet 76" may contain some references to drug use. Throughout its lines, Shakespeare refers to keeping invention in a "noted weed" and to "new-found methods and compounds strange." The study notes the cocaine was likely brought to England by Sir Francis Drake, who visited Peru in 1577-78. Shakespeare, if he did use the drug, was likely using a product grown very far from home, one that required a tremendous amount of travel and resources to make its way into his hands.

– usatoday.com

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2 | **Optic Foliar – OverGrow**

Optic Foliar OverGrow foliar nutrition is the next generation of nutrient delivery systems. OverGrow is a foliar nutrition spray (leaf spray) that provides macro and trace elements directly to the plant tissue, in an easily absorbable form. OverGrow helps transport these compounds to 'sink' locations on the plant, where the nutrient is needed most. This unique spray can even be used with the lights on. OverGrow will speed vegetative growth, reduce required growth times (faster cycles), remedy deficiencies, and increase overall vigour.

3 | **CANNA PK13/14**

Developed in Holland, CANNA PK 13/14 is a high-end bloom stimulant scientifically developed to increase the size and weight of fruiting and flowering plants. This ultra-premium Dutch fruiting and flowering stimulant is an industry leader and sets the benchmark for this popular type of additive. Testimonials from countless growers around the globe who use CANNA PK 13/14 report larger, heavier yields of fruits and flowers with an average yield increase of 35 per cent compared to fertiliser alone.

4 | **Aromask Odour Control Products**

Aromask has been refreshing the environment since 1985. Initially, the product formulation was designed for indoor gardening and the hydroponic industry as effective solutions to eliminate unwanted odours. Over the years Aromask expanded into other market sectors including; automotive, waste management, and general household use. Recently, due to the changes in cannabis laws, Aromask has developed unique retail packs which are readily available in cannabis dispensaries. Aromask is very effective in eliminating cannabis odours from clothing and your smoking space.

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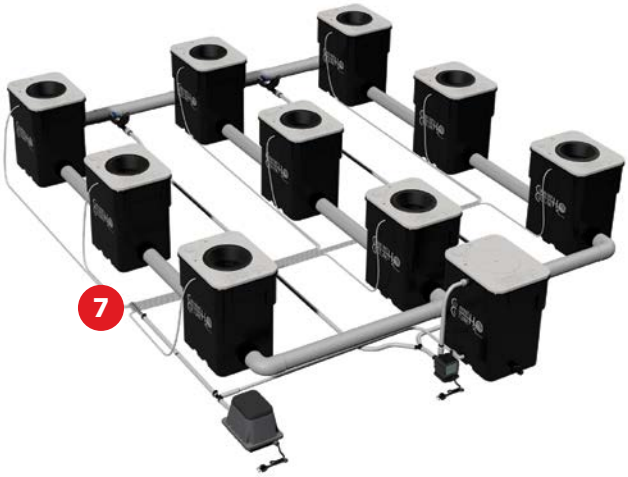

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5 | Hy-Gen Coco Starter Pack

For the grower looking at getting started with a great growing medium and nutrients, Hy Gen's coco starter pack comes with everything. It features one-litre sets of Cocogrow A&B, Cocobloom A&B nutrients, and a litre of Budlink silica. Also packed into the box are a pH test kit, as well as key boosters Nitro-K, PK Top Up, Omegazyme, Humiboosta, and Sea Essentials. And it includes two kilograms of compressed cocopeat, which expands to 30 litres, along with a product guide and feeding schedule.

6 | Reiziger Root Booster

Norwegian sea kelp contains many root-sustaining properties and is a proven organic booster to maximise root function and generate maximum yields. Reiziger Root Booster has been a staple of many professional gardeners and growers for more than 20 years to activate, revive, and stimulate indoor hydroponic plants, outdoor plants, seedlings, trees, flowers, bulbs, natives, and more. This nutrient-rich, organic root stimulator has the power to save, revive, or help newly-potted plants and transplants grow early white healthy roots, give more uniformity, and improve survivability.

7 | Current Culture H2O – UCE 9 XXL 13

Current Culture H2O Undercurrent systems provide faster growth, healthier plants and heavier harvests than traditional water-based hydroponics. Their newest release, Evolution systems, are the next generation of hydroponic crop production with the UC Evolution 9 XXL 13 featuring new pot design (multi-growth modules) with drainage, high-flow aeration and regulation, the new 'add-back' kit, larger spacing, and cleverly refined design. The UCE 9 XXL 13 is a powerhouse production system, easily filling a 3.5x3.5-metre space with heavy yielding crops. Current Culture is distributed by Stealth Garden Supplies.

8 | Ed Rosenthal's Zero Tolerance Herbal Ready-To-Use Pesticide

Ed Rosenthal's OMRI-approved pesticide is a potent mix of food-grade plant oils that eliminate and control spider mites, broad mites, aphids, and powdery mildew. Diluted and used as a repellant, it prevents infestations. Ed's blend of herbal oils fully evaporates, leaving no residue. Zero Tolerance is approved for organic production, is Clean Green Certified, and 100 per cent vegan. As the commercial market becomes more competitive, it is critical that crops test clean. Bottled in quart and gallon sizes.

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9 | **Excel Distributors – Nanolux 1,000W DE Chill**

The Nanolux DE Chill is the first DE commercial overlap fixture of its kind on the market. It's designed with an onboard ballast, is air-cooled, and comes NCCS APP-ready. The Chill removes up to 60 per cent of the heat load in grow facility environments, reducing air conditioning required to maintain good growing temperatures. It features six dimming settings (600-1,200W overdrive) with a replaceable 105khz 120/240V ballast and a three-year warranty. The Nanolux 1,000W DE Chill is available through Excel Distributors.

10 | **CANNA Cannazym**

Cannazym is an enzyme complex that maximises nutrient cycling to unlock the ultimate in plant health and increased bud yields while armour plating the plant rhizosphere by reducing potentially harmful pathogens. This revolutionary CANNA product introduced beneficial enzymes to the green market decades ago. It contains a more diverse suite of enzymes that enhance nutrient availability than the leading enzyme-specific products. It's safe for use in soil, soilless, and hydroponic systems. Use it as a supplement to any fertiliser program.

11 | **Hy-Gen Sea Essentials**

An excellent additive, Sea Essentials is a balanced formulation that encourages flower production and increases root biomass. It is a specially formulated blend of several sea plants, each with its own unique health-promoting properties and benefits. Sea plants are highly regarded for their amino acid and natural stimulant content. These naturally occurring compounds help promote flowering, nutrient uptake, and support a healthy rhizosphere while encouraging beneficial microbes.

12 | **House & Garden Aqua Flakes**

House & Garden Nutrients Aqua Flakes A/B is a complete nutrient solution optimised for recirculating hydroponic systems. Containing a unique blend of all required macro and trace elements for heavy fruiting/flowering crops, Aqua Flakes provides incredibly healthy and rapid plant growth. H&G precisely blends these advanced formulations to allow for pH stability and rapid nutrient uptake in water-based systems. Ideal for stonewool, clay balls, or perlite-based recirculating hydroponics. It's available at Stealth Garden Supplies.

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13 | CANNABOOST Accelerator

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14 | Pinelabs Specialised Grow Tent

Perfect for the craft grower, Pinelab's 1.2x2.4x2.13-metre tents are built for premium cultivation and gardeners, with seriously productive spatial design. Optimised with practical duct outlets, unique drainage solutions, window filters, cable grommets and in-built external gear board, the tent is built tough. It utilises military-grade oxford cloth exterior and ultra-reflective white film interior for clean agricultural practices and easy plant monitoring. At 2.3 metres tall, it's perfect for DE HPS, LED, or CMH lamps to ensure healthy full crops. They're available through Stealth Garden Supplies.

15 | Hy-Gen Budlink

Budlink is the original liquid silica product enjoyed by growers for more than 20 years. The unique formulation is effective at all stages of plant growth and flowering. It improves strength and ability to fight against bacteria and insects. Budlink's active ingredients are imbedded into the plant's cell walls producing plants with thicker and greener foliage. When used as a foliar spray Budlink forms a barrier against airborne bacteria and harsh light levels. Budlink is suitable for all growing systems.

16 | Bio Diesel Marine CaMg+

A growth enhancer, Marine CaMg+ is designed specifically for medical cultivation. With naturally derived ingredients from the sea, including crustacean-derived chitin for high levels of natural micronized calcium and trace elements. Marine CaMg+ provides fast-acting nitrogen and 100 per cent natural growth stimulants from the sea for faster, lush growth and heavy-yielding branches. It encourages plant cell division and growth rates, while promoting increased tolerance to stress and insects. Marine CaMg+ can quickly correct nutrient deficiencies of calcium, magnesium, or nitrogen.

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SHEDDING LIGHT ON MULTI-TIERED INDOOR GARDENS

BY ERIC HOPPER

A multi-tiered set-up in an indoor garden or greenhouse can best utilise light and make the most of floor space, but configuration takes some careful planning. Eric Hopper explains the variables that require consideration when getting started.

Light is a form of radiant energy and diminishes exponentially from its source. The amount of radiant energy available to a plant is determined by how far away the plant is from the light source. In a process known as photosynthesis, plants convert the radiant energy from the light source (the sun or artificial lights) into sugars or fuel for growth. Indoor horticulturists have some advantages over outdoor gardeners in that they have heightened control over atmospheric conditions. This heightened control allows for accelerated growth rates and an extension of the growing season. To make an indoor garden or greenhouse efficient, some gardeners choose to employ methods that best utilise the given radiant energy available from the light source. In a greenhouse setting, a popular way to utilise the radiant energy from the sun is to set up a multi-tiered configuration. A multi-tiered configuration in a greenhouse also helps a gardener make the most efficient use of the given floor space. Indoor horticulturists can also reap the rewards of maximising their light source's radiant energy by configuring the plants on a multi-tiered platform. Indoor gardens are limited by the amount of radiant energy emitted by the light source and a vertical, multi-tiered setup will best utilise the available radiant energy.

Multi-Tiered Setups for Greenhouses

Greenhouses offer some heightened control over environmental conditions, while still giving the plants access to the most powerful radiant energy source around: the sun. All greenhouses have one thing in common — a limited amount of space. Although greenhouses come in a wide variety of sizes, the amount of space within the greenhouse is always a limitation. This is especially true for home hobbyists who generally have, relatively speaking, less space to work with than a commercial greenhouse grower. To maximise the space within a hobbyist's greenhouse, many implement some sort of multi-tiered, vertical setup. Multi-tiered gardens can be a very efficient way to maximise both the plants' exposure to the radiant energy and the given space in the greenhouse. By stacking plants vertically, a greenhouse grower automatically makes better use of his or her floor space. There are many ways a greenhouse grower can implement a multi-tiered, vertical garden in a greenhouse, including shelving, vertical planters, and vertical hydroponic systems.

Greenhouse Shelving

Greenhouse shelving is the most basic and straightforward form of multi-tiered, vertical gardening. Using shelving in a greenhouse allows a gardener to stack plants on top of each other and better utilise the given floor space while maximising the available radiant energy from the sun. There are different ways greenhouse shelving can be set up in a greenhouse. Most greenhouses are designed to have a south or west facing wall to take full advantage of the sun's exposure. Generally speaking, the shelving should be set up in multiple tiers with the highest tier next to the wall that is opposite the side of the greenhouse that receives the most light (north or east facing wall). By doing this, the plants on the higher shelving will not shade out the other plants located down below. It is also important to consider the height of the plants being grown and their location in the multi-tiered setup. Taller plants should be placed up higher on the tier system so they do not start to shade other plants as they grow (just remember to leave enough head room for their growth). Conversely, plants of a shorter stature should be placed on the lower tiers to ensure they do not get shaded out by taller plants. Where to place which type of plant is an important consideration when setting up a multi-tiered system in a greenhouse.

Vertical Planters

Vertical planters are either manufactured or homemade planting structures designed to hold plants in a vertical manner. Vertical planters are basically self-contained multi-tiered gardens. An example of a homemade vertical planter is a 208-litre plastic drum with holes cut into the sides where the plants can be placed. Vertical planters are usually designed to be used with potting soil. Typically, these planters are watered from the top, which allows gravity to bring the nutrient solution to all the plants in the container. Strawberries and lettuce are just two of the crops commonly grown in vertical planters within a greenhouse.

> "**Where to place** which type of plant is an important consideration when setting up a multi-tiered system in a greenhouse."

Vertical Hydroponic Systems

Vertical hydroponic systems are multi-tiered systems that utilise soilless gardening in a vertical position. Most vertical hydroponic systems used in greenhouses are recirculating systems. This means the nutrient solution is collected in a reservoir and reused after each feeding. The nutrient solution is commonly delivered to the uppermost plant module and gravity is the force that brings the solution to the remaining plants down below. Vertical hydroponic systems combine the speed of growth associated with hydroponic gardening with the space-maximising benefits of multi-tiered vertical gardening. When the nutrient solution's temperature is kept in check, vertical hydroponic systems are one of the most efficient growing methods used in greenhouses.

Multi-Tiered Setups for Indoor Gardens

As in a greenhouse, a vertical, multi-tiered setup can help maximise floor space and exposure to the radiant energy within an indoor garden. In an indoor garden, the radiant energy used by the plants for photosynthesis is not provided by the sun, but, rather, an artificial light source. One of the most efficient ways to use an artificial light source for growing plants indoors is to hang the light vertically and surround the lamp with plants. Most high intensity discharge (HID) lighting systems emit radiant energy in a 360-degree circle. In other words, they emit radiant energy evenly from all sides of the lamp. As previously mentioned, radiant energy from a light source diminishes exponentially. The farther the light has to travel to the plants, the less radiant energy is available. A good example of this is the use of light reflectors. When light is reflected and redirected toward the plants (common for a horizontally positioned lighting system), some of the light must travel farther because it must first travel upward toward the reflector and then back down toward the plants. This makes the total distance that the light travels farther than if it reached the plants directly. This is why surrounding the light source with plants is a more efficient use of the given radiant energy. When plants surround the light source, the light travels a shorter distance before reaching the plants, thus providing a higher amount of radiant energy. Similar to greenhouse gardens, there are many different ways an indoor horticulturist can implement a multi-tiered, vertical garden, including stadium- or colosseum-style gardens and vertical hydroponic systems.

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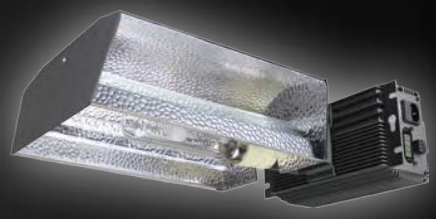

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> **Vertical hydroponic systems** combine the speed of growth associated with hydroponic gardening with the space-maximising benefits of multi-tiered vertical gardening."

Stadium- or Colosseum-Style Gardens

A stadium- or colosseum-style indoor garden can be a very effective type of multi-tier setup to maximise the efficiency of an artificial light source. Stadium- or colosseum-style gardens are similar to the staggered seating in a stadium or colosseum, hence the name. The light source is positioned vertically in the center of the plants. The plants are then staggered around the light source in a manner similar to stadium or colosseum seating. This type of setup minimizes the distance the radiant energy travels from the artificial light source to the plants, thus maximising the available radiant energy. A basic form of indoor stadium- or colosseum-style gardening is shelving that allows the grower to place planting containers around the light source and stagger the plants vertically next to the light. With this setup, the plants can be moved or re-positioned depending on their size to further maximise the radiant energy emitting from the artificial light source.

Vertical Hydroponic Systems

Vertical hydroponic systems can also be set up in a stadium- or colosseum-style to best maximise the available radiant energy from a grow lamp. Vertical hydroponic systems range from homemade stackable modules made from PVC to state-of-the-art pre-manufactured vertical hydroponic systems that come complete with pumps, tubing, and growing accessories. Most vertical hydroponic systems used by indoor horticulturists rely on irrigation lines to deliver nutrients to each individual plant. A series of tubes or gutters collect runoff and direct the nutrient solution back to the reservoir for reuse. A vertically positioned light source surrounded by a vertical hydroponic system provides the highest amount of radiant light energy.

Indoor horticulture and greenhouse gardening provide heightened control over most of the parameters that affect plant growth. To best utilise the given radiant light energy, some growers get creative in the ways they position the plants within their greenhouses or indoor gardens. Multi-tiered, vertical gardens are a great way to utilise the radiant energy from the light source. Both greenhouse growers and indoor horticulturists are limited by their given spaces. To maximise space and radiant energy, many indoor and greenhouse growers are implementing some sort of multi-tiered, vertical gardening technique. Whether a grower chooses simple shelving or a sophisticated automated vertical hydroponic system, he or she is sure to see the biggest return on investment when the given space and the available radiant energy are efficiently used.

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HOW TO BUILD YOUR OWN HYDRO SYSTEM

by Kent Gruetzmacher

If you're thinking about building your own at-home hydroponic system, your best bets are either a nutrient film technique setup or an ebb and flow system.

While it is evident the hydroponic gardening space has no shortage of technological innovations, there is always room for the do-it-yourself hydro grower. Yet, for many modern gardeners, the ease and simplicity of purchasing a pre-fab hydroponic grow system makes perfect sense. These horticulturists, who are more interested in horticulture than garden design, find comfort in the fact that hydroponics equipment companies supply abundant troubleshooting information, as well as spare parts, for their systems. Nonetheless, prebuilt hydroponic systems are quite expensive with basic nutrient film technique (NFT) setups.

More technically inclined growers prefer the challenge of creating their own hydroponic setups, as many indoor and greenhouse cultivators are notorious tinkerers by trade.

For industrious gardeners, it is possible to design a hydroponic garden setup up that is highly-functional, while simultaneously not breaking the bank. For these DIY growers, all that is required is a logical set of plans, some gumption, and easy access to a hardware store. To illustrate some basic concepts on hydroponics system design, *Maximum Yield* broke down the key points of popular hydro methods as a starting point: NFT and ebb and flow. We have included some easy-to-understand advice on designing these systems yourself. After reading this brief survey of homemade hydroponic systems, you can decide which may be the best for your home gardening needs.

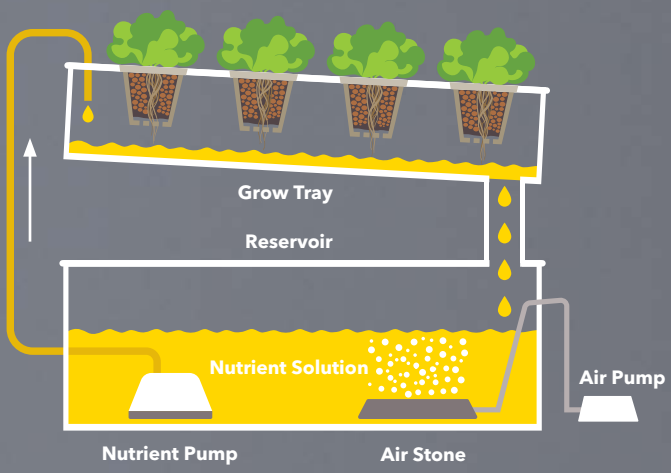
Nutrient Film Technique

Nutrient film technique is one of the most popular hydroponic system designs in use today; its versatility makes it extremely applicable in commercial settings, such as vertical farms and greenhouses. This type of cultivation is characterised by plants situated single-file, in rectangular shaped canals, often made of a PVC-like material.

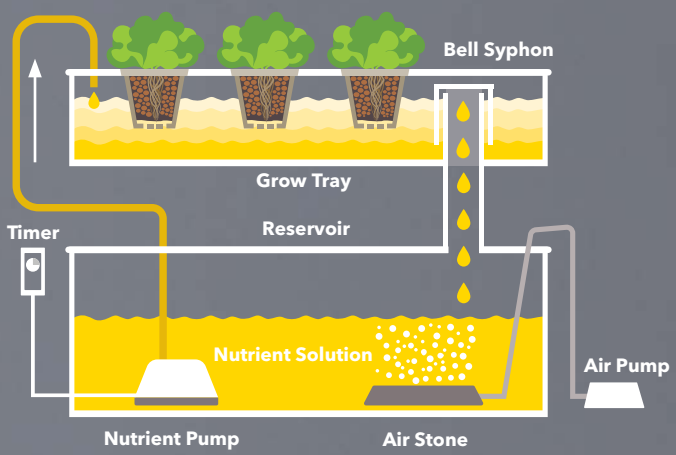
Commercial operations often favor NFT because the thin canals make the system easy to scale, as the single-file rows can be strategically placed to utilise every square foot of available light. In an operational sense, NFT systems pump nutrient-rich water out of a reservoir and through the canals which house grow mediums, or nets, as well as plants. The defining characteristic of NFT hydroponics is a constant, recirculating source of water that is continuously moving past, and in contact with, the root systems of plants while not totally submerging the roots. Essentially, this moving nutrient water leaves a film on the root system, giving NFT its name.

If you are interested in designing your own NFT system, it is important to note these setups have a good amount of moving parts, and all must work in unison to achieve ideal garden conditions. Either way, most of the required parts can be procured at hardware and grow stores and aquarium shops. The primary elements of an NFT hydroponics system are: reservoir, air pump, tubing, air stone, water pump, timer, canal, and grow medium.

As previously mentioned, PVC-like canals are the defining characteristic of NFT hydro systems and hobbyist growers can utilize PVC in the construction of their gardens. For starters, you will cut holes into the PVC that snugly fit your chosen cultivation medium — ideally stonewool or nets — which houses the plants.



A **Nutrient Film Technique system** utilises a constant gentle flow of nutrient solution over the bottom of the plant root systems. This allows roots to breathe air and take in nutrients at the same time. Ample oxygenation of the nutrient solution is neccessary to ensure successful root respiration.



An **Ebb and Flow system** involves a timed flooding of the grow tray with nutrient solution in cycles. A Bell Syphon allows the grow tray to drain automatically once full. This allows roots to breathe air and take in nutrients in turn, while minimising energy input. Oxygenation of the solution is not neccessary but can be beneficial.

These PVC canals are then mounted on a wood frame which positions them a few feet off the ground, and at a slight angle. After that, place a rectangular shaped reservoir (that mirrors the garden size) underneath the PVC/wood frame. The water pump will pump the nutrient-rich water solution through the PVC pipe and through the root zone of the plants, which will then filter back to the reservoir by the angled PVC and gravity. While the water can directly drain from the PVC into the reservoir in a sort of waterfall, many prefer to rig a hose that uses gravity to feed it back to the holding tank. Finally, the air pump and air stone are used to aerate the recirculating reservoir water.

Ebb and Flow Systems

Ebb and flow hydroponic systems are defined by the large, rectangular "hydro tables" seen in many indoor grows. For small-scale, home-based growing, these systems are a safe bet as they have less parts than NFT. To illustrate, ebb and flow systems house all the plants on a single table (or several tables) in a grid formation, essentially sharing the water and garden space. This method is characterised by the periodic flooding of the hydro table in which grow mediums and plants rest. Ebb and flow is set apart from NFT by the fact that with this process, the grow medium and plant roots are almost entirely submerged in nutrient water in static flooding cycles, unlike the continuous film flow seen with NFT. For purposes here, we will be looking into rearticulating ebb and flow systems.

To design an ebb and flow system of your own, many of the NFT system principles are still at play, with some larger emphases on efficient timing and accurate flooding. With this notion in mind, the constituent part of an ebb and flow system generally mirrors those of an NFT system, with a hydro table replacing the canals, plus reservoir, air pump, tubing, air stone, water pump, timer, table, and grow medium.

The most basic, as well as affordable, infrastructure for a DIY ebb and flow garden begins with two symmetrical plastic containers, with one being a good deal deeper than the other. The crux of the setup is the deeper container will act as the reservoir while simultaneously supporting the upper shallow container, which houses the grow medium and plants. Using a drill, two holes should be drilled into the bottom of the shallow container — one will receive nutrient-rich water and one will expel it. Moving forward, you will connect the water pump to a plastic hose that penetrates the water entry portal to fill the shallow grow container. This will be your intake irrigation hose. Next, another plastic hose will be set to penetrate the bottom of the shallow container as the water outtake portal. This water expulsion tube should be lined with a screen and penetrate about two-inches into the grow medium off the base of the flood container; this will act as an overflow when irrigation water gets to the ideal point. Interestingly, when the pump and water shut off, excess water is sucked back into the main holding reservoir with a siphoning effect, effectively letting the grow medium and root zone dry out. The water outtake system should ensure that medium is adequately drained after each flood, otherwise there will be a plethora of overwatering issues. Timing is essential with ebb and flow systems, and an accurate timer must be implemented to allow for precision in flooding, as most plants like their root systems to at least partially dry out between irrigation intervals. This rhythm can only be achieved by trial and error, so a watchful eye will be helpful in getting your ebb and flow setup off the ground.

Homemade hydroponic systems are not only affordable, they can be quite educational. As many experienced horticulturists know, the only way to truly master a grow technique is to understand every facet of the system. While DIY hydro systems are likely not dependable enough to employ on a commercial scale, they can be extremely helpful for the novice grower interested in understanding the ins and outs of hydroponics. Whether it be with NFT or ebb and flow, building your own hydroponic system is a fun and practical way to begin amassing a knowledge base on modern gardening techniques.

DIFFERENTIATING BETWEEN

INDUSTRIAL HEMP AND *marijuana*

by Chris Bond

Are hemp and marijuana the same or are they different plants? The truth is somewhere in the middle.

There is a bit of confusion as to what constitutes industrial hemp and what constitutes weed. Is it the same plant? Is it different? Opinions vary from the highest levels of government on down to the common citizen. Plainly and simply put: they are not the same thing. They are closely related, but industrial hemp is not marijuana and marijuana is not industrial hemp. If you come away with nothing else here, remember that.

Both plants are members of the same species, *Cannabis sativa*, but they are not the same thing. Many people, including some in academia, believe hemp is nothing more than just male marijuana plants. However, this is not true. They are genetically different. The primary difference between them is that hemp and marijuana have dramatically different levels of the psychoactive chemical delta-9-tetrahydrocannabinol (THC). In hemp, THC levels are generally less than one per cent. Legally, hemp is generally required to be less than 0.3 per cent THC as these levels are not thought to have any psychoactive effects. Marijuana plants, on the other hand, range in their respective levels of THC. On average, they have between three and 20 per cent, though many cultivated species have levels of more than 30 per cent.

Besides having different levels of THC, hemp and marijuana are grown differently for different market purposes. Some of the differences between the two are also semantical. "Marijuana" generally refers to the flowering tops and leaves of cannabis varieties that deliver some amount of body or head high to the user. "Hemp" often refers to the leaves, stalks, fibres, or seeds of the hemp plant grown for their industrial or commercial use.

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> **"BESIDES HAVING** different levels of THC, hemp and marijuana are grown differently for different market purposes."

BOTANICAL DIFFERENCES

Botanically, most biologists consider hemp and marijuana to be varieties of the same species *(Cannabis sativa)*. So, how can two plants that are almost genetically identical be so different in function and form? Think of the differences in dogs. All dogs are classified as *Canis familiaris*, but we have all seen the great variation in their sizes, colours, and temperaments. Though they are closely related and genetically similar enough to cross breed, nobody is going to confuse a Great Dane with a Chihuahua. Industrial hemp and marijuana are no different; they are of the same genus and species but have different characteristics.

Hemp leaves tend to be skinnier than marijuana's wider leaves. Hemp also tends to be a taller and skinner plant, while marijuana grows fuller, fatter, and shorter. Not to add even more confusion, but there are similar physical differences between the different marijuana types of sativa, indica, and ruderalis. As noted above, the primary difference between marijuana and hemp is in their chemical compositions. Hemp, having little to no THC, tends to have high levels of cannabidiol (CBD). The level of CBD, of course, is not the main defining factor as sativa, indica, and ruderalis marijuana strains can have varying degrees of CBD in tandem with varying degrees of THC.

CULTIVATION DIFFERENCES

There is a wide gap between the cultivation methodologies for hemp and weed. Hemp crops can tolerate a wide range of temperatures and are grown in many parts of the world, whereas marijuana plants are usually restricted to warmer climates. The typical growing season for hemp crops is between 100 and 120 days. Marijuana's range is generally more like 60 to 90 days.

Industrial hemp plants are grown as close together as 10 centimetres, often in large plots, with up to 50 plants per square foot. This dense planting reduces branching and flowering, meaning industrial hemp plants are typically grown as a single main stalk with a few leaves and branches. Hemp growers that wish to realise high yields grow their plants tall. They can be towering, with some species reaching heights of up to 4.5 metres. Hemp is grown primarily for its two types of fibre: bast and hurd. Bast is the outer portion of the hemp stem and hurd is the pith, or interior fibre.

When cannabis is grown for marijuana, it is almost always done with the intent to produce and harvest the female flowers (and often the leaves). The female flowers are short, clustered, and full of THC. So, unlike with hemp cultivation, marijuana is cultivated to encourage the plant to become bushy with wide branches and heavily foliated to promote flowers and buds. This requires that plants be well-spaced, generally two to three metres apart, with no more than two plants per square yard. That's more than 200 times more space than a single hemp plant is afforded.

It should be noted that growers who produce both hemp and marijuana (or produce one crop near a grower who produces the other) do so at their own risk. Cannabis plants are open-, wind-, and insect-pollinated, and hemp and marijuana are related closely enough to cross breed (again, think of dog species). Cross-pollination between the two crops would spell disaster for the quality and intent of either. It could reduce the desired psychoactive effects of marijuana or render a hemp crop illegal due to increased THC levels. Even the cross-pollination of a hemp crop with inferior hemp plants (or a marijuana crop with inferior weed plants) is not desirable. Some fibre and seed crops are valued based on their purity and any dilution of that could make a crop less marketable.

All these differences do not cover the full spectrum of variations between industrial hemp and marijuana, of which there are thousands. This does not even consider the scores of differences in legal opinion, laws, ordinances, and other governance pertaining to the differences between the two crops, regardless of the intended use and if based in science or popular opinion. The bottom line is: they are very closely related, but are not the same plant.

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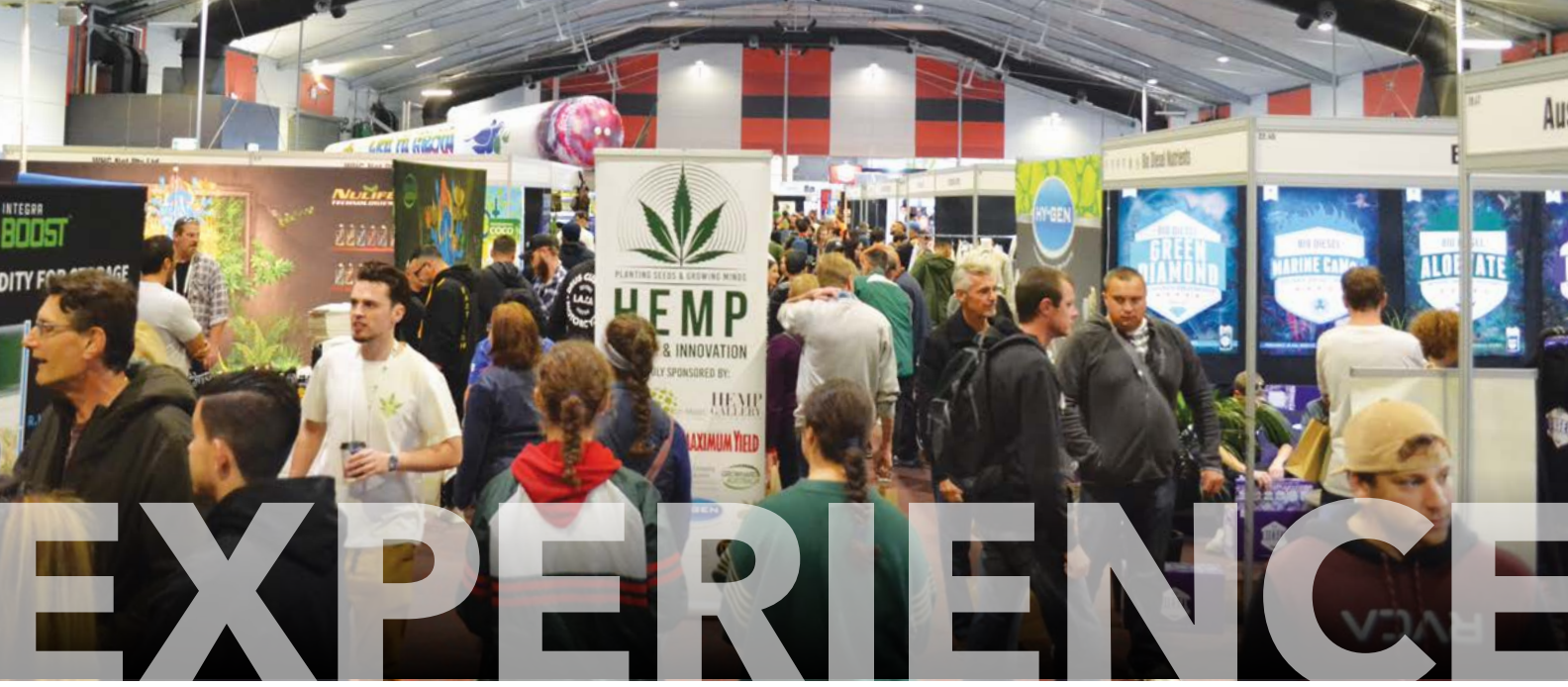

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A SNEAK PEAK INTO THE 2019 HHI EXPO

Australia's largest hemp and cannabis expo, Hemp, Health, and Innovation (HHI) is heading back to Sydney from May 18-19 at the Rosehill Racecourse Exhibition Centre. With more than 25,000 attendees over the past three years, HHI Expo is the only event in Australia for everyone seeking information and greater awareness around the crucial benefits the hemp and cannabis plant has already unlocked, and its innovative and sustainable solutions for the future. Key speakers this year include Adam Miller (the founder of Budding Tech and the Medical Cannabis Council of Australia), Dr. Sanjan Nijhawan (the medical director of Cannabis Access Clinics), and Carol Ireland (the CEO of Epilepsy Action Australia), along with many more.

NEW TO THE HHI FOR 2019

This year's expo (in an Australian first) will see the Cannabis Access Clinics (CAC) offering a limited amount of one-on-one, 15-minute appointments to determine the eligibility of individuals to get TGA approval for medicinal cannabis. Another new part of the expo is the Food Hempire. Since hemp seed became legal for human consumption in Australia in 2017, the Australian hemp food and beverage industry has boomed. Broadening your taste buds, the Food Hempire is your eat street for everything hemp. Ice-cream, street food, coffee, smoothies, pastries, bakery goods, yiros, and more; this specialised food hub has something for everyone, vegans and vegetarians in particular. There's also the Eco Fashion Showcase dubbed "Fashion for Nature," which will showcase fashion created with organic & sustainable fabrics with a focus on hemp. Featuring clothing and accessories available from companies such as Hemp Gallery, Made In Hemp, Kathmandu Hemp, Margaret River Hemp Co, and more, the showcase will open the public's eye to the versatility, style, and future of this fast-developing industry.

ABOUT THE EXPO

Experiential and educational with interactive activities for all ages alongside local and international exhibitors, HHI Expo is Australia's opportunity to taste, touch, feel and experience it all; in a safe, family-friendly environment. Through workshops, displays, speakers, and exhibitors, the HHI brings all the research, science, innovation, products, industries, and uses of hemp together under one roof. Fibres, foods, beverages, clothing and textiles, medicinal products, oils and tinctures, extraction equipment, vapes, art, building materials, beauty products, gardening equipment, and much more, the HHI Expo is Australia's opportunity to experience it all first-hand. As always, the 2019 Australian Cannabis & Hemp Symposium will bring together the world's leading medical professionals, academics, research associates, pharmacists, activists and entrepreneurs for conversations and Q&A sessions around the many uses and benefits of this incredible plant.

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> – DR. ETHAN RUSSO
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How to Grow FRESH HYDROPONIC HOPS

by Dr. Lynette Morgan

Hops are not the first thing one thinks of when considering a hydroponic crop, but as Lynette Morgan explains, they are increasingly in demand and do very well in a controlled environment.

Hops are not a crop routinely associated with hydroponics — a tall vining plant produced on an extensive scale outdoors in suitable temperate climates for the brewing industry. Despite seeming to be an odd specimen for greenhouse or indoor cropping, hops have, in fact, become one of the new, innovative options for growers looking to produce a niche market product. For those who have a liking for craft beers or inkling to brew their own, growing a few hop plants can be a viable option as well as a fascinating new crop to experiment with.

The hop plant *(Humulus lupulus)* has a long history of cultivation and is primarily grown for the production of dried or pelleted hop flowers (cones) which are used to add bitterness, flavour, and aromatics to beer. However, the fresh hop cones (called wet hops), which have a very limited storage life, can also be used in brewing, and may confer additional qualities that the pelleted form does not. Commercial wet hop brewers typically aim to use the fresh cones within 48 hours of harvest for maximum compositional quality and will pay a premium price for such a niche market crop.

The harvestable portion of the hop plant are the flowers (also called cones or strobiles).

> "**DESPITE SEEMING** to be an odd specimen for greenhouse or indoor cropping, hops have, in fact, become one of the new, innovative options for growers"

For home brewers, the potential of producing selected varieties of hops specifically for wet-hop brewing immediately after harvest has become an exciting possibility as fresh hops are often difficult or impossible to obtain.

The harvest season for outdoor grown hops is extremely short and only occurs once a year, however, hydroponic hop crop experiments suggest three to five crops per year of fresh cones may be possible with the use of climate control under protected cultivation. With successional planting, it could be possible to supply high-quality fresh crops throughout the year from hydroponic production. There have been reports that with the controlled nutrition in hydroponics, hops with higher concentrations of essential oils, aromatic compounds, beta acids, and flavonoids can be produced as well as larger, heavier cones and a higher overall yield.

Apart from their essential use in beer brewing, hops have other properties of interest. These include medicinal compounds that can act as a mild sedative for the treatment of insomnia. Hops pillows — pillow fabric filled with dried hop cones — have long been used to help induce sleep, while other compounds have been used to treat anxiety and restlessness. Other hop products include tea and soft drinks, and the tips of the young shoots can be steamed and eaten in a similar way to asparagus. Hops are also occasionally used in culinary dishes for a unique flavouring or to add a distinctive aroma.

Hop cones are produced on long bines (vine-like stems) which support the plant by clinging to support structures.

Greenhouse-grown hops may be grown for year round production of `wet hops' for the craft beer industry.

VARIETIES

There are a number of modern commercial varieties of hops bred for specific uses, as well as many older, general purpose heirloom types. Popular varieties include Cascade, Chinook, Columbus, Magnum, and Centennial, each with different compositional qualities. Research into hydroponic hops has shown that Cascade and Chinook are suitable varieties for small-scale hydroponic production and perform well under greenhouse production. The Cascade variety is the most widely utilised by craft brewers in the US and is used in the production of many types of ale and some lagers. With a high alpha acid content (4.5-6 per cent) and a pleasant citrus like aromatic quality, Cascade is a general-purpose hop variety well suited to hydroponic production

GROWING

Hops are relatively easy to grow as they are extremely vigorous and heavy feeders that benefit from the controlled nutrition of hydroponic systems. Hops produce separate male and female plants, with only the female plants producing cones, thus hop propagation is typically carried out vegetatively to ensure only female plants are grown. If male flowers are present in a hop crop, the pollination of the female flowers results in seeds that are undesirable for brewing beer. For small-scale growers, hops are typically obtained during the dormant winter season as short sections of rhizome containing a number of dormant buds. Once planted into warm conditions, rhizomes establish quickly and produce several young shoots. Hop cuttings can also be taken from established plants that will produce roots readily at leaf nodes without the requirement for any rooting hormone application. At certain times of the year, young potted hop plants are available for purchase. Once growth has begun, the hops produce long, climbing shoots called bines that develop short, stiff hairs along the stem surface, allowing the bine to cling and climb upwards (vines on the other hand, use tendrils or other means to cling to surfaces). This rapid upward growth of the bines requires support, and hydroponic hops are well-suited to being grown on training systems similar to those used for tomato and cucumber crops. Tomahook tomato support systems — overhead wires with strings or trellis — may be used to support hops and plants will readily climb and cling with no assistance. Since hop plant bines grow to considerable length and height, for indoor and greenhouse production the "lean and lower" system of training, commonly used for commercial tomato crops, appears to work well. As the bines increase in height, the supporting string is detached and lowered along the floor or lower levels of the cropping area as required. Alternatively, the tops of the bines can be trained vertically along supports at the top of crop, or allowed to grow upwards, and then trail back down towards the floor.

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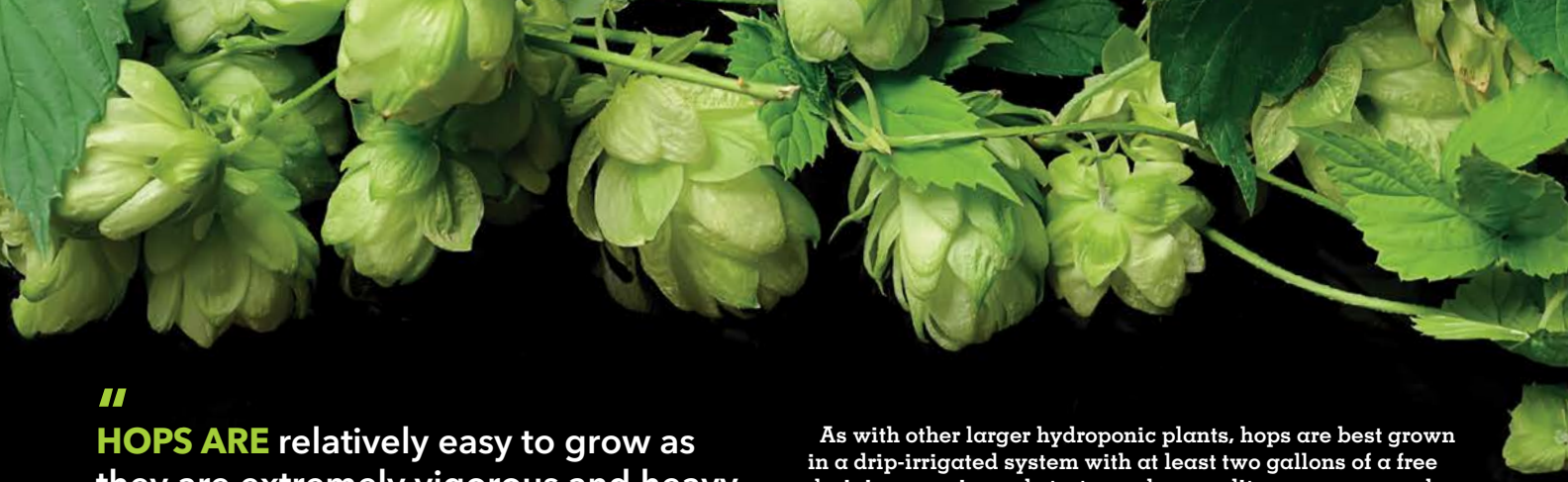


"HOPS ARE relatively easy to grow as they are extremely vigorous and heavy feeders that benefit from the controlled nutrition of hydroponic systems."

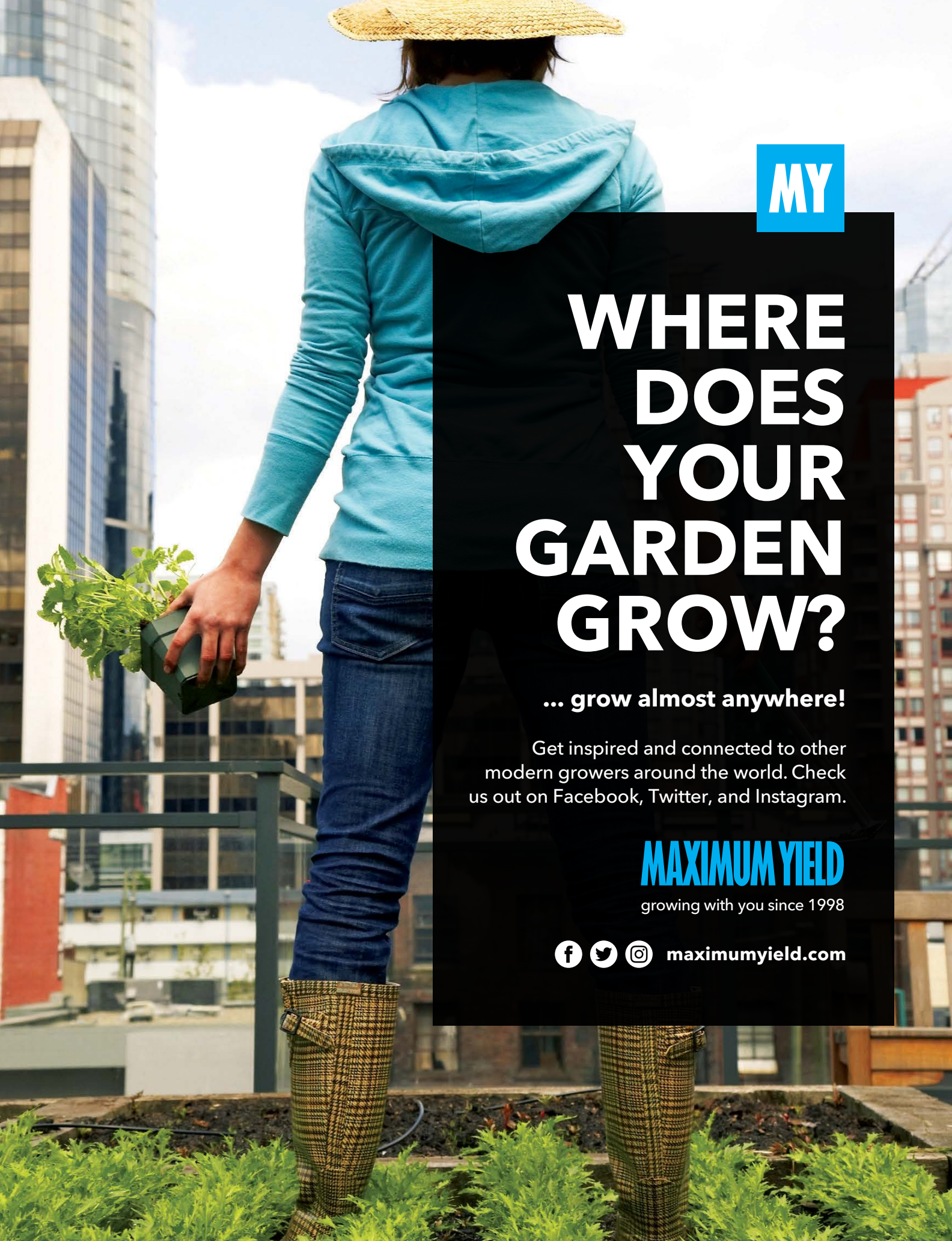
Young hop shoots produced by an underground rhizome system which is used for propagation.

As with other larger hydroponic plants, hops are best grown in a drip-irrigated system with at least two gallons of a free draining growing substrate, such as perlite or coarser grade coconut fibre, as they are intolerant of wet feet, particularly in the early stages of growth. Nutrients should initially start with a high-quality, general purpose vegetative formulation at an EC of 1.8–2.2 with a high ratio of nitrogen to potassium. During the later stages of growth, this can be switched to a flowering/fruiting formation with higher potassium and phosphorus levels, as well as gradually increasing the EC during the cone production stage to maintain high levels of essential oils and other compounds that constitute the quality of the flowers. Hops are a warm-season crop; during the active growth phase the crop requires light of similar intensity to tomato, cucumber, and pepper crops. Good air flow is essential, particularly around the lower levels of the plant where high humidity can promote disease. While vigorously growing hop bines under ideal growing conditions are relatively problem free, they can be prone to mite infestations in warmer, drier conditions. Early detection and ongoing control is advisable as mites can cause considerable crop damage. Powdery mildew may also be a concern in some hop varieties, particularly where air flow is insufficient around a dense canopy.

HARVEST

Under good growing conditions, cones will develop along the bines in succession and ripen at slightly different times. For this reason, hand-harvesting ripe cones from the bines and leaving immature ones to develop further can be carried out on a small scale. Determining harvest ripeness can take some experience, but mature cones will appear plump, fully sized, soft and dry, light weight, slightly paler or yellow in colour, and will have developed a high level of fragrance. Immature cones are generally greener, firmer, and compact and can be left to ripen on the plant. For larger scale hop crops, all the bines can be cut back and removed at harvest for easier cone removal leaving 90-120 cm at the base of the plant for regrowth. Once harvested, the fresh cones can be used immediately, however, shelf life is relatively short, and the quality can decline rapidly under warm conditions. Fresh cones can be stored in the refrigerator for a few days if necessary but are best used within 24 hours. Most fresh hops, once removed from the vines, are rapidly dried to maintain quality. On a small scale, this can be done by laying the cones in a cool, dry place, out of direct light for several days until fully dried. These can then be stored in vacuum sealed bags either under refrigeration or in the freezer before use.

Hydroponic hops production may be a relatively new trend and an unusual plant for protected cultivation, but their value is in the demand for high-quality fresh cones that are best used within a day or two of harvest. With a wide range of cultivars to select from and several different training system possibilities, hydroponic hops are a crop that has a promising future.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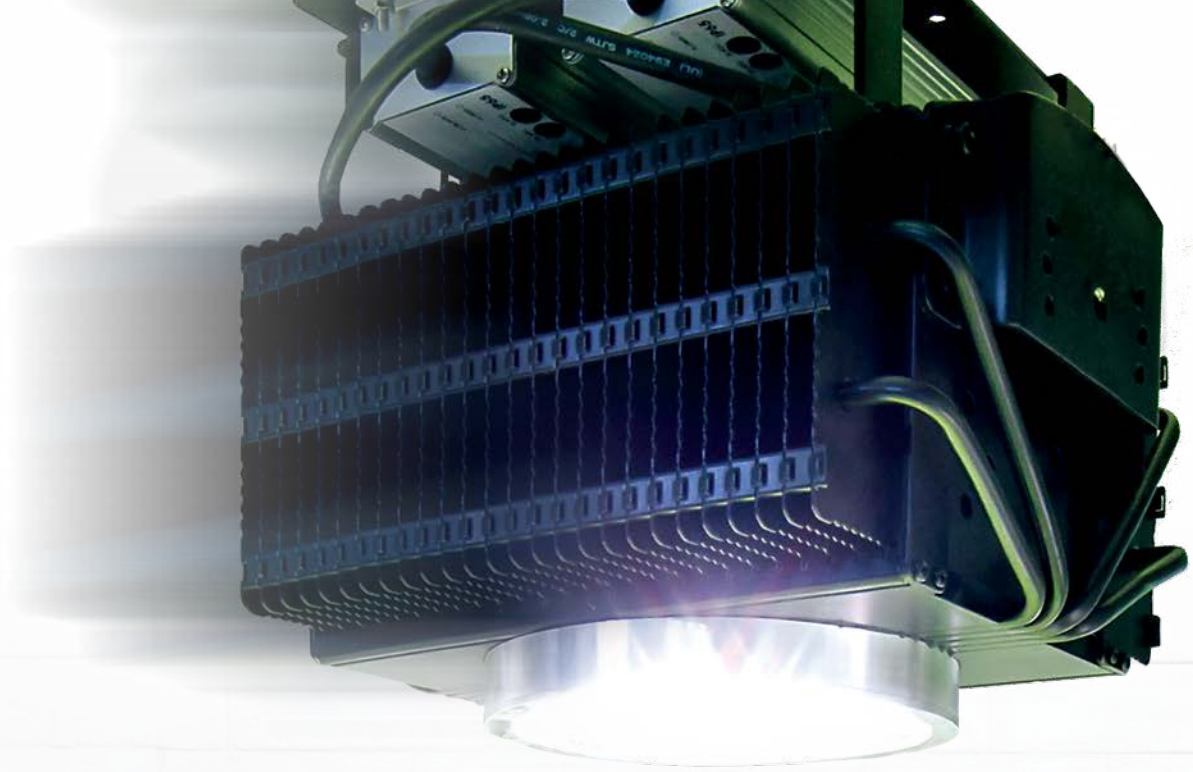

THE EFFECTS OF LIGHT MOVERS

ON GROW LIGHT PPFD AND PHOTO EFFICIENCY

by Nancy Hamilton

For hydroponic growers to get the most yield as well as energy efficiency from a crop, Nancy Hamilton recommends getting a grow light with excellent PPFD and photon efficiency and use it with a light mover for better canopy coverage.

Grow light numbers, including lumens, LUX, watts, photosynthetic active radiation (PAR), photosynthetic photon flux (PPF), photosynthetic photon flux density (PPFD), and photon efficiency, are all useful terms for lighting, but they are not equally weighted when it comes to their importance to growers and their grow lights.

Photosynthetic photon flux density is the grow light term that gives us the most information and the PPFD chart tells the story of how these numbers are significantly affected by distance to the canopy, and by movement. With the PPFD chart, look at the readouts (both for the stationary grow light and the light mover grow light), and that's at 15 inches (38 cm) and at 20 inches (50 cm). This was charted for a double-ended 1,000W grow light. The PPFD chart demonstrates that when a grow light moves along the canopy and on a light mover, an even and predictable PPFD output can be realised. And the grow lights can be positioned closer to the canopy for more maximised grow light interaction. Grow lights can be placed even closer still, so as the canopy gets taller, there is no stress or burn because those grow lights are moving. Conversely, stationary grow lights are limited and there is no sweet spot.

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FLUENCE
BY OSRAM

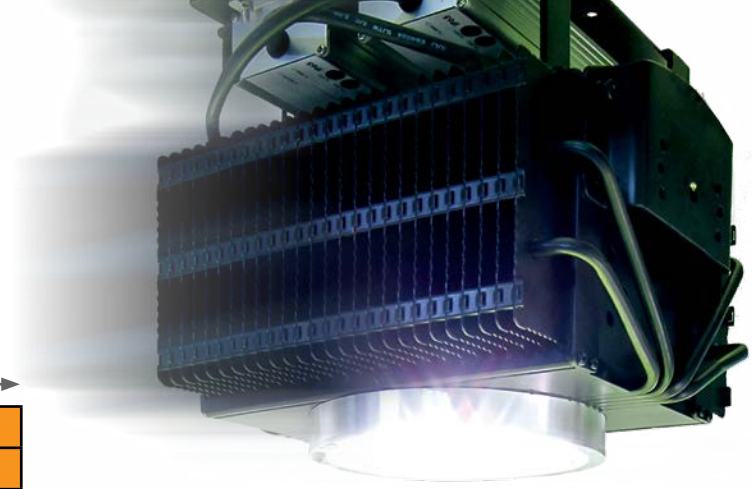

Fig. a

height	60″				
15″	720	878	858	878	720
20″	460	616	614	616	460
25″	228	447	484	447	338
30″	263	334	370	334	263

PPFD readings for a moving grow light.

height	60″				
15″	90	590	2815	590	90
20″	122	602	1472	602	122
25″	148	512	942	512	148
30″	166	419	638	419	166
35″	170	339	456	339	170
40″	163	280	353	280	163
45″	151	230	275	239	151

PPFD readings for a stationary grow light.

To understand this on another level, stationary grow lights are always at a reduced strength because of the limitations of stationary grow light rules. It's a paradox of having a beautifully strong, quality grow light that is forced to be positioned up high so that it is safely diluted, so as not to cause harm. Then, as a strategy to get some degree of grow light strength back, a grower is forced to place their grow lights in a tighter formation, resulting in more grow lights in use. Beyond the logical conclusion that this is wrong for cost and for practicality, it is also wrong for efficiency of electrical usage. With light movers, the grow lights can be positioned much closer and they can cover about 30 per cent more area — and that's per grow light. That's with each light mover consuming only about five to nine watts. In a time when electrical savings and energy efficiency are as important as yield numbers, moving grow lights is a way to have both variables significantly improved.

The PPFD chart tells the story of an even canopy, along with faster growth and yield increases due to the moving grow light. A side story is the effect of the optimised moving grow light that moves off-side slightly and then back intensely overhead, again and again. This ongoing action reduces shadow patterns and is how more of the leaves interact with the grow light. It mimics how plants have evolved over millions of years to best receive light. Plant receptors will open more when the light is intense but intermittent. So, the light mover's effect on PPFD readouts is perhaps the most important grow light variable to know. It's a story of better coverage and the effect goes even beyond the chart numbers. But, grow lights have their own input and there are many grow light numbers beyond PPFD to decipher.

"This is how to best maximise PPFD with stronger/better coverage while creating better efficiency than with a stationary grow light."

Breaking Down Grow Light Numbers

The following breaks down some of the most common grow light numbers used, along with the ones to pay particular attention to.

Lumens and LUX

Lumens are actually an eye measurement, so these are numbers strictly from a human perspective. It revolves around a photopic bell curve where humans are sensitive more in the middle for green light and less sensitive on the ends for blue and red light. LUX is simply a measurement of lumens in feet as lumens/ft squared. Because lumens and LUX deal in human terms for light, they are somewhat weak in the far ends of the spectrum. Humans don't need the far-end colours to see well but plants absolutely use the reds/blues as the fuel for photosynthesis. Because of this, we need those far-spectrum numbers represented. Lumens and LUX don't give us grow light numbers at the plant's perspective and because of this, they are not really useful terms for grow light output.

Watts

Watts is a term used for an overview only and is not used for accuracy. In other words, our general acquired knowledge might be to know which wattage is ideal for what we grow and at what stage.


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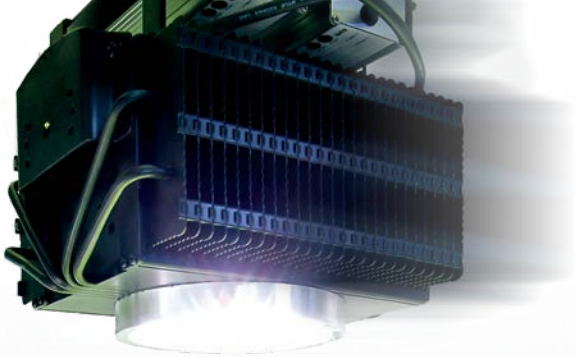


"With light movers, the grow lights can be positioned much closer and they can cover about 30 per cent more area – and that's per grow light."

Fig. b

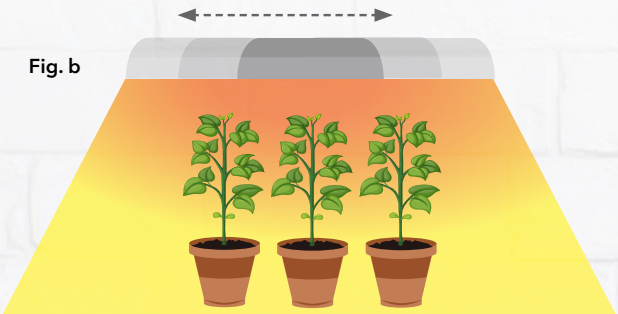
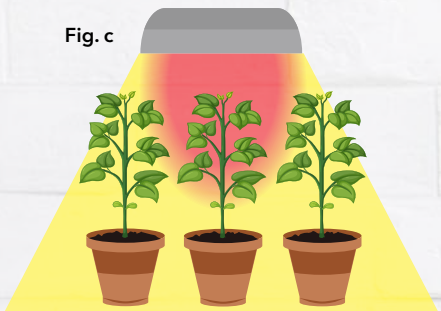


Fig. c



Light movement ensures more of the leaf surface interacts with the grow light. This mimics how plants naturally receive light (**Fig. b**). This reduces shadow patterns and hot spots associated with stationary lights (**Fig. c**).

PAR, PPF, PPFD

PAR is the wavelength of light in the range of 400-700 nanometers and this is the range for photosynthesis. For the acronym components, it is photosynthetic active radiation which is important in a conceptual way, but it is without true measurement because it lacks time and space. We can, however, dilute it with distance from the light source, or we can concentrate it by positioning the light source closer. That's an example of Inverse Square Law which is also highlighted in the PPFD chart, with the PPFD numbers hugely diminished, and that's geometrically diminished, with distance. Photosynthetic photon flux gives one more piece of information for PAR, which is time. We can see photon output per second. A quality grow light emits a continuous strong output, and PPF tells that story. The measurement is micromoles per second (µmol/s). The best grow light number to know, however, is PPFD because it incorporates space and time into the calculation. Basically, it is PPF plus micromoles per metre. It is the measurement of PPFD. Photosynthetic photon flux density readings must be done properly and include distance to grow light, horizontal coverage, and the number of readings taken over a period of time. For the PPFD chart, the distance and the horizontal coverage are listed. For other needed information, the meter took a reading every 30 seconds, so 120 readings per hour and every 30 minutes, calculated for the average, and that was per area.

Photon efficiency: This is all about how efficient a grow light is in converting electricity into PAR. It's important to know because we are not just thinking of electrical input but are now having the added information of realized output. For the math and knowing PPF (µmol/s) plus knowing wattage (Joules or J/s), the formula is µmol/J because the "s" for seconds cancels out on both sides of the equation. The higher this number, the more energy efficient a grow light is at converting electricity, which is input, into photons of PAR, which is output.

The two most important grow light numbers to know are PPFD and photon efficiency. A quality grow light will be outstanding for PPFD and should be noticeably better than most for photon efficiency. Then, placing that grow light on a light mover and getting it closer than would be recommended in a stationary setting is ideal for optimized results. This is how to best maximise PPFD with stronger/better coverage while creating better efficiency than with a stationary grow light. And, that's by covering 30 per cent more area as a moving grow light.

Grow lights can be powerfully effective while being energy efficient, and light movers are the single best way to maximise this. So, know a grow light's PPFD, know the photon efficiency and, just as importantly, know the possibility of those grow light numbers when maximised on light movers.

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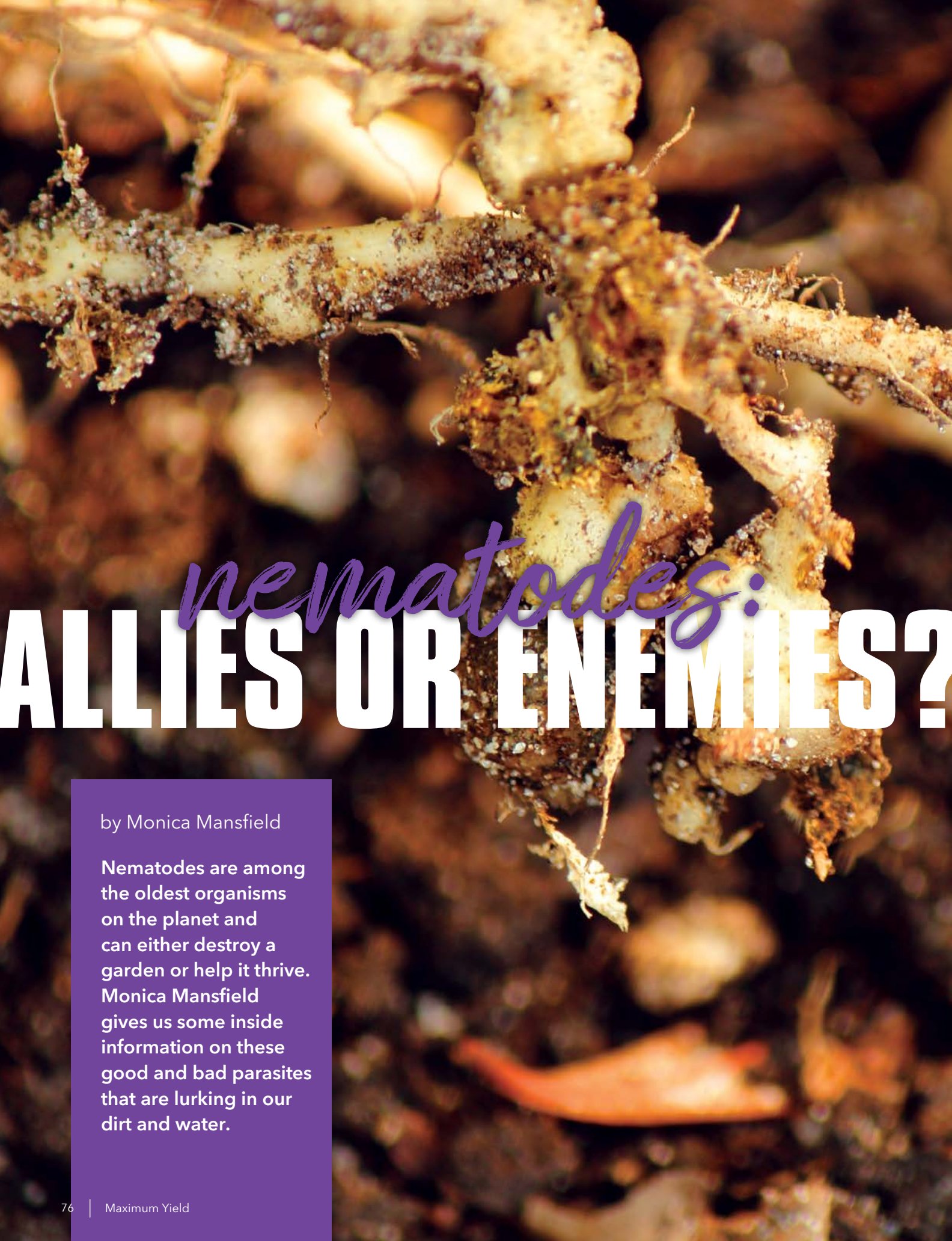

nematodes: ALLIES OR ENEMIES?

by Monica Mansfield

Nematodes are among the oldest organisms on the planet and can either destroy a garden or help it thrive. Monica Mansfield gives us some inside information on these good and bad parasites that are lurking in our dirt and water.

Nematodes can either be a gardener's best friend or worst enemy. Plant parasitic nematodes invade our gardens and cause yellowing leaves, stunted growth, and poor harvests. Beneficial nematodes are powerful allies that feed on harmful bacteria, fungi, insects, and other nematodes that want our crops for themselves. Beneficial nematodes also break down organic matter and recycle nutrients in the soil.

Nematodes are microscopic round worms that can range in size from 0.05 centimetres up to several cm long. They were some of the first organisms to exist on the planet, having been around for an estimated one billion years. They live in water and soil and, depending on the type, feed on bacteria, fungi, protozoans, other nematodes, insects, plants, animals, and even humans. They are a vital part of the soil food web, serving as predators, prey, and nutrient recyclers.

There are more than 15,000 known species of nematodes on the planet, with an estimated 15 per cent of the species being parasitic towards plants. They are so abundant that if you were to remove everything on Earth except nematodes, we would still be able to see an outline of everything on Earth. In fact, just one handful of soil can contain millions of them.

Harmful Nematodes

Plant parasitic nematodes are only about 0.05 cm long, with smooth, unsegmented bodies. Most are long and slender, while some species are more pear shaped. They have sharp, pointed mouths, called stylets, which puncture cell walls and allow them to feed on tissues.

> *"Nematodes* **ARE A VITAL PART OF THE SOIL FOOD WEB, SERVING AS PREDATORS, PREY, AND NUTRIENT RECYCLERS."**

There are four classifications of plant parasitic nematodes. Migratory ectoparasites feed on the outsides of the roots. Sedentary ectoparasites burrow their heads into the roots to feed and stay there. Migratory endoparasites tunnel into the roots and then search for another host when they are done feeding. Sedentary endoparasites burrow into the roots and stay there permanently to feed. Nematodes will also eat parts of the plants above ground at different times in their life cycle.

They can cause some serious harm, to the tune of an estimated $77 billion in damages to crops worldwide. The most common plant parasitic nematodes are root knot nematodes. They get their names from the damage they cause to root systems. When they puncture the root and move in, they actually expand the size of the root to make more room for themselves and their offspring. When you dig your sick plants up at the end of the season, you'll find the roots have knots in them.

Symptoms may include yellow wilted leaves, signs of infection, stunted growth, and poor yield. Nematodes also present as patches of poor growth in an otherwise healthy field, which may spread if left untreated. If you suspect nematodes are the cause of the problem, you can gently lift the plant out of the ground and examine the roots. You may see root rot, injured root tips, small lesions and knots, or excessive root branching.

The symptoms may be mistaken for other issues until you dig up the plant, and sometimes there is no damage to the plant at all. Healthy plants can actually tolerate small infestations without suffering a loss in production.

How to Get Rid of Harmful Nematodes

The first parasitic plant nematodes were noted in wheat seeds in 1743, followed by root knot nematodes on cucumbers in 1855, and cyst nematodes on sugar beets in 1859. By the early 1900s, the field of agricultural nematology had taken root. Nematodes were first treated by soil fumigation in the 1940s, however, most nematicides are now strictly regulated or banned due to their harmful effects on the environment.

Nematodes may not move more than a metre in their lifetime, but they can travel long distances in a variety of ways. They can be carried on shoes, farm tools and equipment, in dirt that is moved, in water during floods, and on plants and seeds. Dried nematodes in their dormant state can even be carried in the wind. These modes of travel make it challenging to quarantine and kill nematodes, so the best option is to manage their populations as best we can in our gardens.

Follow Proper Sanitation Practices

Because of the way nematodes can travel, it is important to follow proper sanitation practices. Be sure to clean farm equipment, tools, shoes, and clothing when moving from field to field, or garden to garden.

When bringing in new plants, be sure to quarantine them for a short time to make sure they are healthy before introducing them to your garden. You can also check their roots for knots and lesions before transplanting. Bringing sick or infested plants into your garden is one of the most common ways to spread pests and disease. This raises a great argument for starting your own plants from seed.

"BRINGING SICK OR INFESTED PLANTS INTO YOUR GARDEN IS ONE OF THE MOST COMMON WAYS TO SPREAD PESTS AND *disease.*"

Crop rotation is an effective way to manage nematodes. By planting non-host plants in alternating years, you can decrease their populations. Cauliflower, broccoli, and millet are ideal. French dwarf marigolds and common vetch are effective when used as a cover crop and then turned into the soil. Growing non-host plants for two years in a row will significantly lower nematode populations.

You can also plant nematode-resistant varieties. For example, many tomatoes are nematode-resistant, such as Best Boy, Big Beef, French Rose, Lemon Boy, OG 50, Sugar Snack, Supertasty, and Winter Red. Your seed catalogs should be able to point you in the right direction.

Neem oil kills parasitic nematodes without harming beneficial nematodes. Neem oil works by disrupting their growth cycle, which will prevent them from laying eggs before they die off. Neem won't harm most beneficial insects, such as bees, and is also an effective fungicide and insecticide ideal for preventative use.

"BENEFICIAL NEMATODES ARE A GARDENER'S BEST *friend."*

Bring in Some Carnivorous Fungi

Nematophagous fungi are carnivorous and feed on nematodes. These fungi actually set traps to snare nasty nemotodes — either sticky traps or circular rings that capture and kill their prey. What's remarkable is these fungi will only set the traps when they detect the nematode's ascarosides, which are the chemical cues nematodes use to communicate with one another.

Nematophagous fungi are found in abundance where there is rotting organic matter, such as the compost pile, leaf mold, and decomposing bark. Adding compost, leaf mulch, or layering your garden with wood chips will encourage the fungi that protect your garden from parasitic nematodes.

Healthy plants resist well and perform better than plants suffering nutrient deficiencies, even in the presence of harmful nematodes, so regularly adding compost and organic matter to your garden serves a double function.

The most effective method of managing harmful nematodes is to use a combination of these methods, as just one will probably not be effective on its own.

Beneficial Nematodes

Beneficial nematodes are a gardener's best friend. Instead of attacking our plants, they attack a wide variety of garden pests. The most helpful strains in the garden are endoparasites of insects, which introduce *Xenorhabdus sp.* bacteria into the insects they eat. This bacteria kills them within 24-48 hours and breaks down their tissues so the nematodes can make their home inside of the insect, lay their eggs, and feed on the decomposing tissue.

The most commonly used beneficial nematodes are *Steinernematidae carpocapsae, S. feltiae, S. glaseri, Heterorhabditisheliothidis,* and *H. bacteriophora.* They are effective against many pests including weevils, cutworms, chinch bugs, white grubs, clearwing borers, fungus gnats, and sod webworms.

These beneficials are sold commercially as biological insecticides. They can stay viable for months as long as they are kept at the correct temperature, and mix well with fertilisers and pesticides. They are considered environmentally friendly by the EPA since they occur naturally, are not genetically modified, and do not harm vertebrates. There is no evidence insects develop resistance to the bacteria these nematodes produce.

How to Use Beneficial Nematodes in Your Garden

Beneficial nematodes can be purchased from most garden centres, dormant in a powder. To use, add them to water and spray them on your plants and soil. Be sure to remove the screen in your sprayer so they can get through.

Because they must be stored at the correct temperature to remain viable, you can guarantee their viability before use by adding them to water and observing them under a microscope.

It is important to apply beneficial nematodes in the correct conditions. They require warm, moist soil to be effective, so it is a good idea to irrigate the garden before and after application. Because they travel in water, watering the garden after application helps to move them around and find hosts. The ideal conditions also include high humidity, moderate temperatures, and indirect sunlight. Applying them in the morning or evening is best.

As gardeners, we need to understand and prevent potential threats to our gardens. By applying beneficial nematodes and using best practices to reduce plant parasitic nematodes, we can take care of these threats in a way that's effective and won't harm the environment. MY

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CYCO™ PLATINUM SERIES

Cyco manufactures and distributes the Cyco Platinum Series brand – a cutting-edge range of hydroponic plant nutrients, additives, and mediums. The company utilises the latest technologies and sources only the best ingredients for its pharmaceutical-grade plant products, which are available in 40 countries. Cyco owner and director Shaun Jones answers our questions.

cycoflower.com | info@cycoflower.com

cyconutrients @cyco_nutrients MrCycoflower

WHAT DID YOU AND YOUR PARTNERS DO BEFORE STARTING CYCO PLATINUM?

Prior to starting Cyco, I owned and operated a chain of hydroponic stores in Australia. At the time they were industry leading stores; it was in these stores that I saw an opening for an analytical, pharmaceutical-grade, and food grade product in the market.

HOW DID YOU GET INTO THIS INDUSTRY?

I recall it vividly. I was 21 years old and freshly married, driving to my day job, and when I put gas in, I noticed I had $7 in my bank account. That day I drove past the local hydroponic store and saw people gathering to get in (back in the 1990s, Australia had huge growth with hydroponic stores and demand). I drove straight to the bank and borrowed $20,000 with which I opened my first hydroponic store. It was a huge success for me — 18-hour days, seven days a week for 10 years and we had a thriving hydroponic chain.

WHEN AND WHERE DID CYCO BEGIN?

Cyco Nutrients started in 2008.

WHAT WERE THE START-UP YEARS LIKE?

They were very difficult times. Being based in Australia, it meant wherever in the world I travelled promoting Cyco, I knew it was going to be a long, time consuming, and expensive journey. For a young man with an equally young family, I was often away from home for weeks and months at a time living out of hotel rooms and suitcases. The travel sounds glamorous at first but after hundreds of flights you really do get very tired of it all, but it is something you have to do. I still fly out to quite a few expo/trade shows per year and don't look forward to the long flights, but its great reconnecting with friends I have met along the journey.

HOW DOES YOUR COMPANY PHILOSOPHY TRANSLATE TO OPPORTUNITIES?

Connection with our customers: We will truly understand their needs better than any other company as we are all industry descending and have experienced retail, wholesale, and cultivation first hand.

Focus on the job at hand: In order to do a good job and fulfil our clients' needs we must eliminate all of the unimportant situations that arise in day-to-day business and focus on our job at hand in the current moment — which is to provide the best product and service possible.

Represent: I have learned in business that people do judge a book by its cover. We may have the best product possible, the highest-quality product possible, etc., but if we present them in a careless manner, they will be perceived as slapdash products. If we present them in a creative, professional manner, our clients will see and understand the quality, effort, and passion we apply to our business.

WHAT DID CYCO FIRST PRODUCE?

We first produced the core range of Cyco products for the Australian market and, as the line expanded into global markets, more products were developed to suit each country and the different growing methods they utilise.

WHAT WERE SOME OF YOUR STRUGGLES AS YOU STARTED THE BUSINESS? HOW DID YOU OVERCOME THEM?

Cyco Nutrients started as a small family business and as it grew, there was a magnitude of struggles; entering international trade and being recognised by international distribution was the hard part. Registering products in each country and each state, then having to explore those markets to see if it was possible to grow sales in each country and what marketing and support would be needed to do so. I feel we have succeeded in brand building and recognition, and now it's a steady climb consisting of great business manners, relationships and loyalty amongst our distribution channels, retailers, and end users.

> "**CYCO NUTRIENTS STARTED AS A SMALL FAMILY BUSINESS** AND AS IT GREW, THERE WAS A MAGNITUDE OF STRUGGLES; entering international trade and being recognised by international distribution was the hard part."

From Left: Morgan Sumner, Luke Gillan, Nathan Hunter, Holly Mail, Sasha Jones & Rachael Maur

> **"OUR COMPANY IS ONLY AS GOOD AS THE PEOPLE** SELLING OUR PRODUCTS and I am very proud of the distribution channels and retailers we have aligned ourselves with."

HOW DID CYCO GAIN MARKET SHARE AND RECOGNITION?

Cyco Nutrients has always been at the forefront of the tradeshows, online marketing platforms, and magazines to our own forum and help centre. In 2018, we participated in 20 trade shows and a magnitude of customer appreciation days. All aiding in the product support and in return helping our retailers, which relayed onto our end users.

HAS CYCO MOVED OR EXPANDED SINCE THE BEGINNING?

Cyco Nutrients has been moved four times in its growth cycle, as we grow out of each facility within a few years. I simply did not think we would ever become the size we are; in saying that I am hoping the last move is hopefully our last. The latest facility we purchased has ample room for expansion as we built an extra facility next to the current one to allow for extra international growth, as I learned my lesson with the first few times. We brought the current facility in 2013 and revamped it for the purpose of fertiliser manufacturing. The facility has the capacity to produce 30,000 bottles a day of all sizes and hold 3,000 pallets of back-up stock, giving our clients minimal wait times for their orders to sail.

WHAT IS CYCO'S CURRENT PRODUCT LINE?

We have the original "Cyco Platinum Series" line of liquid products that has served our end users well over the years and I'm sure will remain our go-to product for most hydroponic growers. In 2018 we launched the "Outback Series" of dry fertilisers aimed at the outdoor/greenhouse growers, and our latest product is the "Commercial Series" — a one-part powder solution which we developed with larger commercial grows in mind… look out for that one in the first quarter of 2019.

WHERE DO YOU DISTRIBUTE?

We distribute through leading distributors in each country; some of these distributors distribute into several countries which lightens our load and makes handling such a large market easier for us at head office. In Australia, we self-distribute and have Accent Hydroponics aid us in national distribution. In the United States we have the Hawthorne Gardening Co., and in Canada we have Hydrotek. In Spain we have Hortitec, and in England we have Eden Horticulture, and the list goes on. From our distribution channels, the Cyco products are then shipped to leading hydroponic stores in approximately 40 countries.

We found having strong relationships with our distributors works the best for our company and brand. I have never wanted to self-distribute as I was a store owner and understand the politics of manufacturers selling direct. We pride ourselves on working closely with our distributors and the trust we show each other as they know we will not sell direct to their hydroponic store clients, nor to the end users keeping our hydroponic retailers safe and making money — which I think is crucial to maintain a solid long-term product reputation and, for me, trust and relationships is everything for gaining growth and good business.

HOW MANY PEOPLE NOW WORK FOR CYCO?

Thirty in Australia and another 11 offshore giving us a total of 41.

WHAT ARE YOUR COMPANY'S STRENGTHS?

The quality of our product being the first and most important. The Cyco products are manufactured with the highest-grade inputs, our products are manufactured with analytical/pharmaceutical inputs which is perfect in a medical/recreational market resulting in its growing popularity in the medical recreation markets not to mention the numerous awards and growers cups it has won for its purity. Our second-most important strength is we manufacture all our own products in house — liquid nutrients, dry fertilisers, and rooting hormones, giving us full control of our own quality control and ensuring we deliver the best possible product to market and of the highest grade possible, time after time.

The third-most important is the staff we have and the representative team. I hand-picked all our representatives after years of studying the market. Each staff member has their own unique skills and strengths to help service our customers, so our clients can be assured our reps are all from this industry and know all aspects of retail and growing.

WHAT ARE SOME OF YOUR PROUDEST MOMENTS?

My proudest moments are most definitely the three beautiful children I share with my wife, Sasha, but as far as my proudest industry moments go, that is hard as there have been many! I think the one moment that really stands out was when my product, Cyco Platinum Series — the same product I had travelled all over the world promoting with many sleepless nights, ridiculously long plane rides, and many lonely nights away from my beautiful family — finally started becoming recognised as a top-shelf, high-quality product that I knew it to be. This led to Cyco being picked up by my first major distributor in the USA, an extremely proud moment for me after so many people had turned me away during the journey. This one event alone made it all worthwhile and I knew right there and then that Cyco as a business would never be the same again… We were playing with the big boys now. To further that proud feeling, in 2017 we secured our Canadian distributor, Hydrotek. Hydrotek has been a true pleasure to work with and has continually grown our Cyco customer base. It has been an absolute pleasure working with these guys on a day-to-day basis.

In July 2018 we were picked up for distribution in the United States by Hawthorne Gardening Co. (formerly Sunlight Supply). This made me extremely proud as in my eyes they are the mecca of US distribution and after working with them I truly understand why; their everyday professionalism, customer service and staff's commitment is refreshing. A true joy to work with and we look forward to a strong healthy relationship in the years to come.

Watching the line grow with our distributors makes me extremely proud as the hard work we have all poured into the line for many years is now supported by the biggest distributors on the planet and what I call our working family.

Our company is only as good as the people selling our products and I am very proud of the distribution channels and retailers we have aligned ourselves with. As a result, the Cyco brand is a global leader, with full service across the US, Canada, Australia and Europe.

> "**OUR SECOND-MOST IMPORTANT STRENGTH** IS WE MANUFACTURE ALL OUR OWN PRODUCTS IN HOUSE – liquid nutrients, dry fertilisers, and rooting hormones."

The list of proud moments is endless, and the journey of good business and growth are continuing for Cyco and we thank our global distributors in each country for making this a reality.

WHAT SIGNIFICANT THINGS HAVE YOU LEARNED SO FAR ABOUT THE INDUSTRY?

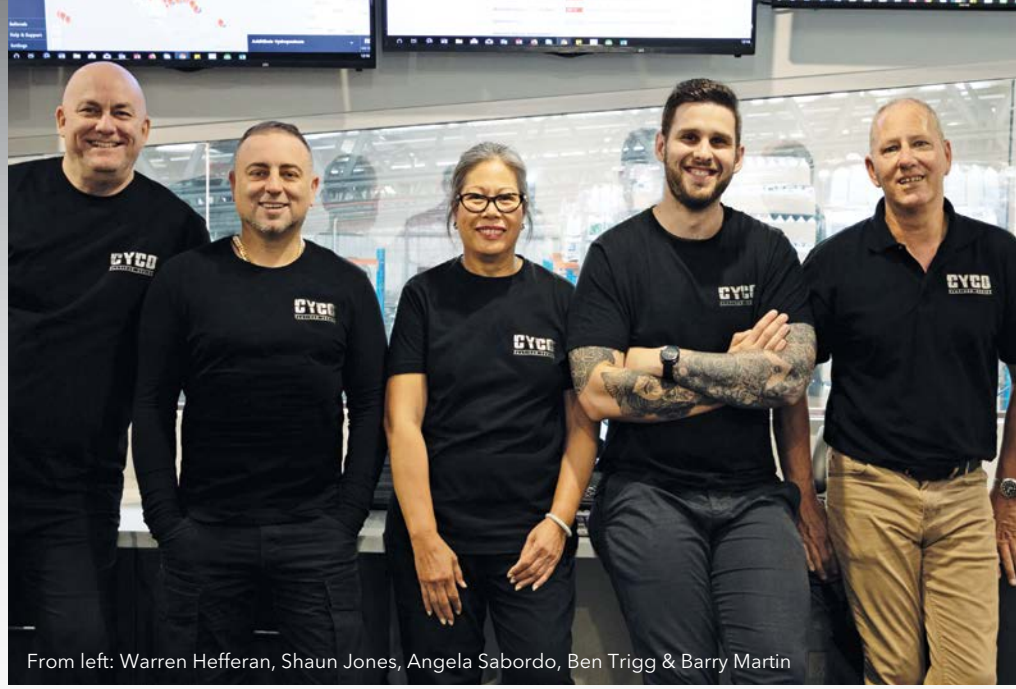
I have been in this industry for over 20 years and, in that time, I have seen the industry cycle multiple times. All the markets are as they have always been with exception of the United States. As the US industry corporatists, it becomes susceptible to commercialisation. This saturates the margins on the finished product, creating a need for stores to become market savvy and the idea of more online and commercial will become a reality, enabled by new product technology and often at a lower cost. Think portable calculators versus computers, Amazon versus bookstores, Netflix versus Blockbuster, or digital cameras versus film — Cyco versus the rest.

WHAT HAVE YOU LEARNED ABOUT STARTING AND GROWING A COMPANY?

Where do I start with this one… I have learned that nothing good in life comes easy or everyone would have the same outcome. No success comes without a magnitude of work hours and a positive mind; coming to work each day for me is a lifestyle not a job, which I believe is the difference, giving me the stamina and mental strength to propel the company forward. To start a new company needs strengths in all aspects of the director's life's, and part of my success is due to the team I have around me and the family which allows me to work as many hours as I need, and still receive the hugs of my loving family. I have always said if my products are better, my service is better, my trading hours longer, then how can I fail?

WHAT MAKES YOUR TEAM SO AWESOME? HOW DOES YOUR TEAM BOND?

The team at Cyco are located all over the globe. The main headquarters where all research, development, manufacturing, and shipping of the product to the rest of the world takes place is Australian-based. Our Australian retailers are serviced by Ben T., our operations and sales manager, along with Barry, our national sales representative — two great guys. Accounts is taken care of by Angela, and we have our own in-house genius media guy, Warren. Our manufacturing starts with Danny in the mixing tanks with a team of gents. Ben B. and Morgan run the bottling line with the line team. The bottling area is managed by Nathan, and international picking and loading is managed by Sasha (my wife), Rachael, and Holly (my lovely sisters-in-law) as they take care of final packing and shipping. It really is a family business, even my princess Olivia, my beautiful daughter, helps out during her time off schooling. Our US staff includes Chris (vice-president of sales and marketing), Brandon (national sales manager), as well as John, Velvet, and Jake, our US sales representatives. Gilles is our French-Canadian sales rep taking care of things in Canada (he is also a pretty good artist from what we hear), and Hugo is our man on the ground in Spain. In the UK and Ireland, we have Diarmuid (Dermott) — he takes care of everyone in the United Kingdom and Ireland… and the list goes on. All these people make Cyco what it is today, and they are in fact… awesome.



From left: Warren Hefferan, Shaun Jones, Angela Sabordo, Ben Trigg & Barry Martin


From left: Chris Keck, Brandon Conner, Velvet Loving, John Higby & Jake Armstrong

> "**ALL THESE PEOPLE MAKE CYCO** WHAT IT IS TODAY, and they are in fact… awesome."

WHAT WORDS OF WISDOM CAN YOU SHARE ABOUT THE BUSINESS, THE INDUSTRY, OR THE FUTURE OF THE INDUSTRY?

It's been said many times before and it's become a bit of a mantra of mine that I impart to anyone willing to listen: "you can't sell a secret." You have to get out there and take your product, service, and sometimes even yourself to the people that need to see it. Also, be a hard worker and put in those long hours. There will be times when you think it is never going to happen and you feel like giving in, but you have to keep going. It's those qualities that lead to success — that "never give up attitude" will take you a long way in this world. A goal is just a dream with a plan. If you can dream it then you can achieve it.

CUSTOMER THANK YOU!

I would like to thank our global distribution partners, retailers, and end users for the loyalty and support they show us day in day out. Our company and products are only as good as the people promoting them, so I am grateful for the very best brand ambassadors that support the Cyco line. I am extremely proud of what we have achieved all together!

Thanks for giving us the opportunity to grow with you, from my family to yours.

Respectfully,
Shaun Jones at Cyco Nutrients.
Director / owner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distribution **LIST**

retail stores are listed alphabetically in each 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 Ave.
Banks Town NSW 2200
(02) 9790 1525

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

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

Ballina Hydro
19 Cessna Cres.
Ballina NSW 2478
(07) 3354 1588

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

Cougars Hydroponics
2/6 Ace. Cres
Tuggerah NSW 2259
(02) 4330 0190

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

Earth & Colour Vertical Gardens and Hydroponic Supplies
1/43 Corporation Cir.
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
(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 6873

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
(04) 1460 9241

The Green Room Hydroponics & Organics
2/6 Davids Cl.
Somersby NSW 2250
(02) 4340 0339

The Grow Shed
4/22 Alliance Ave.
Morisset NSW 2264
(02) 4972 6872

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

Warrawong Hydroponics Centre
240 Cowper St.
Warrawong NSW 2502
(02) 4274 8001
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
(08) 8947-2576

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

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
Unit 3, 4 Billabong St.
Stafford, Brisbane QLD 4053
(07) 3354 1588

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
46 Spencer Rd.
Nerang QLD 4211
(07) 5527 4155

HydroMart Hydroponics
1/23 Victoria St.
Capalaba QLD 4157
(04) 3127 8211

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 Parade
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
1/31 Casey St.
Aitkenvale, Townsville QLD 4810
(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 SA 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
(08) 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) 8268 2636

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, SA 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

Advanced Hydroponics
26 Mulgrave St.
South Launceston TAS 7249
(03) 6344 5588

Aqua Hydroponics
Rear 45 Burnett St.
New Norfolk TAS 7140
(03) 6294 9233

Ezy Grow
625 East Derwent Hwy.
Lindisfarne TAS 7015
(03) 6243 9490

Garden World
717 West Tamar Hwy.
Legana TAS 7277
(03) 6330 1177

Green Acres Hydroponics
46-48 Bingalong Rd.
Mornington TAS 7018
(03) 6245 1066
sales@greenacreshydroponics.com.au

Growers Choice
225 Main Rd.
Derwent Park TAS 7009
(03) 6273 6088

Hydroponics Systems
131 Main Rd.
Moonah TAS 7009
(03) 6278 3457

Hydroponic World
322 Bass Hwy.
Sulphur Creek TAS 7316
(03) 6435 4411

Lifestyle Gardens
167 Gilbert St.
Latrobe TAS 7307
(03) 6426 2003

Organic Garden Supplies
17 Don Rd.
Devonport TAS 7310
(03) 6424 7815

Tasmanian Hydroponic Supplies
99 Lampton Ave.
Derwent Park TAS 7009
(03) 6272 2202

The Hydroponic Company
69 Charles St.
Moonah TAS 7009
(03) 6273 1411

The Hydroponics Company
289 Hobart Rd.
Kings Meadow TAS 7428
(03) 6340 2222

VICTORIA

99 Garden Services
Unit 31 12-20 James Court
Tottenham VIC 3012
(03) 9314 8088

AAA Lush Hydroponics
2-4 The Arcade, Junction Village
Melbourne VIC 3972

Albury Hydroponics/ Cappers Hydroponics
62 Thomas Mitchell Dr.
Springvale VIC 3171
(02) 6024 4029

All Seasons Hydroponics
3 Springvale Rd.
Springvale VIC 3171
(03) 9540 8000

A-Grade Hydroponics
60/148 Chesterville Rd.
Cheltenham VIC 3192
(03) 9555 6667

Aquamatic
299 Monbulk Rd.
Monbulk VIC 3793
(03) 9756 6666
aquamatic.com.au

Banksia Greenhouse and Outdoor Garden
530 Burwood Hwy.
Wantirna VIC 3152
(03) 9801 8070

Barb's Hydro and Nursery
15 Wallace Ave.
Interverloch VIC 3196
(03) 5674 2584

Belgrave Hydroponics
5/ 60-68 Colby Dr.
Belgrave Heights VIC 3160
(03) 9754 3712

Brew 'N' Grow
4 - 479 Nepean Hwy.
Edithvale VIC 3199
(03) 9783 3006

Casey Hydroponics
12 The Arcade St.
Cranbourne VIC 3977
(03) 5996 3697

Casey Hydro
78 Spring Square
Hallam VIC 3803
(03) 9796 3776

Central Hydro
Factory 3/9 Mirra Court
Bundoora VIC 3083
(03) 9466 7635
centralhydroponics.com.au

Chronic Hydroponics
31 Anderson St.
Templestowe VIC 3106
(03) 9646 8133

Crown Garden Supplies
8 Glencapel Crt.
Hillside VIC 3037
(04) 5996 6344

Discount Hydroponics
18 Princes Hwy.
Doveton VIC 3177
(03) 9792 2966

Echuca Hydroponic Nursery & Supplies
23 Ogilvie Ave.
Echuca VIC 3564
(03) 5480 2036

Echuca Pump Shop
128 Ogilvie Ave.
Echuca VIC 3564
(03) 5480 7080

Epping Hydroponics
10 Dilop Dr.
Epping VIC 3076
(03) 9408 4677
eppinghydroponics.com.au

Excel Distributors Pty Ltd
2/41 Quinn St.
Preston VIC 3072
(03) 9495 0083

F.L.O.W. Plants and Environments
66B Chapel St.
Windsor VIC 3181
(03) 9510 6832

Fastway Hydroponics
Unit 2/444 Geelong Rd.
West Footscray VIC 3021
(03) 9314 1119

Fruits of Nature Pty Ltd T/A Westside Hydroponics
202 Main Rd.
Ballarat, VIC 3350
(03) 5338 7555

Gardensmart/ AutoPot Systems
810 Springvale Rd.
Braeside VIC 3195
(03) 9701 8811

Global Hydroponics
10 Knight Ave.
Sunshine VIC 3020
(03) 9356 9400

Greenleaf Hydroponics
9a Church St.
Traralgon VIC 3844
(03) 5176 0898

Greenleaf Hydroponics
Factory 7, Ind. Pk. Dr.
Lilydale VIC 3140
(03) 9739 7311

GreenLite - Ringwood
291 Maroondah Hwy.
Ringwood VIC 3134
(03) 9870 8566

Grow 4 XS
Rear 24 Simms Rd.
Greensborough VIC 3088
(03) 9435 6425

Growlush Australia
Factory 5, 102-128 Bridge Rd.
Keysborough VIC 3173
(03) 9546 9688
www.growlush.com

Guerrilla Gardens
factory 1/4 Wren Rd.
Moorabbin VIC 3189
(03) 9912 6090
guerrillagardens.com

Holland Forge Pty Ltd.
68-70 Rodeo Dr.
Dandenong South VIC 3175
(03) 9791 8800

Hydroware
1/54 Lara Way.
Campbellfield VIC 3061
(03) 9357 8805

Hyalite Airport West
Unit 4/504-506 Fullarton Rd.
Airport West VIC 3042
(03) 9331 5452

Hyalite Bayswater
4/19 Jersey Rd.
Bayswater VIC 3153
(03) 9720 1946

Hyalite Global
10 Knight Ave.
Sunshine N VIC 3020
(03) 9356 9400

Hyalite Westend
3 Third Ave.
Sunshine VIC 3020
(03) 9311 3510

Hydroponic Central
110 Dynon Rd.
West Melbourne VIC 3003
(03) 9376 0447

Hydroware
1/54 Lara Way
Campbellfield VIC 3061
(03) 9357 8805

Indoor Garden Company
29 Glasgow St.
Collingwood VIC 3066
(03) 9416 1699

Inner City Hydroponics
155 Darebin Rd.
Thornbury VIC 3071
(03) 9480 1078

Impact Distribution
PO Box 2188
Salisbury Downs VIC 5108
(08) 8250 1515

JB Lighting
492 - 500 Neerim Rd.
Murrumbeena VIC 3163
(03) 9569 4399

Just Hydroponics Deer Park
Shop 11, 29/39 Westwood Dr.
Deer Park (Ravenhall), VIC 3023
(03) 8390 0861
justhydroponics.com.au

Just Hydroponics Geelong
Shop 1, 22 Essington St.
Grovedale (Geelong) VIC 3216
(03) 5421 6046
justhydroponics.com.au

Just Hydroponics Hoppers Crossing
3, 8 Motto Ct.
Hoppers Crossing VIC 3931
(03) 8742 2830
justhydroponics.com.au

Just Hydroponics Mornington
Shop 4, 14 Latham St.
Mornington VIC 3029
(03) 5973 6281
justhydroponics.com.au

Latrove Valley Home Brew Supplies
PO Box 802
Morwell VIC 3804
(03) 5133 9140

Living Jungle
345 Sommerville Rd.
Footscray West VIC 3012
(03) 9314 0055

LTM Co
12/87 Hallam South Rd.
Hallam VIC 3803
(03) 8712 2421

M.H.C.
Unit 4, 9 Rutherford Rd.
Seaford, VIC 3198
(03) 9775 0495

Magick Brew
205a Bayview Rd.
McCrae VIC 3938
(03) 5981 1160

Melton Hydroponic Supplies
18/10 Norton Dr.
Melton VIC 3194
(03) 9746 9256

Midtown Hydroponics
Factory 1, 821B Howitt St.
Wendouree VIC 3355
(03) 5339 1300

Mirror Paints
110 Dynon Rd.
W. Melbourne VIC 3003
(03) 9376 0447
mirrorpaints.com.au

Monster Crop Hydroponics
567 Waterdale Rd.
Heidelberg West VIC 3081
(03) 8528 3474

One Stop Sprinklers
1 Burwood Hwy.
Wantirna VIC 3152
(03) 9800 2177

Pakenham Hydroponics
1/27-31 Sharnet Circuit
Pakenham VIC 3810
(03) 5940 9047

Pam's Home Brew & Hydroponics
61 McArthur St.
Sale VIC 3850
(03) 5143 1143

Pakenham Hydroponics
1/27-31 Sharnet Circuit
Pakenham VIC 3810
(03) 5940 9047

Prestige Hydroponics Pty. Ltd.
S 2.10 Level 2, 343 Little Collins St.
Melbourne VIC 3000
(61) 4187 81083

Revolution Harvest
9/177 Salmon St.
Melbourne VIC 3000
(04) 0242 5451

Shepparton Hydroponics
87A Archer St.
Shepparton VIC 3630
(03) 5831 6433

Simple Grow
12 Blackfriar Pl.
Weterill Park VIC 2164
(02) 9604 0469

Simply Hydroponics
5/ 411-413 Old Geelong Rd.
Hoppers Cros. VIC 3029
(03) 9360 9344

Smart Hydro Garden
3/4 Lacy St.
Braybook VIC 3019
(03) 9318 8110

St Albans Hydroponic
55 St Albans Rd.
St Albans VIC 3021
(03) 9366 7788

Sun-lite Hydroponics
23B Wood St.
South Geelong VIC 3220
(03) 5222 6730

Sunray Hydro
157 Tenth St.
Mildura VIC 3500
(03) 5023 6422

Supply Net International P/L
PO Box 171
Highbury VIC 5089
(08) 264-3600

The Hydroponic Connection
5/393 Dorset Rd.
Boronia VIC 3155
(03) 9761 0662

Urban Hy
1/59 Gilbert Park Dr.
Knoxfield VIC 3180
(03) 9764 9400

Valley Hydro and Home Brew
166 Argyle St.
Traralgon, VIC 3844
(61) 3 5164 2297

Vic Garden Pty
31B Slater Parade
Keilor East VIC 3033
(04) 3160 5025

Waterworks Hydroponics
Unit 1, 5 Brand Dr.
Thomastown VIC 3074
(03) 9465 1455

Westside Hydroponics
202 Main Rd.
Ballarat VIC 3350
(03) 5338 7555

WESTERN AUSTRALIA

Accent Hydroponics
Unit 2/141 Russell St.
Morley WA 6062
(08) 9375 9355

Aqua Post
Unit 2B 7 Yampi Way
Willetton WA 6155
(08) 9354 2888

Aquaponics WA
Lot 12 Warton Rd.
Canning Vale WA 6155
(08) 0064 0222

Bloem
PO Box 1816
Subiaco WA 6008
(08) 9217 4400

Bunbury Alternate Growing Supplies
8/13 Worcestor Bend
Davenport WA 6230
(08) 9725 7020

Creative Grow Store
1/95 Dixon Rd.
Rockingham WA 6168
(08) 9528 1310

Great Southern Hydroponics
Shop 1, 21 Hennessy Rd.
Bunbury WA 6230
(08) 9721 8322

Greenfingers World of Hydroponics Maddington
Shop 1, 6-8 Emerald Rd.
Maddington WA 6109
(08) 9452 0546

Greenfingers World of Hydroponics Midvale
22 Elliot St.
Midvale WA 6056
(08) 9274 8388

Greenlite Hydroponics
4/91 Wanneroo Rd.
Tuart Hill WA 6060
(08) 9345 5321

Growsmart Hydroponics
47768 South Coast Hwy.
Albany WA 6330
(08) 9841 3220

Hydro Hill Hydroponics
9/35 Biscayne Way
Jandakot WA 6164
(08) 6461 6816
hydrohill.com.au

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FACTS ON
TOMATOES

by Philip McIntosh

Once thought to be the poisonous fruit of an unpleasant vine, the tomato has evolved into a staple fruit easily grown using hydroponic methods.

1. The tomato, *Lycopersicon esculentum,* entered the agricultural record somewhere in western South America around 700 AD.
2. The genus name derives from Greek, *lykos* (wolf) and *persicon* (peach) and the specific epithet means "good to eat."
3. One often sees another name for this plant still in use, *Solanum lycopersicum*.
4. Tomatoes, recognisable as members of the nightshade family *(Solanaceae)*, have not always been considered esculent.
5. The tomato's early bad reputation in Europe and America was due to its association with nightshades, and from much false information propagated by would-be experts.
6. True, the family contains the notorious deadly nightshade, *Atropa belladonna*, but so do well-known edible species such as peppers, potatoes, tomatillos, and eggplant.
7. Times have changed and the tomato is harvested worldwide at a rate of about 40 million tons per year.
8. It varies by region, but currently about a quarter of all tomato growers in North America use hydroponic production methods.
9. Tomatoes are not deadly poisonous, but they do contain the toxic alkaloid, tomatine, most of which is localised in leaves and stems.
10. You'd have to eat about 500 grams of tomato leaves to experience any serious negative effects from the tomatine.

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