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NOV/DEC 2019

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The Good, the
Bad, and the Ugly

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IN A GROWROOM**

The Science Behind

COMPANION PLANTING

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“

Generally, whether you have hard water or soft water is determined by your geographical location.”

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42 The Ups and Downs of Growing Fads

by Alan Ray

Plenty of garden fads have come and gone over the years. This month we look at the fun, the bad, and the just plain ugly when it comes to garden trends.

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by Rich Hamilton

Is hard or soft water better for your plants? Rich Hamilton checks out the pros and cons of each water type when it comes to greenhouse growing.

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“

Before we knew it, our garden exploded into a colourful array of healthy fruits and veggies.”



from the EDITOR

TG Toby Gorman

Is there anything better than putting food on the table that you grew yourself? In the spring, my wife and I planted peas, cucumbers, arugula, Detroit beets, blueberries, and Mary's Austrian tomatoes in our resurrected raised garden bed. Mary (who is not Austrian) also found some store-bought potatoes that had been withering in our garage. She cut them in half and buried them deep in the box.

We waited.

Mother Nature worked her magic with the help of some very rich compost, and before we knew it, our garden exploded into a colourful array of healthy fruits and veggies. First the arugula, which we put in our salad, then the blueberries, which we purchased from Maximum Yield editor Cam Maxwell who was raising money for his son's baseball team.

The peas all developed at once and the weight of them allowed them to flop over our fence. Our neighbour's dog helped herself.

And those buried store-bought potatoes? Beneath a thick canopy of leaves, the tubers grew by the dozens, filling up their place in the garden box. Each night when she arrived home from work, Mary went straight to the box and dug a few up before coming inside

with dirty hands and a huge smile on her face. Dinner never tasted so good.

We began to worry a little about the beets, cucumbers, and tomatoes. Our typically warm and dry Mediterranean summer had fallen short of expectations, and we wondered if these plants would produce anything at all.

Soon enough we got our answer. We recovered a few good-sized beets, but the tomatoes and cucumbers went next level. They just kept producing. We ate as many as we could, we gave them to friends, we gave them to neighbours. I even offered a few to our neighbour who we didn't always get along with and lo and behold, our relationship has improved dramatically ever since.

Now, as snow threatens, our little raised garden bed sits quiet with no hint of the splendour that had filled it just a few weeks ago. As I pulled the last of the decaying stems from it, I realised it gave us a lot more than nutritious food. It brought joy, helped fund youth sports, mended a relationship with a neighbour, entertained a bored dog, and allowed us to share with friends.

Pretty awesome. Can't wait for spring. 🍅

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Featured Contributors

AR **Alan Ray** has written five books and is a *New York Times* best-selling author. Additionally, he is an award-winning songwriter with awards from BMI and ASCAP respectively. He lives in rural Tennessee with his wife, teenage son and two dogs: a Boerboel (South African Mastiff) and a Pomeranian/Frankensteen mix.

RH **Rich Hamilton** has been in the hydroponics industry for more than 20 years and enjoys working on a daily basis with shop owners, manufacturers, distributors, and end-users to develop premium products.

Contributors

+ **Kent Gruetzmacher**
Eric Hopper
Monica Mansfield
Philip McIntosh
Dr. Lynette Morgan



A COMPANION PLANTING



Companion planting is the strategic and purposeful selection of plants grown in close proximity to other plants which provide certain mutual (symbiotic) benefits. Companion plants can provide many different benefits to their partner plants: companion plants can offer shade and/or support, they can replenish key depleted nutrients in the soil, attract beneficial insects, or even deter pests.

Companion planting is an excellent way to conserve space and water while fully utilising a garden's available space. Ideal for controlled environment growing, this "mutual climate co-operation" reflects crops that, when they become full size, complement the environmental needs of other plants growing around them.

Whether physical, nutrient, or pathogen resistance, the benefits of well-planned companion planting are numerous and highly valuable to the home grower.

Check out Monica Mansfield's article on page 60 for more information.

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branching OUT

 @ronb5508

Being a medical cannabis grower for myself I still enjoy seeing veggies and herbs growing inside.



 **Mark Sadore**

I used to only grow in aeroponics, then we had the 2003 blackout and lost everything. Switched to ebb and flow. Miss the the good old days. Got better yields and tighter flower growing in aeroponics.



 @puffsalotdr

Cucumber? Controlled drip system with coco work best. Gotta keep that moist all the time. Unless ur playing the pH drift of course.



 **Mike Statin Jr.**

Nice read!



 @cannacashier

Fantastic article, thank you.

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
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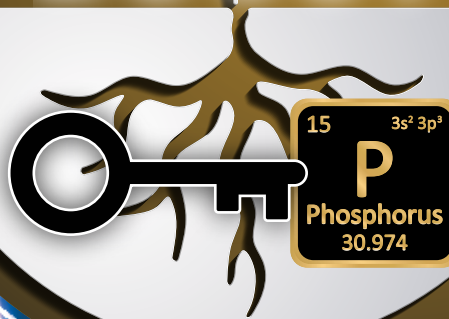
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ask a GROWER

by Dr. Lynette Morgan



I use an organic nutrient range for leaf vegetables in a recirculating deep-water system. I am currently growing various lettuces and pak choi. Both of these crops are showing salt deposits on the leaf edges (presumably as a result of guttation). The leaves then burn where the salt deposits have been. They are otherwise growing well. The system is running a pH of 6.3 and an EC of 1.2. Water temperature varies between 18-24°C (night/day) and polytunnel air temperature between 14-28°C. Can you give any advice on how to avoid this problem?

Many thanks, Richard



The type of damage you are seeing is termed "outer leaf marginal necrosis," also known as leaf burn, and is a physiological disorder that is different from the more commonly seen tip burn, which occurs on the inner, young leaves of lettuce under warm, high-humidity conditions. With outer leaf marginal necrosis, which tends to occur on the lower leaves of the plant, guttation is the main cause of leaf burn. Under conditions of high root pressure, water containing salts and many other compounds is pumped up the plant and out to the ends of the leaves where hydathodes (specialised glands that secrete water) are located. These droplets, or guttation, is typically seen in the early morning as root pressure is generally much higher at night. As this water evaporates from the leaf, it leaves behind salts that accumulate and cause cellular damage known as marginal leaf burn. This type of guttation induced salt damage can be more severe when using organic nutrients than with conventional hydroponic fertilisers as the balance of salts may not be optimal, or levels of unwanted salts such as sodium can be higher and accumulate over time. The hydroponic system also plays a role, with solution culture systems such as deep-water culture and NFT being more susceptible to guttation and leaf burn.

Prevention or minimisation of guttation is the key to preventing the marginal necrosis. Guttation occurs when plants have a strong and vigorous root system

creating a high degree of root pressure at night that forces large volumes of water up into the plant and out of the hydathodes. This typically occurs when the air temperature and root temperature are cooler at night combined with humid conditions around the leaf surface. Since stomata are closed at night, this restricts moisture loss from the foliage, leading to a further buildup of turgor pressure within the plant. Prevention of guttation involves ensuring there is a good rate of air movement across the plants and ventilation in the growing area and restricting root pressure by increasing the EC in the nutrient solution. A higher EC restricts the amount of water plants can take up and thus reduces root pressure and guttation. Pak choi is also a plant that requires higher EC levels than lettuce (around 1.8–2.0) and would benefit from bringing the EC up gradually. Warmer night temperatures can also assist with this problem as guttation is higher where night temperatures are much lower than day temperatures. There can be a lot of genetic variation in guttation and marginal leaf necrosis severity, so if the problem continues it would be worth trialing other cultivars of lettuce and pak choi, as those varieties with less vigorous root systems often don't suffer from as much guttation and leaf burn. ^{NY}

*Kind regards,
Lynette Morgan*



Dr. Lynette Morgan holds a B. Hort. Tech. degree and a PhD in hydroponic greenhouse production from Massey University, New Zealand. A partner with SUNTEC International Hydroponic Consultants, Lynette is involved in remote and on-site consultancy services for new and existing commercial greenhouse growers worldwide as well as research trials and product development for manufacturers of hydroponic products. Lynette authored five hydroponic technical books. Visit suntec.co.nz for more information.

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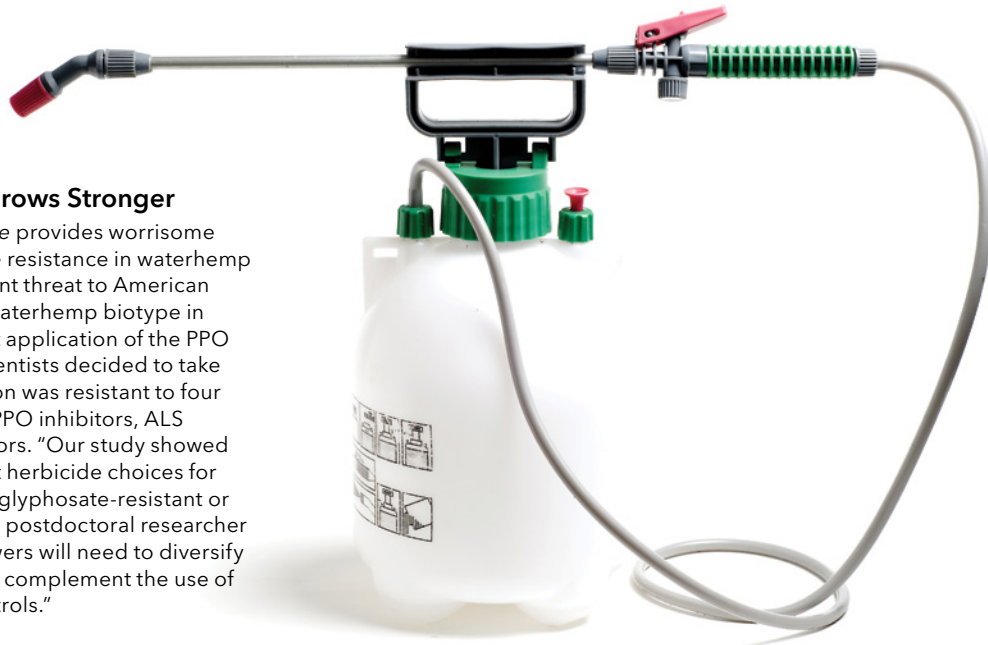


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Waterhemp Herbicide Resistance Grows Stronger

A research study in the journal *Weed Science* provides worrisome new details about the evolution of herbicide resistance in waterhemp – an annual weed that represents a significant threat to American Midwest corn and soybean crops. When a waterhemp biotype in eastern Nebraska survived a post-emergent application of the PPO inhibitor fomesafen, a team of university scientists decided to take a closer look. They discovered the population was resistant to four distinct herbicide sites of action, including PPO inhibitors, ALS inhibitors, EPSPS inhibitors, and PS II inhibitors. “Our study showed there simply are no effective post-emergent herbicide choices for the control of resistant waterhemp in either glyphosate-resistant or conventional crops,” says Debalin Sarangi, a postdoctoral researcher at the University of Nebraska-Lincoln. “Growers will need to diversify their approaches to weed management and complement the use of chemicals with cultural and mechanical controls.”

– phys.org

Combating Disease Affecting Brassica Crops

A team of Punjab Agricultural University and University of Western Australia researchers recently reported a breakthrough in disease resistance in Brassica crops. Brassica varieties are used for food, including broccoli, cauliflower, cabbage and – especially – oilseed crops for producing canola oil and mustard (the condiment). The researchers claim their findings will lead to advances that strengthen Brassicas against attack from Sclerotinia stem rot. This disease is particularly damaging to Brassica crops like canola and mustard, causing major yield losses. The study, recently published in the journal *Frontiers in Plant Science*, describes genetic markers associated with resistance against the Sclerotinia stem rot disease in *Brassica juncea* (Indian mustard). Professor Martin Barbetti from the UWA School of Agriculture says managing Sclerotinia stem rot could be achieved by the genetic resistance present within brassica crops: “Developing crops with greater disease resistance is the only effective avenue for long-term, cost-effective management of this devastating, worldwide pathogen.”

– ruralnewsgroup.co.nz



Poisonous Plants for Dogs

With lots of attention being given to CBD and dogs, the canine website rover.com published a lengthy list of 20 plants that are harmful to dogs. Just as dog owners wouldn't want their dog eating a few grams of cannabis, these plants will also have an adverse affect on Fido, starting with aloe vera, which is one of the most popular house plants. When dogs eat it, it will irritate the digestive system. Ivy is another common plant and when consumed by a dog, the animal could have difficulty breathing, a rash, or even go into a coma with paralysis, so make sure your pet can't access those leaves that sometimes dangle down from a bookshelf. Another plant that's poisonous for dogs is the jade plant. When dogs ingest jade leaves, they may begin vomiting, while their heart rate can drop. It will also make your dog depressed.

– rover.com





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Tomato Roots Can Remove Phosphate from Water

A PhD student from the University of Windsor has discovered that old greenhouse tomato roots are better than garlic, cannabis, and leek roots when it comes to cheaply removing phosphate from contaminated water. David Ure, who earned his undergraduate degree from Western University, says a field test in manure-contaminated water showed tomato roots could remove 71 per cent of the phosphate. Phosphates are used as plant fertiliser, but runoff can cause the water body to become choked with algae and other plants. Eutrophication deprives the water of available oxygen, causing the death of other organisms. Ure wasn't expecting much from the roots. Past research had used processed shrimp shells, but they were expensive, so he was looking for cheap material to chemically modify as a filter to capture phosphate. Tomato plants that grow hydroponically in recirculated, fertilised water are periodically cleared out of greenhouses to start a fresh crop.

– windsorstar.com



Wendy's Using Greenhouse-Grown Tomatoes

All Wendy's North American outlets are now using tomatoes grown in greenhouses. The fast-food chain, which includes more than 6,000 locations, shifted from field to indoor grown tomatoes in order to give customers fresher fruit in their burgers and salads. "We are excited about the superior flavours we can achieve with this change," says Dennis Hecker, senior vice-president of quality assurance for Wendy's. Wendy's uses a dozen greenhouse companies and hydroponic farms throughout North America, including the West Coast, Pacific Northwest, Southeast, and Great Lakes regions of the United States; eastern and western Canada; and Mexico as the fast food industry shifts to fresh ingredients. Tomatoes grown in a field are usually picked while still green and kept cool as they are transported across the country to protect them from spoiling and bruising. As a result, they often don't reach maximum ripeness.

– hortdaily.com



Snow White Strawberry Costs a Pretty Penny

Strawberries can be expensive but the Snow White strawberry will set you back a dollar... for one berry. The berry hails from Japan and when it matures, the surface seeds are round and turn red. It also has a white peel with white flesh. Over the past two years, the strawberry industry has been introduced to the Snow White variety, which is sweeter than regular berries. The reason for this is it's a winter variety and the cold makes for a longer ripening time, so it has more time to accumulate sugar, hence the sweetness. It gets its white appearance because the red strawberry pigment, anthocyanin, is absent in the white strawberry peel. Snow White strawberries cost more because of low production, about 698 pounds per acre, while high-yielding strawberry varieties can reach 1,466 pounds per acre.

– freshplaza.com



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★ **PROTEINS AND AMINO ACIDS** are essential during the peak metabolic stages of flowering. Bio Diesel contains special L-Amino acids which act as building blocks for protein synthesis, enhanced flower size and overall weight.

★ **COMPATIBLE** with all major programs Bio Diesel does not raise the PPM/EC or change the pH of your solution. It is compatible with all major nutrient programs including PK bloom enhancers.

★ **ORGANIC PHOSPHOROUS** in the form of fossilized Bat guano is instantly available to the plant and doesn't lockout with other minerals. Beneficial microbe populations are also increased and unaffected compared to detrimental mineral salts.

★ **HUMIC AND FULVIC ACID** for increased mineral chelation and enhanced nutrient cycling in both hydroponics and soils. These fatty acids make nutrients mobile in the plant and avoids nutrient lockout.



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1 | CO2Meter Safety Multi Sensor System (CM-7000)

The new CO2 Safety Multi Sensor System (CM-7000) series is the seventh version of CO2Meter’s renowned safety monitoring system. This wall-mounted device will feature expandable sensor capability with up to 12 remote sensors, 8-inch touchscreen display, configurable settings, and audible/visual alarms. The innovative device will be utilised for indoor growers and extractors for multi-point grow control and safety monitoring across the United States.

2 | CANNABOOST Accelerator

Get up to a 22 per cent sellable increase in bud yield from your fruiting and flowering plants in less flowering time with CANNABOOST Accelerator. It’s safe for use in soil, soilless, and hydroponic systems. In a recent research trial on tomatoes, CANNABOOST Accelerator increased bud yield by 22 percent. When used in combination with other CANNA base fertilisers, the product has a positive effect on root growth and overall plant development. CANNABOOST Accelerator is backed with a “100 per cent satisfaction guarantee.”

3 | Reiziger Bud Booster

Bud Booster was crafted in Holland more than 20 years ago for commercial growers to help medicinal plants build extremely large, crystal-laden colas indoors, outdoors, and in any medium. Reiziger Bud Booster is a chosen favourite for all short-cycle plant strains. The element-rich liquid is brimming with more than 90 different organic compounds including carbohydrates, gibberellins, auxins, cytokinins, phenols, vitamins, amino acids, and polysaccharides which help produce powerful blooms with a dense growth pattern and the desired combination of increased weight, colour, flavour, and potency.

4 | Bio Diesel Green Diamond A&B

Another excellent Bio Diesel product, Green Diamond is a two-part grow and bloom base that’s specially designed for hydroponic and coco fibre grow environments. It’s a complete base that’s rich in all micro- and macronutrients required for fast growth and flowering. It’s packed with natural chelates and organic plant metabolites, along with pure minerals of the highest quality. Bio Diesel has also added additional trace elements, B vitamins, fulvic acid, and other biostimulants that work exceptionally well in hydroponic and coco fibre media.



5

5 | CANNA Cannazym

Cannazym is an award-winning 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.



6

6 | FloraMax Flowering Enhancer

Featuring unique 3-in-1 performance, FloraMax Flowering Enhancer is an advanced PK additive containing calcium and iron that promotes vigorous blooms, heavy fruit, and more swell. Flowering Enhancer's heavy dose of calcium and iron serves to fulfill the role that 'CalMags' are meant to serve in nutrient regimes. Furthermore, this leading-edge formulation offers a unique pH buffering feature that locks pH in the reservoir below 6.5 in bloom, helping prevent common nutrient deficiencies, salt blockages, and lockout. Flowering Enhancer takes out some of the guesswork so you can focus on your atmosphere and growing environment.



7

7 | Cyco Ryzofuel

Ryzofuel is designed for both indoor and outdoor plants. It's an amazing root stimulator promoting explosive root growth that works well on mature plants, seedlings, trees, and bulbs. This product contains enzymatically digested Tasmanian kelp which retains naturally higher levels of cytokinins, auxins, and gibberellins. Among the many beneficial, quality ingredients are pure kelp (for plant stimulation), natural hormones, soluble potash, and more than 50 trace minerals. Ryzofuel encourages growth and closer internodal spacing. It's available in several sizes.



8

8 | CenturionPro Mini

CenturionPro's Mini is one of the most sought-after cannabis trimming machines on the market and packs quite the punch, replacing 15-20 human trimmers without sacrificing quality. With a processing capacity of 12-16 pounds (dry) per hour (60-80 pounds wet), the Mini is nothing but a powerhouse, and is perfectly suited for small-to medium-size operations looking to streamline their process. It has a Toro-hardened steel cutting reel featuring 11 high-quality blades. The Mini also boasts magnetic-blade technology, promising a consistently sharp blade and clean cut.



9 | Lucius LED 150W Grow Light

The Lucius LED 150W grow light is designed to efficiently provide maximum levels of light with minimum power consumption. The 150W Lucius LED grow light can achieve 1,200 $\mu\text{mol/s}$ (highest point before light saturation) without emitting excessive heat. Whereas, gardeners using HID light systems struggle to operate at that level due to heat emission. By using innovative LED technology, cultivators can ensure maximum light is achieved while eliminating the risk of burning plants.

10 | Cyco Supa Stiky

Cyco Platinum Series Supa Stiky is an additive designed to increase plant resin production and aid in fruit size, aroma, and quality. Supa Stiky will increase essential oil production in plants and heighten terpene and terpenoid use in the final four weeks of the bloom cycle. Supa Stiky is a plentiful source of 99.8 per cent pure magnesium, which is required to catalyze many enzymatic reactions within the plant. Supa Stiky is also a source of potassium and phosphate – key minerals used in fruit formation.

11 | Ed Rosenthal's Zero Tolerance 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 repellent, 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.

12 | 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 using fertiliser alone.



13 | Green Harvest Eco-Fungicide

A registered and proven BFA Organic product for the management of fungal diseases in roses, grapevines, geraniums, vegetables, and strawberries. Green Harvest Eco-Fungicide is effective against powdery mildew, black spot, pelargonium rust, and most mildews in vegetables and ornamentals. It's specially developed to control disease without impacting the biological balance of your garden and it is safe for good bugs and bees with no residual effect. Eco-Fungicide alters the pH and the osmotic balance of the leaf surface, inhibiting fungal spores from germinating and growing.

14 | California Lightworks SolarSystem 275

The SolarSystem 275 is an LED grow light suited for commercial, greenhouse, and personal growers. This full-spectrum light covers a 3x3-foot bloom area and a 5x5-foot vegetative area, while drawing a maximum of 200 watts. This LED grow light system provides all the benefits of programmable spectrum control, meaning an unlimited potential for all types of growing operations. Using all parts of the light spectrum focuses energy into wavelengths plants need to thrive and the SolarSystem 275 has minimal heat output and can be used individually or chained together.

15 | FloraMax OrganaBud

Simplify your life with class-shattering function and ease of use. FloraMax's OrganaBud is a carefully and fully stabilised, 100 per cent organic solution containing *Ascophyllum Nodosum* sea kelp extracts, humic and fulvic acids, vitamins and organics to provide a natural source of amino acids, gibberellins, cytokinins, auxins, and betaines... all in one bottle. But the best part: OrganaBud's class-leading 5-year shelf life and next level solubility translate to easy mixing and clean-up, equipment maintenance, and overall ease of use. You can also use this organic aeroponically.

16 | Ezi-Root Rooting Gel

Ezi-Root is a scientifically formulated rooting hormone that provides a superior strike of cuttings – both hardwood and softwood. This unique hormone formulation comes as a ready-to-use gel that's used directly (without dilution) to improve the vegetative cuttings of a range of plant species. In some propagation applications, the use of a premium gel like Ezi-Root can be advantageous, as the active ingredients (IAA, IBA, and fungicide) are retained at the base of a cutting for a longer duration, providing improved bioactivity and ultimately improved results.

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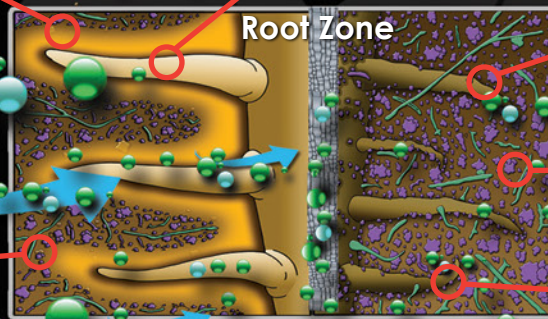


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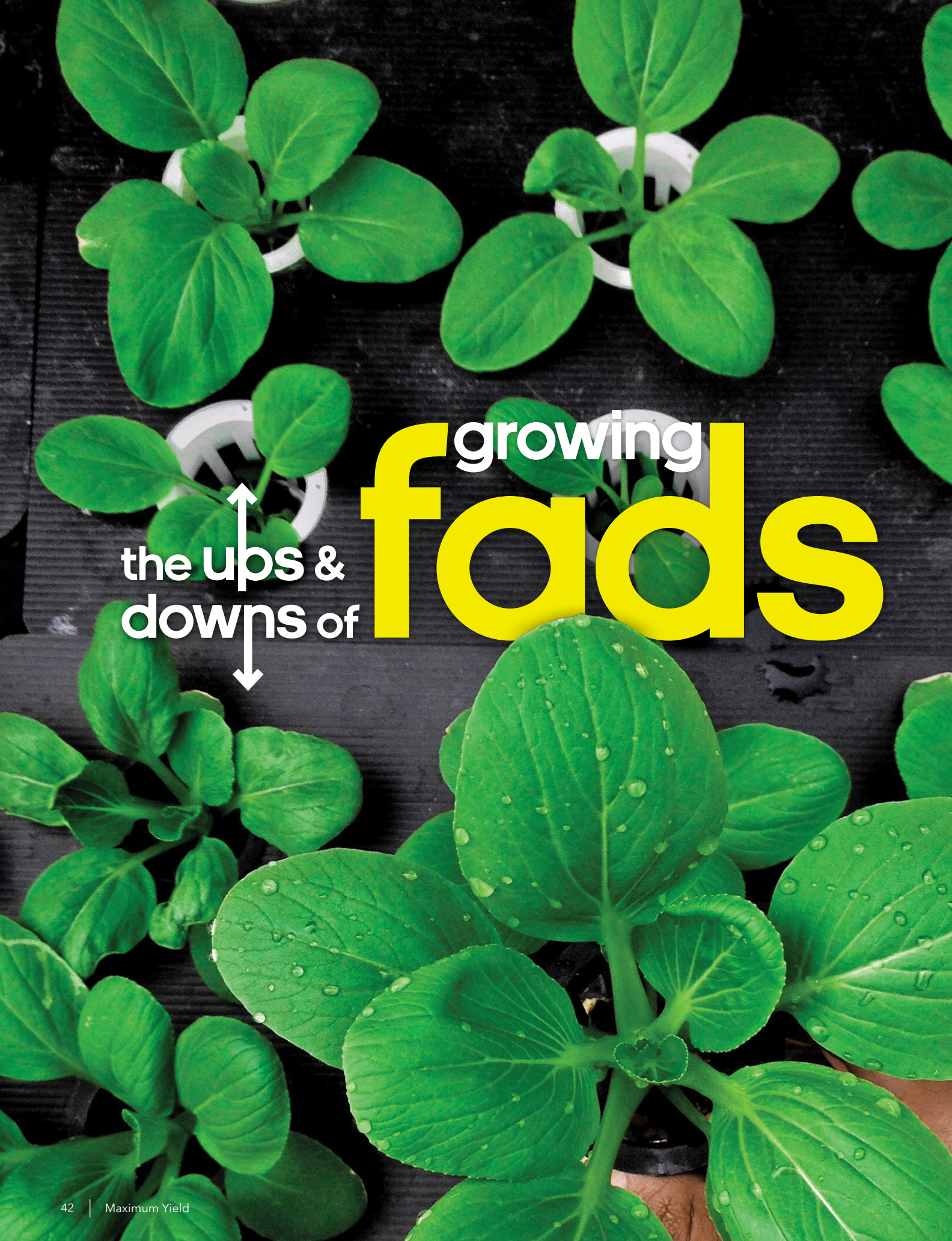
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**Eradicates
Brown Roots**

**Blocks Bacteria
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**Root Zone
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growing
fads

the ups & downs of



Gardens have seen their share of trends and fads over the years. Here's a fun look at the good, the bad, and the plain ugly.

by Alan Ray

Gardening has been around a long time, and gardens have seen no shortage of fads and fashions come and go over the years. From different crops to pest control methods, designs and layouts to the proverbial pink flamingo and garden gnomes, garden techniques, style, and care have gone through many notable transformations. Outdoors, growing practices like crop rotation and companion planting have respectively led to better soil health and solutions for natural pest control. Indoors, vertical farming and internet-connected plant monitoring systems such as the Internet of Things platforms and Machine to Machine technology have increased efficiency and productivity while decreasing environmental impact. Here's a look at some fads that had their moment in the sun before fading into the shade of history and some of the latest agricultural trends that seem destined to influence the way we garden today and tomorrow.

Trends of Yesteryear

Garden Types

Originating in England, the cottage garden is one gardening fad that has lost much of its popularity in recent years. Lovely in their naturally rugged way, cottage gardens are a hodgepodge of grasses and plants amidst a mishmash of multi-coloured perennials and herbs. They're generally set close around the house with an informal and seemingly casual design. With such a large variety packed into a small space, cottage gardens sometimes crowd out natural vegetation and require a lot of water. Naturally, there are some who still plant this style of garden (it's lovely surrounding a quaint stone cottage in England), but for many, it's a fad whose time has come and gone (plus cottage gardens can appear somewhat out of place in a yard sporting an aluminum-sided house).



Will you have a part in Victory?



"Every Garden a Munition Plant"

Charles Lathrop Puck, President

Another once-popular style of garden was the victory garden. Also known as war gardens, they were planted in the US, Canada, Australia, the UK, and other countries during the First and Second World Wars. Born out of necessity, victory gardens contained an amalgamation of fruit, vegetables, and herbs that helped reduce the strain on the public food supply during the lean war years.

Other gardens that have gone out of style include shade gardens and water gardens.

Gardening Techniques

In Thomas Jefferson's day, it was common practice to spread manure over the entire garden surface in preparation for the coming planting season. This trend was "poopular" well into the 20th century. Though it is still in use by some gardeners today, this trend faded for the most part with the advent of bagged fertilisers containing all the plant-specific nutrients needed to grow a healthy garden. Less mess with better results and no effluvium meant the spreading of manure over the garden floor became unnecessary.

Promoted by governments, victory gardens were born out of necessity to help feed the populace of a country at war.

"From different crops to pest control methods, designs and layouts to the proverbial pink flamingo and garden gnomes, garden techniques, style, and care have gone through many notable transformations."



Modern Day Garden Types

Raised garden beds are a popular trend these days. They afford gardeners a bevy of perquisites. There is less bending, better pest control management, and, if the bed is built right, potentially less weeding. Additionally, there is no trampling down of the garden soil while tending your plants, so you'll also realise more efficient drainage.

Another trend *Maximum Yield* readers will know well is hydroponics. The word "hydroponics" is a synthesis of the Greek words *hydro* (water) and *ponos* (work). Literally, let the water do the work. In a hydroponic garden, a plant's roots are submerged in a nutrient-infused water solution or a soilless medium such as stone wool, coco fibre, or perlite. Even though growing plants without soil has its roots in previous centuries, it didn't really catch on until late in the 20th century with the development of hydroponic and aquaponic systems for the home gardener. Up until then, the idea that one could grow edible plants and vegetables without dirt sounded a little crazy. However, the advantages of indoor hydroponic gardening are self-evident: increased yields without the digging, inclement weather, and dirt.

Finally, as more people with less space look for a way to continue gardening, vertical farming has come onto the scene. As with a hydro system, plants in a vertical farm are grown indoors in a controlled environment employing artificial lighting and no soil. Often, the entire operation is monitored electronically while adjustments to temperature, nutrient intake, and watering are all made instantly through a bank of electronic sensors. Of course, you can also grow vertically without all the electronic minutia.



Vertical gardening techniques continue to advance and evolve.

Gardening Techniques

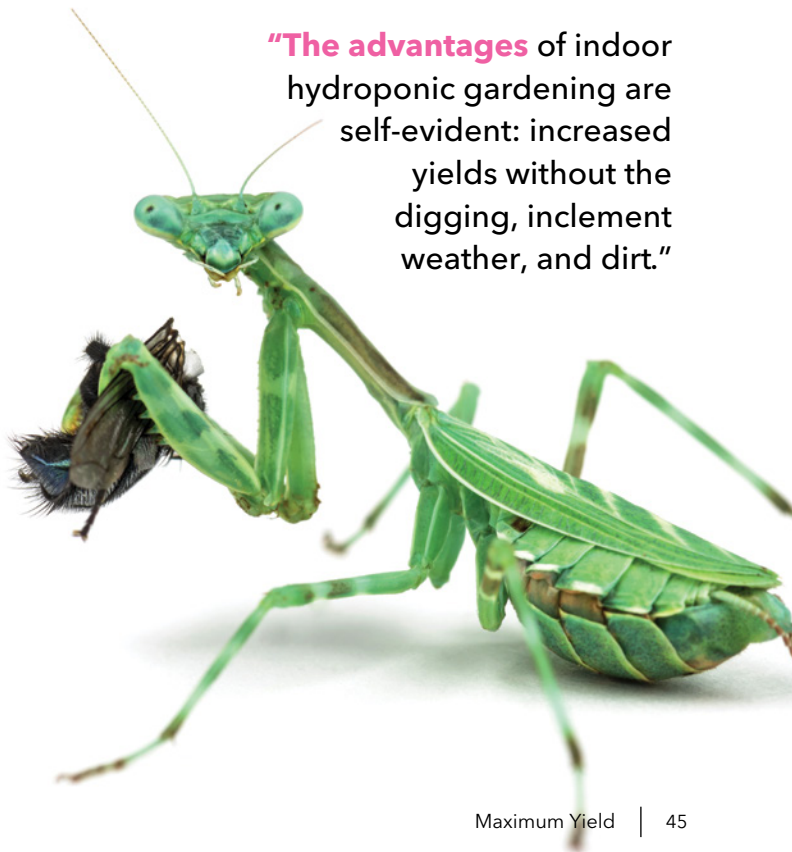
In an ever more health-conscious world, the use of chemical pesticides in the home garden is one trend that's on its way out. We need only look at the once ubiquitous insecticide DDT to know why this a good thing. Banned from agricultural use a few decades ago, the disturbing side effects of DDT are felt to this day in the form of human health scares and dangerous ground contamination. There is no downside to avoiding chemicals in the garden. The less chemicals used, the safer and healthier you and your garden will be.

Today, the upcoming trend is natural pest control using good insects to fight bad insects. For example, *Ichneumonidae* is a family of parasitic wasps that lay their eggs on or inside a host insect or the hosts' eggs. They prey on several insects including caterpillars, beetles, and flies, and their larva make short work of the bad bugs. Other beneficial bugs include lacewings, ladybugs, hoverflies, tachinid flies, minute pirate bugs, and damsel bugs. Growing certain plants helps attract these good bugs and repel a few harmful ones. A few examples include parsley, mint, some types of marigolds, lemon balm, dill, caraway, coriander, masterwort, Queen Anne's lace, crimson thyme, Peter Pan goldenrod, lavender globe lily, and fennel.

Crop rotation is also coming back in vogue. For years, it was common for gardeners to plant the same crop in the same plot year after year. However, this eventually depletes the soil of all its nutrients. With crop rotation, however, different crops are planted in a plot each year. The advantages of this old trend made new again include the promotion of healthy soil, better annual yields, and reduced erosion.

Garden fads and trends continually come and go, and there isn't enough time to try them all. So, find a few proven methods that benefit your garden and fit your lifestyle and you'll always be trending in the right direction. 🌱

"The advantages of indoor hydroponic gardening are self-evident: increased yields without the digging, inclement weather, and dirt."



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HARD OR SOFT H₂O

Know what's best for your plants



When growing indoors we often hear about hard water and soft water, but do you really know what the difference between the two is? It's worthwhile to look at exactly what hard water and soft water are, what their differing components are, and what positive or negative effects they have upon your plants and equipment, and why.

by Rich Hamilton

Hard Water: High Calcium and Magnesium Levels

Hard water contains a higher-than-normal concentration of calcium (Ca) and magnesium (Mg). These minerals have had a longer or greater exposure to mineral-rich rocks and soil as it flows naturally through rivers and waterways. It also increases the chemical reactive levels within the water in terms of pH, making it much more alkaline. Generally, whether you have hard water or soft water is determined by your geographical location.

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“

...the buds do not have a PGR look to them and they look natural almost organic in their structure... the bud sites are huge and filled with resin!

(USA Commercial consultant)

”

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“**The more calcium and magnesium in the water** will directly influence how much of the other nutrients, such as potassium and phosphorus, get locked out and not taken up by the plant.”

What impact do these higher concentrations of minerals have on your plants? Generally, the presence of more calcium and magnesium isn't the problem in itself — it's the balance between all the nutrient elements that can and does cause problems. The more calcium and magnesium in the water will directly influence how much of the other nutrients, such as potassium and phosphorus, get locked out and not taken up by the plant, causing deficiencies which in turn lead to undernourishment and growth problems. Further to this, the positive ions in the calcium and magnesium will serve to increase the pH of the feed solution and then any excess of CO₂ carbonates in the water will exacerbate this situation further, causing the pH to become more and more alkaline in not only the solution but in the medium itself. The harder the water is, the more acid is needed to bring the pH back down to a plant-friendly level.

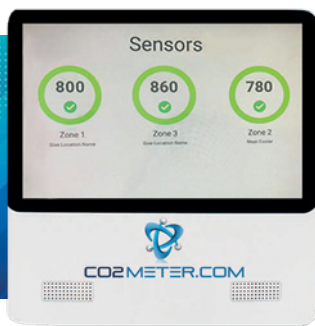
Maintaining Proper pH with Hard Water

So how do you combat this effect? Well, before you begin growing you should find out whether the water source you intend to use is hard or soft. You can do this by looking online as there are maps available that will show which areas have hard or soft water. You can also call your city services and ask. If you suffer with lime scale buildup in pipes, kettles, or other household appliances and systems, then chances are you have hard water. Measurement-wise, anything between 17.1-60 ppm is classed as slightly hard and shouldn't cause you any noticeable problems. You can buy strip tests online which, when dipped into a water sample, will change colour and the corresponding colour will tell you how hard the water is (like a pH test). In fact, pH is good indicator as to how hard your water is.

Ways to Deal with Hard Water

Hard water feeds are available from many of the big nutrient companies. They work by lowering the final pH of your feed but should only be used if you have very hard water, so a pH of 7.8 and above. If you use a hard water feed and your pH is still too high, you can use 'pH down' to reduce it further to the plant's sweet spot of 5.5-6.5. Just remember to not try and adjust your solution until all your other nutrients have been added.

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Another solution is using reverse osmosis on your water. This is a filtering system where the water is pushed through a set of membranes which have pores that decrease in size. This process removes calcium, magnesium, and other hard water culprits by blocking molecules over a certain size from passing through the membranes and so softens the water. Be warned, however, that this can be a costly process to run and maintain. If you are considering reverse osmosis for all of your water, it can also strip other nutrient elements from the water which could leave you with another set of problems if you use it too much.

Hard water may also impact equipment, where you will see a white chalky buildup of magnesium or calcium carbonate. This can accumulate quickly because the presence of heat within the growing environment creates an endothermic reaction in the solution, where the warmer it gets the more carbonate is created and deposited, creating blockages, restrictions, and, ultimately, underperforming or failing equipment. This is why hard water is not recommended for use in recirculation systems and such.


Ins and Outs of Soft Water

By contrast, soft water has had minimal exposure to rocks and earth that are rich in minerals, especially calcium and magnesium. It is water originating from surface pathways like rivers and streams where the basins are formed from hard, impervious rocks. Water can also be made soft via treatments like reverse osmosis and through using a water softener. Water softening is where hard water ions of calcium and magnesium are flooded with and replaced by sodium ions, which lowers the hardness of the water. This is a popular and useful treatment for clothes washing and bathing as it reduces the amount of chalky buildup in pipes and machinery. Soft water is not the best for human consumption or for feeding plants. In measurement terms anything below 17.1 ppm or a pH of 7.8 or below is classed as soft water.

Soft Water Feeds

Just as there are many feeds created especially for hard water, there are also feeds for soft water, however, just keep in mind soft water is not a problem in anywhere near the same respect as hard water. Soft, slightly acidic water provides perfect conditions for nutrient uptake in your plant

both by roots and by foliar feeding, and it causes no known problems to equipment, so unless your water is extremely soft and your pH is very low, a universal feed will do the job without any trouble. Universal feed works well in soft to mid-range hard water. If you do choose to use a soft water feed, then be aware your pH will already be low and soft-water feeds do not really affect the pH of the nutrient solution, so you will definitely need to adjust it yourself using 'pH up.'

Hopefully this has given you more of an understanding of your water source, why it is important to know what's in it, and how it can affect not only your plants but also your equipment and other nutrient elements. If you can do your research and testing to help get and keep the conditions as near to perfect as possible before you start growing, then you will have a sound foundation to build upon and you won't go too far wrong. 

“**Soft, slightly acidic water** provides perfect conditions for nutrient uptake in your plant both by roots and by foliar feeding.”

Get Snackin'

SALTY AND SAVOURY HYDRO CROPS

Whether you're sitting down with friends to watch a movie or you've got holiday guests over, impress everybody with some tasty snack foods you grew in your hydro garden.

by Dr. Lynette Morgan





Salty, savoury, and satisfying... Who doesn't love snacks? Some of the best are not only homemade but homegrown as well. Common snack-producing plants such as sunflowers, peanuts, pepitas, and pickles can all be grown hydroponically and thrive in warm, protected environments. Some, such as pickle gherkins (a variety of mini cucumber), are well known as hydroponic crops, whereas pepitas and peanuts are a little more unusual but worth the effort to obtain a highly flavourful snack-food harvest.

Pepitas

Pepitas, also known as pumpkin seeds, are not only considered a health food due to a high content of protein (30 per cent), good fats, fibre, zinc, niacin, iron, and magnesium, but once roasted and salted are a crunchy and delicious snack. Growing and preparing pepitas is not difficult provided the correct cultivars are selected to start with. Edible pumpkin kernels are only produced by particular varieties that develop dark green hull-less seeds inside the fruit's seed cavity. This means there is no tough outer seed covering to remove to get to the edible kernel. Hull-less varieties are also called oil seed types as the edible kernels can be pressed to extract a high-quality oil with a number of culinary uses. Once the pumpkin has been grown to maturity, the fruit are split open to reveal masses of hull-less kernels that only need to be scooped out, soaked, and rinsed to remove any remaining pumpkin flesh, then dried for storage. Many seed companies stock both modern hybrid and older heirloom hull-less pumpkin seed varieties for pepita or oil seed production, however, a good choice for hydroponics is Naked Bear F1 or Kakai.

Growing pepitas in hydroponics is similar to any other fruiting crop — the main requirements are warmth (18-26°C), high light levels similar to tomatoes and cucumbers, and sufficient space.

“Common snack-producing plants such as sunflowers, peanuts, pepitas, and pickles can all be grown hydroponically.”

Like melons, pumpkins can be trained upwards to maximise space in an indoor garden provided the heavy fruit are supported as they develop, or they can be left to trail along the floor. Each plant should provide multiple pumpkins, depending on how long the vine is permitted to develop. Electrical conductivity levels for pepitas are similar to cucumber crops and these are easily grown alongside each other in the same system. An EC of 1.8-2.4 and pH of 5.8-6.0 with extra potassium provided during the fruit development stage is ideal.

Substrate systems with good sized root volume such as the Bato bucket system suit pepitas and the crop responds well to a moisture-retentive substrate such as coconut fibre.

Peanuts

Peanuts are a small, compact legume plant that performs well in hydroponics provided the correct conditions and substrate are provided. Peanuts are easily started from seed and there are a number of interesting and potentially gourmet-flavoured types that smaller growers can experiment with to obtain the ultimate snack crop. Of the commercially grown peanut types there are four main groups: Virginia (largest seeds), Runner (used for peanut butter), Spanish (smaller seeds for snacking), and Valencia (bright red with a sweeter flavour that performs particularly well in hydroponics). There are also a number of heirloom and speciality types available from some seed companies. To obtain peanut planting stock, purchase raw seed that is still contained in its outer husk or pod, as this prevents drying out, and shell these just before planting out. Large, plump, raw (non-heat treated) peanuts, free of any signs of deformity or rot, are best selected for seed and germinated on a heat pad or at 22-29°C. The essential step with growing peanuts is to surface sterilise any nuts used as seed or treat with fungicide powder as these are prone to fungal attack during the germination stage and "damping off" disease as young seedlings.

Top: Pepitas, sunflower seeds, and peanuts all make great hydroponic snack crops.

Middle: Peanuts are a legume crop that produces underground pods.

Bottom: Hydroponically grown peanuts in a drip irrigated substrate system.

The peanut plant produces its pods on the ends of pegs — long stems that develop from the aerial portion of the plant after flowering and self-pollination — then burrow down under the growing media to develop the young fruit (peanut seeds inside brown pods).

For this reason, hydroponic systems for peanut plant production need to have substrate that is soft, friable, and light with the surface under the plant exposed for the pegs to grow down into. Finer grades of sterilised coconut fibre or blended coconut fibre and perlite make ideal substrates for this crop. Peanut plants need a warm growing environment with reasonably high light levels for maximum growth, and good air flow up and under the crop as damp conditions favour fungal pathogen development. A well-grown peanut plant can have up to 40 pods, so a growing container or bed that holds at least two gallons of media is required when growing hydroponically. A standard vegetative nutrient formulation followed by a higher potassium fruiting formulation during the pod development phase at an EC of 1.2–1.6 is ideal under good growing conditions. Outdoor peanuts are harvested when the foliage begins to turn yellow and die back, however, in a hydroponic system it is possible to dig back some of the growing substrate, observe the development of the young pods, and determine when the peanuts are large enough to harvest. Harvested peanuts then need to be dried inside the pods in a warm place for about four weeks before they can be stored.

Pickles

The small pickle cucumber, or gherkin, is a more compact plant than the seedless European cucumbers commonly grown hydroponically and produces large numbers of crisp, seedless, and mild fruit that can be eaten fresh or

processed in a spiced pickling solution to make an addictive snack. There is a wide selection of gherkin seed to select from, including varieties of green- and white-skinned types, however, the main characteristics to consider with hydroponic crops are compact plant size, wide disease resistance (particularly to mildew), parthenocarpic plants (fruit set without the need for pollination and with no seeds inside), size, and shape. Pickling cucumbers need sufficient warmth (15–28°C), moderate to high light levels, and can be intercropped with tomatoes, capsicum, and other heat-loving crops. Since gherkin plants are smaller than other cucumbers, they can be grown

“**Some keen pickle makers**

also grow various hydroponic herbs and spices to add to their jars of pickles for additional flavour, the most common being dill for the famous dill pickle flavour.”

two to three plants per planting space and trained upwards and along strings for wires. Nutrient solutions should begin on a standard vegetative formulation at a moderate EC of 1.8–2.2 and pH of 5.8. This should then be switched for a fruiting formulation with higher potassium levels for maintenance of good fruit quality as soon as the first tiny fruitlets have formed, and maintained until the crop is finished. Under hot growing conditions, the EC can be dropped back slightly, particularly if the plants are wilting under overhead lights. Cucumber vines are largely indeterminate, so they need to be carefully trimmed and trained to prevent them taking over the entire growing area; growth can be directed upwards to an overhead support and then downwards again so the maximum number of fruit can be obtained from a minimum of vertical space.

The small fruit only take a few days to develop to a suitable pickle size once flowering has occurred and need to be harvested frequently. Fruit can then be stored in the refrigerator until enough



From the Top: A number of heirloom and gourmet peanut types are available that perform well in hydroponics; Choosing gherkin varieties with mildew resistance is advisable to avoid common disease problems; Hydroponic pickles come in green and white varieties of mini cucumber or gherkin; Sunflower plants grow well in a moisture retentive substrate with frequent irrigation.



have been gathered to make the jars of pickles. Some keen pickle makers also grow various hydroponic herbs and spices to add to their jars of pickles for additional flavour, the most common being dill for the famous dill pickle flavour. However, hot chillies, lime leaves, basil, tarragon, and garlic can all be added to the pickle liquid to give a unique flavour.

Sunflowers

Sunflower kernels are another popular snack that can be eaten raw or roasted and salted, and have the advantage of also producing an attractive bloom to brighten up any growing space. Sunflower seeds may also be germinated and eaten raw as sprouts. As with pepitas, cultivar selection is vital and choosing a variety with extra large, easy-to-crack seeds will make snack preparation much easier on the fingers. Varieties such as super snack hybrid have been developed for edible kernel production and produce plants

Top: Sunflowers not only produce an attractive bloom but edible seed kernels as well.

Bottom: Sunflower sprouts are another healthy snack that can be grown hydroponically.

that are not overly tall. Sunflowers, like other snack crops, prefer a warm, high light environment and will grow rapidly at 22-31°C. Plants generally don't need support and are best grown in small groups to maximise space. Sunflowers have a strong root system, large leaves, and require high volumes of water, so are best grown in a moisture retentive substrate with frequent irrigation. EC levels in the range 1.8-2.0 with a pH of 6.0 are ideal. Once the flowers form, they should be left on the plant for several weeks to allow the seeds to develop in the centre of the head; once this has occurred the stem can be cut and the flower hung upside down to further dry before the seeds are removed for hulling.

Hydroponic snack crops provide some exciting opportunities to expand the options of home-grown produce and provide some truly unique taste sensations. Most of these crops are fairly similar to commonly grown hydroponic produce, so don't need a lot of extra care or modifications, but do provide something just a little bit different to experiment with. 🍷

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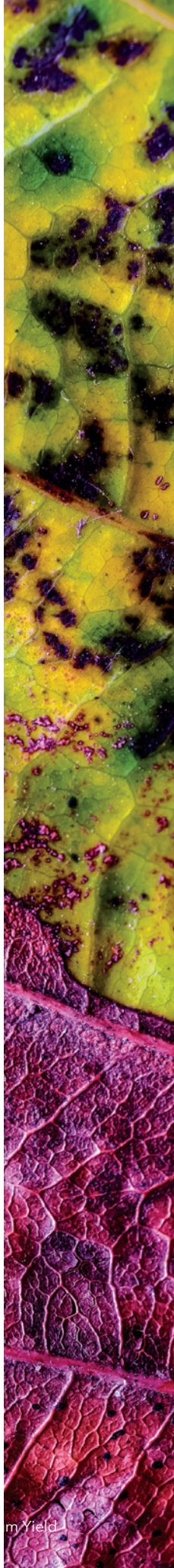
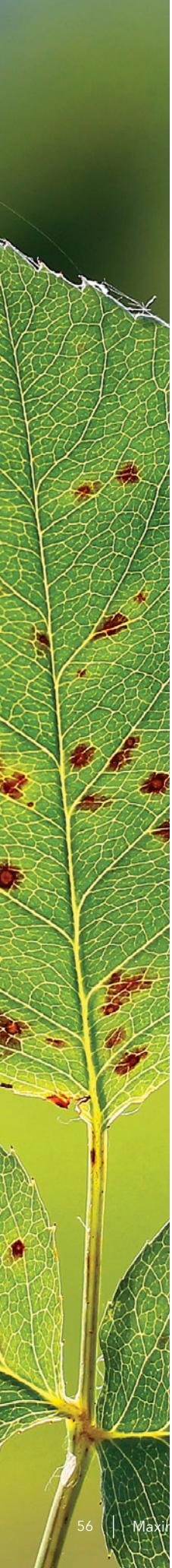
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PEST + PATHOGEN prevention

by Eric Hopper

There is an old saying: “an ounce of prevention is worth a pound of cure.” This is so true for indoor horticulturists. Preventing pathogens and pests that could destroy an otherwise healthy crop is something every indoor horticulturist should focus on, says Eric Hopper.

Using pest prevention tactics is arguably the most important step a grower can take to defend a growroom. Although using preventative methods is not a guarantee against all pest insects and pathogens, it is sure to reduce the likelihood of problems and automatically puts the grower in a better position to combat a problem if one does arise. Indoor growers should cope with pests and pathogens using prevention, identification, and treatment. Prevention is the first logical step against pest insects and pathogens. Then, before any sort of treatment is administered, an indoor gardener must identify the problem correctly. Once the issue has been positively identified, a gardener can research and implement a treatment.

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“IN MOST SITUATIONS, GENERAL PREVENTION IS A GROWER’S BEST DEFENSE AGAINST A PEST INSECT OR PATHOGEN *problems.*”

PREVENTING PATHOGENS AND PEST INSECTS

In most cases, both pathogens and pest insects are preventable. To prevent pest insects and pathogens in an indoor garden, a horticulturist needs to understand how most insects and pathogens get introduced. In most situations, general prevention is a grower’s best defense against a pest insect or pathogen problems.

Intake Air Filtration/Air Purification

Perhaps the most common way pathogens and pests enter a garden is through the fresh air intake. Gardeners inadvertently draw pathogens and insects into their gardens from the outdoors when the conditions are right. Molds, bacteria, viruses (by way of an insect vector), and pests can easily be brought into a garden room from the outside through an unfiltered fresh air intake.

A few examples of destructive fungi that are transmitted through the air include powdery mildew, black spot, and botrytis. Under the right conditions, these opportunist fungi quickly cause problems to otherwise healthy plants and have the capacity to destroy an entire crop in a short period of time. Since the spores of these fungi are invisible to the naked eye, they are often overlooked by inexperienced indoor horticulturists. If a crop contracts one of these destructive fungi, it takes serious work to eradicate the issue entirely. As with most problems that can occur within an indoor garden, prevention is key.

By using an intake air filter, a gardener can remove many of the spores and pest insects that could end up in the growroom. High efficiency particulate arrestance (HEPA) filters offer some of the best protection against pest insects and spores. When designing a ventilation system for an indoor garden, it is important to consider filtration for two reasons. First and foremost, air filtration will greatly reduce the likelihood of pests and pathogens and should be budgeted into the ventilation system. Secondly, depending on the specific filter, the filter will alter the rate at which the fan can move air. This is important to consider because mechanical fans are rated by cubic feet per minute (CFM). Growers use a fan’s CFM rating to determine if the fan will be powerful enough to adequately exchange the air in the garden.

Since filters reduce a fan’s CFM, growers must take this into consideration when designing their ventilation systems.

In addition to intake filters, air purification systems can be installed within a growroom to eliminate spores and bacteria. Air purification systems are one of the best preventative devices available to indoor horticulturists. Photocatalytic air purifiers are probably the most effective at eliminating air-borne pathogens but are more expensive.

General Cleanliness and Sanitation

An easy yet very effective preventative measure against pests and pathogens is general cleanliness. Dead or rotting plant material, used soil, and stagnant water are ideal breeding grounds for many molds and pests. In addition to keeping a tidy grow area, it is wise for a grower to clean herself before entering the growroom. It is not a good idea for a grower to enter a growroom right after visiting a friend’s garden or doing yard work. Some professional gardeners have changing rooms with designated growroom attire. Designated clothing for indoor horticulture may sound somewhat extreme, but gardeners who understand the power of prevention tend to make the most successful growers.

Temperature and Humidity Control

Another important prevention tactic that protects against a wide variety of pathogens is proper atmospheric control. Put another way, maintaining a proper growing atmosphere will help prevent unwanted visitors. The temperature variance from the lights-on cycle to the lights-off cycle is an important factor to consider. Keeping the temperature variance between 5.5-8°C from the lights-on period to the lights-off period will reduce the likelihood of condensation. This will automatically prevent many molds or fungi from having the proper environment to grow and, therefore, prevent them from ever affecting the garden. Although a vegetative room can withstand higher humidity, a general rule is maintaining a humidity level of under 60 per cent. This is especially important for the later stages of the flowering period. High humidity is a breeding ground for molds and fungi.

IDENTIFICATION – MONITORING FOR PEST INSECTS

As previously mentioned, positive identification is very important when dealing with pests or pathogens. Early detection and positive identification can mean the difference between a simple fix and total infestation. Yellow and blue sticky traps are great tools for monitoring an indoor garden for pest insects. Sticky traps are like fly paper in that they catch insects in a glue-like substance. These traps can be hung above the plants or set just above the soil at the base of the plants. By closely examining the sticky traps a gardener can see which pest insects are present, if any. Daily monitoring of sticky traps will help a grower identify if, what, and where a problem is occurring.

POSITIVELY IDENTIFYING THE PEST INSECT OR PATHOGEN

Positively identifying the pest insect or pathogen early on is vital to stopping the problem before it's catastrophic. When monitoring the sticky traps and the plants themselves, there are some tell-tale signs that will indicate the specific pest or pathogen a gardener may be dealing with.

Spider Mites

The first sign of a spider mite problem usually shows up in the form of yellow speckling on the surface of the leaves. Closer examination of the leaf bottom will reveal clusters of spider mites and their eggs. In more extreme infestations, webbing may be found in between or on the tips of branches and leaves.

Fungus Gnats

A tell-tale sign of a fungus gnat problem is the small, mosquito-like black or gray insects that fly around aimlessly. They are most prevalent right after watering or when the soil is disturbed.

Thrips

The first sign of a thrip problem is usually the shiny streaks showing up on the surface of the leaves. The shiny trails are the areas on a leaf where the thrip larvae have been feeding. To the naked eye, thrip larvae resemble fast-moving grains of rice. The larvae can be many different colours but are generally yellowish-green.

Mealybugs

The first sign of mealybugs is usually cotton-like, fluffy masses found in the crotches or joints of the plant. These cotton balls are clusters of slow-moving mealybugs.

Scale

The first sign of scale is typically a protective covering or bumps on the plants' stems and stalks. The females lay eggs underneath the protective covering. After one to three weeks, the eggs hatch and the newly-hatched nymphs leave the protective covering to move around the plant and feed. Nymphs insert their piercing mouthparts into the plant and begin feeding, gradually developing their own protective covering as they turn into immobile adults.

Powdery Mildew

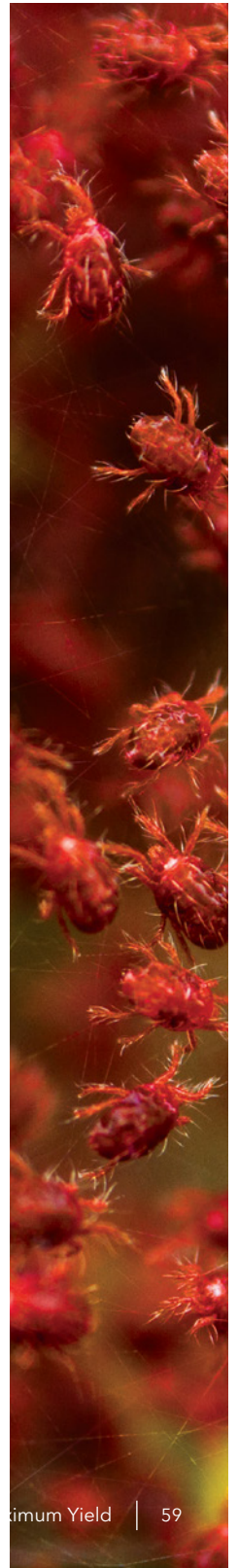
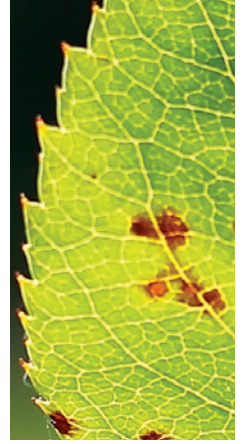
Plants infected with powdery mildew look like they have been sprinkled with white flour. Powdery mildew usually starts off as small, circular spots on the leaves, but can also be found on the stems or flowers. In some cases, powdery mildew causes the leaves on a plant to twist, break, or become distorted. Eventually, the white spots spread and cover the majority of the leaf's surface. If left untreated, powdery mildew will greatly reduce the yield and quality of the harvest.

TREATMENT OPTIONS

No matter how clean a grower keeps an indoor garden or how hard she tries to prevent unwanted visitors, chances are, at some point, she will have to deal with pests or pathogens. Before running out and buying an arsenal of treatments, a grower must positively identify the problem. Growers who take the time to research the pest insect or pathogen and positively identify what it is and where it is in its life cycle will have a better chance of successfully treating the problem. Once a pest insect or pathogen is positively identified, a grower can weigh his or her options for treatment.

But remember, prevention is key when it comes to pests and pathogens. Don't let them in and you hopefully won't need to deal with an infestation in your growroom. ☺

“POSITIVELY IDENTIFYING THE PEST INSECT OR PATHOGEN EARLY ON IS VITAL TO STOPPING THE PROBLEM BEFORE IT'S catastrophic.”



THE SCIENCE BEHIND companion PLANTING

by Monica Mansfield



Not all traditional companion planting recommendations hold up to modern day science, but some do. Monica Mansfield pored through numerous studies to shed light on what works and what doesn't in the garden.

If you ask a group of gardeners what they think about companion planting, you're bound to get a mixed response. Some swear by the traditional practice and follow the recommendations religiously in their own gardens, while others dismiss it as nothing more than "garden woo." As with most things, the truth lies somewhere in the middle.

Companion planting is the practice of planting crops together that have a mutually beneficial effect on one another. For example, many gardeners plant garlic throughout their garden to deter pests and studies have shown this to be an effective strategy.

A well-known example of companion planting is the Three Sisters garden, which was practiced by some Native American tribes in North America.

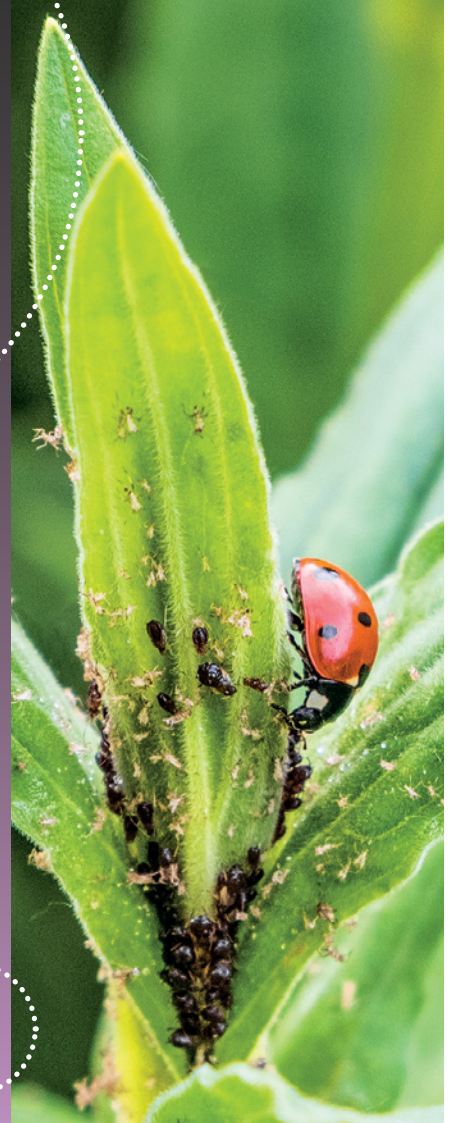
They would plant corn, beans, and squash together. The beans would fix nitrogen from the air and help feed the corn, which is a heavy nitrogen feeder. The corn would act as a trellis for the beans, and the squash would spread over the ground helping to suppress weeds and deter racoons from eating the corn.

Many of the traditional recommendations and companion plant lists come from the observations and experiences of past gardeners, mythology, and the occult, but they rarely give the reasoning behind their recommendations. As more scientific studies are performed, we are finding that some of these beneficial plant associations can be proven and explained by science, while others have been disproven and dismissed.

In an effort to distance themselves from the supernatural aspect of traditional companion planting, many scientists prefer not to use the term companion planting at all, instead using terminology such as plant associations, mutual climate cooperation, intercropping, trap cropping, nurse cropping, and symbiotic nitrogen fixation.



“ONE OF THE BEST WAYS TO CUT DOWN ON PESTS IN THE GARDEN IS TO encourage BENEFICIAL INSECTS TO CALL YOUR GARDEN HOME BY PLANTING THEIR FAVOURITE FLOWERS.”



Some of these techniques can be used to manage pests in the garden. While it isn't likely that any of these techniques will rid you of pests completely, they will help you build an ecosystem in your garden that is more favourable to beneficial insects and doesn't lay out an all-you-can-eat buffet for the harmful ones.

Beneficial Insect Attractors

One of the best ways to cut down on pests in the garden is to encourage beneficial insects to call your garden home by planting their favourite flowers. There are many beneficial insects you can attract, but ladybugs and parasitic wasps are two of the best.

Ladybugs eat aphids, mites, mealybugs, whiteflies, and scale insects. They can eat up to 1,000 aphids in their lifetime. They are attracted to dandelions, dill, coriander, and alyssum.

Parasitic wasp larvae eat aphids, beetle larvae, bagworms, cabbage worms, Colorado potato beetle, corn ear worms, cucumber beetles,

cutworms, gypsy moth caterpillars, Japanese beetles, leaf-miners, mealybugs, Mexican bean beetles, moth caterpillars, sawfly larvae, scale, squash vine borers, tent caterpillars, tobacco budworm, tomato hornworm, and whiteflies. Plant marigolds, zinnias, yarrow, white clover, cosmos, thyme, rosemary, dill, and lavender to attract them to your garden.

Trap Crops

For the pests that your beneficial insects leave behind, plant trap crops to lure them away from your main crops. Many studies have shown trap crops are an effective way to manage pests in the garden, however, the technique must be managed properly or else the trap crop becomes nothing more than a pest nursery and can do more harm than good.

The key is to find a trap crop that is more appealing than the crop you are trying to protect, plant it at the right time so that pests infest the trap crop before the protected crop is available,

and then treat or dispose of the trap before the pests move onto other plants in your garden.

For example, nasturtiums will attract aphids away from other crops. In California, the need to spray cotton fields for Lygus Hahn was almost completely eliminated by using alfalfa trap crops. Snap beans have been successfully used as a trap crop to control Mexican bean beetles in soybeans.

Intercropping

Intercropping is when you plant two or more crops together that have a beneficial effect on one another. The practice can create more biodiversity in your garden which has been proven to effectively manage pests. If a pest finds a crop they like in a monoculture setting, they just hop from plant to plant. However, in a polyculture, where different plants grow together, the variety makes it harder for the pests to find their favourite crops for dinner.

“ALTHOUGH INTERCROPPING HAS BEEN USED SUCCESSFULLY FOR centuries AND SCIENCE CONFIRMS SOME OF THE APPLICATIONS, THE TECHNIQUE CAN HAVE DRAWBACKS.”



One study's results suggest that intercropping garlic or undercropping Chinese chives is an effective pest management technique for strawberry crops.

Another study confirmed that alliums effectively suppressed Fusarium wilt in cucumber seedlings. The scientists were trying to understand the mechanism behind the results and, although still not entirely understood, they believe it has to do with the microorganisms in the allium's rhizosphere.

Gardeners have used marigolds to repel pests in their gardens for generations. Current studies show that this is effective in some cases and not in others. One study intercropped marigolds with tomatoes and found it to be effective against whitefly as long as the marigolds were planted when the tomatoes were very young. However, another study proved them to be ineffective at protecting carrots from the carrot fly. The same study did show, however, that interplanting young onions with carrots helped to manage carrot fly populations, but once the onions started to form bulbs, the benefit was removed.

Although intercropping has been used successfully for centuries and science confirms some of the applications, the technique can have drawbacks. If you plant your crops too closely together, they will compete for nutrients which can have a negative impact on your harvest. Proper spacing is still important in polyculture if you want your plants to thrive.

Biochemical Insect Suppression

Scientists are still trying to understand the mechanisms behind why some plants help to manage pests. Although they don't have a complete understanding, they are starting to put the pieces together. One hypothesis suggests that some aromatic plants contain volatile oils that interfere with pests feeding, distribution, and mating, which results in lower pest populations. Plants such as neem contain chemicals that have been proven to repel pests and treat fungal disease. Pyrethrum is a well-known botanical insecticide that comes from certain daisies. Basil has been shown to successfully repel thrips in tomatoes.

While these studies make a case for companion planting, other studies have proven other pairings to be ineffective. For example, research has shown that marigolds and mint do not repel the onion fly or cabbage root fly as once thought.

Symbiotic Nitrogen Fixation

Legumes are nitrogen fixers, meaning they can convert nitrogen from the atmosphere into food for themselves and can then feed other plants around them. They feed other plants in three main ways: their leaf litter will feed the soil when they die and decompose, their root exudates feed the surrounding soil, and soil microbes will take nitrogen from them and feed nearby plants via mycorrhizal networks.

Some studies have shown that the major benefit of these nitrogen fixers only comes once they die and decompose, returning nitrogen to the soil. Others show that they do indeed supply a substantial amount of nitrogen to surrounding plants, which also seems to be related to higher microbial populations in the soil. To be sure you're getting the benefits, you can follow heavy nitrogen feeders such as corn and tomatoes with a crop of peas or beans and then let them decompose and feed the soil where they are planted.

Mutual Climate Cooperation

When designing your garden layout, you always want to remember that in order to be healthy, plants need nutrients, sunlight, water, and the proper pH in the soil. Plants that do well in the same pH zone will grow well together. Shade loving plants will grow well next to tall plants that block the sun for part of the day.

Nurse crops can be used to shield smaller plants from harsh conditions while they grow. By planting seeds and starts next to larger plants that will be pulled by the time the small plants grow larger, the nurse plants will protect the babies from harsh sunlight and can act as a windbreak.

Companion planting can be used as a tool to help manage pests in your garden, but should be viewed from a scientific perspective. Not all traditional companion planting recommendations hold up to modern day science, however, some do and can be an asset to your garden. It's important to keep this in mind when reading traditional companion planting charts and manuals. Keep a healthy skepticism, read the science, and plan your garden accordingly. 🌱

“NOT ALL TRADITIONAL COMPANION PLANTING RECOMMENDATIONS HOLD UP TO MODERN DAY science, HOWEVER, SOME DO AND CAN BE AN ASSET TO YOUR GARDEN.”



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GROWING MULTIPLE CROPS in a Growroom

As we know through nature, plants are stronger and healthier in a permaculture environment. As technology becomes better, a multi-crop growroom is now attainable for the hobby grower, though patience is required.

by Kent Gruetzmacher

As indoor gardening continues to progress as both a science and artform, it borrows ideas from a variety of sources. For sustainably minded cultivators, the natural world provides an excellent blueprint to mimic for indoor agriculture. There are some interesting ways in which indoor growers can benefit from imitating Mother Nature — foremost of these is the practice of planting multiple crops in a growroom. The benefits primarily have to do with optimising grow conditions and developing resistance to pathogens.

The process of poly-cropping an indoor garden stands in stark contradiction to most commercial agriculture practices where industrial farms plant massive swaths of monocrop fields. As we are beginning to understand, this popular form of industrial agriculture is inefficient, unnatural, and unsustainable. Monocrop fields simply do not exist in nature. Planting massive swaths of monocrop fields presents risks to the environment as well as the crops. Of these risks, it is well known that planting a singular species of plant in the same area year-after-year will leach the soil of nutrients, consequently stifling food production. Likewise, single crop fields are far more at risk from pathogen attacks than more biodiverse operations.

Permaculture gardening is the concept of using the most natural and suitable plant species for a specific environment in order to grow crops. This forward-looking school of thought has some fascinating implications in modern crop production, including controlled environment agriculture (CEA). Like in nature, permaculture gardening also seeks to create entire ecosystems by establishing diverse plant species in a garden. According to regenerative.com, "Permaculture gardening promotes biodiversity. It seeks to maximise the number of productive species of plant within a plot, not only to offer the gardener a diverse and vibrant number of crops to harvest for the kitchen, but also so that the ecosystem itself is strong, with different plants performing different functions so that all can thrive."



On the flipside, indoor growers also have the rare ability to build an environment around chosen plant species. This notion stands in stark contradiction to outdoor growing, where gardeners are wholly at the mercy of Mother Nature. As such, the enterprising indoor grower can recreate nearly any cultivation environment on Earth if so chosen! This idea includes producing your favourite crops in a symbiotic, permaculture ecosystem. Have fun with designing your dream garden. If you live in the northern US or Canada, why not try growing a tropical permaculture garden in the dead of winter?

If you are interested in developing a permaculture garden indoors, it may take months or years to understand exactly how your ecosystem is coming along. Therefore, be patient and attentive with your garden; in time you can come to understand how the various plant species benefit one another.

“**Permaculture gardening** is the concept of using the most natural and suitable plant species for a specific environment in order to grow crops.”

For many, the thought of developing a complex permaculture ecosystem within the artificial environs of the indoors may seem superfluous. Largely because, as in nature, these gardens generally take years to mature into a functioning, symbiotic bio-network. Attempting to power a “forest-like” garden with grow lights may seem like a fool’s errand. However, permaculture practices are already gaining major traction with hobbyist greenhouse growers. Also, LED lighting and the use of supplemental sunlight from windows and skylights makes permaculture more viable for indoor gardens. For those inquisitive cultivators interested in permaculture gardening, or simply growing multiple crops in a growroom, here are some points of wisdom to take home.

OPTIMISING CONDITIONS

Planting multiple crops in a growroom affords horticulturists the ability to understand what crops do best in specific artificial environments. To this end, indoor gardening is still a relatively new practice. Every growroom has unique environmental constraints that affect plant growth. Therefore, through a process of trial and error, growers can optimise their given cultivation environment with plants best suited for the conditions at hand. In time, they can build this collection of plant species into a hearty garden that serves as a healthy food source.



PATHOGEN RESISTANCE

As any experienced cultivator knows, bugs, mold, and disease can hinder any garden operation, both large and small. Certain varieties of pathogens prefer certain plant species. Entire crops can be destroyed if they encounter a particular insect species or variety of mold. It is well known that aphids can abolish a plot of leafy greens in a matter of hours. Similarly, powdery mildew is known to plague strawberry crops in both greenhouses and fields. Yet, it’s possible to insulate your crops from such pathogen attacks by diversifying the plant species present in your garden.



more vulnerable to aphids can help insulate your garden from the potential decimation of a single insect. Expanding beyond such simple practices and delving into permaculture, a much more sophisticated approach is required in understanding natural plant communities in relationship to pathogen resistance.

As the indoor gardening space evolves with inspiration from Mother Nature, it will be interesting to see what new developments arise. It can't be denied that CEA growers are at the forefront of redefining our global food systems through such practices as vertical farming and aquaponics. Within this movement, where artificial cultivation environments are built

“Cilantro, dill, and fennel are known as aphid-resistant plant species, and can even help deter aphids from attacking a garden.”

By planting a variety of crops in a growroom, be it by simple mix and match or permaculture design, growers create a natural barrier against total infestation. Cilantro, dill, and fennel are known as aphid-resistant plant species, and can even help deter aphids from attacking a garden. As such, planting these in conjunction with those varieties

exclusively to mimic Mother Nature, it's evident that permaculture gardening has its place. Yet, it remains to be seen how such complex biological systems

can be utilised more efficiently within the confines of indoor growing. Moving forward, the practice of planting multiple crops in a growroom can at least help insulate gardens from some of the downfalls of monocrop gardening. Even better, it gives the hardworking grower the ability to harvest a variety of food choices on a regular basis. 🌱

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Founded in 2015, **MediPharm Labs** is a pioneer in the cannabis industry and has the distinction of being the first company in Canada to become a licensed producer for cannabis oil production under the Access to Cannabis for Medical Purposes Regulations (ACMPR) without first receiving a cannabis cultivation licence. This expert focus on cannabis concentrates from current Good Manufacturing Practices and ISO standard clean rooms and critical environments laboratory allows MediPharm Labs to work with its established cultivation partners to produce pharmaceutical-grade cannabis oil with a competitive advantage. MediPharm Labs is research-driven and focused on downstream secondary extraction methodology, distillation, and cannabinoid isolation and purification. Sybil Taylor, MediPharm's chief marketing officer, answered our questions.

What did MediPharm's founding partners do before starting MediPharm Labs?

Prior to launching MediPharm Labs, our founders served various roles within the pharmaceutical space, specifically Pat McCutcheon who worked at Jansen Pharmaceuticals (Johnson & Johnson) where he led the Hospital Division for Renal and Mental Health products. MediPharm's other founder, Keith Strachan, is a supply chain management expert having held various procurement positions in different ministries/agencies including correctional services, policing, transportation, and health care.

What inspired the founders to enter the cannabis industry?

Having a deep understanding of the pharmaceutical space and supply chain management, the founders observed the amount of vertical integration taking place within the industry and hypothesised that the supply chain would evolve into a horizontal model, allowing for companies to demonstrate excellence within their respective supply chain vertical or discipline. MediPharm was born out of a focused approach to excel at the highest value segment of the cannabis supply chain.

Where and when did MediPharm begin?

In 2014, Pat introduced the industry to Keith and they started to discuss the concept of MediPharm Labs and how it can deliver a differentiated service and product to the cannabis space in Canada. The business was incorporated in 2015 and planning began on the first state-of-the-art facility in Barrie, Ontario, Canada.



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MEDI PHARM WAS BORN OUT OF A FOCUSED APPROACH TO EXCEL at the highest value segment of the cannabis supply chain.”

How did MediPharm recognise the demand for quality cannabis oil?

In the initial phase of development for the Canadian cannabis industry, licensed producers focused primarily on aggressive scaling of large cultivation facilities across the country. This has continued today in what looks to be an arms race focused on maximising production capacity for flower. Subsequently, licensed producers and product manufacturers have identified the need for brands and differentiated products to establish and build market share within desired target markets. MediPharm Labs has identified that there is a significant gap between cultivators and product manufacturers, and is uniquely positioned to assist companies focused on either side of the supply chain to achieve their strategic goals.

Why focus on concentrates instead of cultivation?

MediPharm's leadership team believes in combining our passions, skills, and experience to focus on what we do best, which is to serve the global cannabis industry by providing leading extraction and product manufacturing services to our partners.

What was the learning curve like when it came to sourcing raw materials?

The sourcing of raw materials, specifically cannabis flower, has been a fast-evolving segment of the industry. Currently, Canada is significantly undersupplied to serve both the medical and adult-use demand domestically, with just over 40,000 kg available for legalisation. With the arms race for production capacity unfolding, it is anticipated that supply of raw materials will exceed the domestic demand by 2021 as more licensed producers come online and expansions become licensed. This will create a glut of product for the domestic market, evolving cannabis flower to become a graded commodity over time.

MediPharm is uniquely positioned as the market evolves, having over 3,000 kg of cannabis flower in our vault, in addition to sourcing multiple supply partners who are already establishing and producing high volumes of cannabis flower.

MediPharm's business model is a first in Canada by applying to distribute medical cannabis oil to licensed producers. What were some of the challenges related to that application?

Having a first-of-its-kind licence in Canada has been both exciting and challenging, as MediPharm had to work with Health Canada to define ourselves as a unique business model outside of what others were doing in the space. This has led to an impressive amount of collaboration with Health Canada and other stakeholders, allowing MediPharm to create a unique business within the Canadian cannabis space.

What is the key to creating such high-quality products?

Quality and consistency are critical to our business. MediPharm's state-of-the-art facility is in compliance with European current Good Manufacturing Practices requirements and is designed to ISO standard cleanrooms and critical environments. The standard of design and construction are currently the most innovative and technically advanced in the Canadian cannabis industry.

These pharma-grade critical environments combined with our discipline and proprietary methodologies result in repeatability in manufacturing, precision dosing, and purity assurance. These foundations of our organisation ultimately deliver trusted, safe products for patients or end consumers.

What products does MediPharm produce?

At MediPharm Labs we focused on what was legal today in Canada. Currently, MediPharm is able to produce bulk crude or formulated cannabis oil. In preparation of the Canadian regulations around cannabis products evolving, our facility continues to add customised equipment. We will be able to offer partners high-volume contact manufacturing for soft gel capsules, water/oil soluble isolate, and custom-formulated vape cartridges.

How is MediPharm gaining market share?

Who are your customers?

MediPharm is uniquely positioned to be a premier partner for businesses along the entire cannabis supply chain. We are currently working with cultivators by providing either contract manufacturing

services to meet their needs for cannabis oil supplies, as well as supplying licensed producers with bulk oil to meet any shortfalls they may have. MediPharm is also one of the largest buyers of wholesale cannabis in Canada.

Our primary customers and partners are licensed producers within Canada, but we anticipate that as regulations evolve to facilitate concentrates and edibles, MediPharm will be able to work with a wide array of domestic and international partners focused on unique products such as drinks, edibles, and other consumer packaged goods allowed under evolving federal regulations.

What kind of response have your products received from the market?

Our business-to-business tolling partners have been very happy with our turnkey processing services, allowing them to shortly add oil to their product offering. We will be able to deploy our products for partners located across the country. We are incredibly excited to support our partners to power their products and brands as we enter the new era of cannabis legalisation.



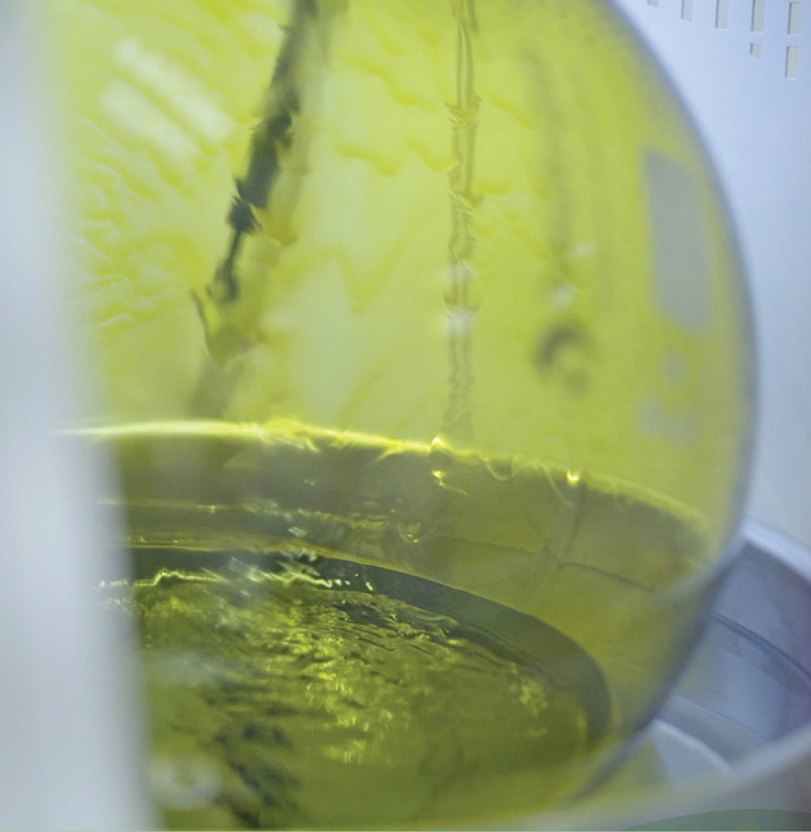
QUALITY AND CONSISTENCY
are critical to our business."



Our goal at MediPharm Labs is to provide the cannabis inputs for a range of products spanning food and beverage, beauty, and nutraceuticals. Our library consists of many extracted strains, each with their own cannabinoid and terpene profile that produce different effects. By curating a library of these extracts, we are able to offer customised white-label solutions to customers with unique formulations that are best suited to their brands and target markets.

How is MediPharm positioning itself for the edibles and extracts market in Canada?

MediPharm is incredibly excited to partner with other licensed producers and brands as the edibles and concentrates licenses are released. By providing bulk oils and isolates for our partners, we are positioned to be the supplier of the key inputs required to produce commercial scale products to enter the Canadian marketplace. MediPharm is currently aligning with licensed producers and brands who are looking to enter into this space with a wide variety of products and formulations.



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WE WILL BE ABLE TO OFFER PARTNERS HIGH-VOLUME CONTACT MANUFACTURING for soft gel capsules, water/oil soluble isolate, and custom-formulated vape cartridges.”

Why did MediPharm choose to open a facility in Australia?

The Australian medical cannabis regime has many similarities to Canada, which has allowed for a smooth transition and replication of our business model in Wonthaggi, Victoria. We have had an incredible working relationship with the Australian government to follow a similar path as our Canadian business, once again breaking the mold to establish ourselves as a unique business along the cannabis supply chain.

What are the future plans for the Australian facility?

Our Australian facility is uniquely positioned to serve both the domestic market and become an international hub for global production and distribution. We are incredibly excited to continue to develop our domestic relationships in Australia, and are positioned to serve the global cannabis market as it evolves across different international jurisdictions.

What have you learned so far about this industry?

One challenge, which every licensed producer has encountered, is the ability to scale at light speed to meet the enormous demand of the domestic and international markets. We are incredibly lucky to be operating in a progressive jurisdiction like Canada, which has allowed for Canadian licensed producers to have a first mover advantage for what is already becoming a global industry. As Canadians, we are at the forefront of this fast-evolving industry, which has led to less competition and more collaboration between producers. We all understand the importance of capitalising on this first mover advantage and support each other to overcome challenges as the regulatory environment continues to evolve and licensed producers scale for commercial production.

What are some of the company's proudest moments?

There have been numerous milestones that have been celebrated by MediPharm since our inception, but breaking the mold and achieving the first production-only license in Canada sticks out as one of our proudest moments. We are so proud of our team, collaborators, and advisors for all the passion, effort, and sacrifice that has gone into MediPharm and will continue to be invested into the company as we move forward into this exciting global industry.


What is MediPharm's outlook on the future of medical cannabis as the industry settles into legalisation?

We see legalisation within Canada as just the beginning of something incredibly special for the country. We celebrate the achievements of our partners within the industry as we all take our respective roles to lead the world in establishing Canada as the global centre of excellence for cannabis and take a leadership role for the development of the industry. We look forward to the many exciting years ahead for the development of unique cannabis products, brands, and technologies that will change the world for the better. 🍀



THE RIGHT STRAIN FOR BACK by Rich Hamilton PAIN

Back pain can be one of the most debilitating kinds of discomfort. It can wear you down and reduce your quality of life. More and more, people with back issues are looking away from opioids towards cannabis to manage their pain.



Back pain is the leading cause of disability and work absence, and roughly one in four people experience at least one day of back pain in a three-month period. The spine and surrounding muscles and tissue are an intricate, essential, and fundamental part of our physiological structure, bearing a person's body weight and its everyday tasks, day after day. There is a large and varied array of reasons and causes that lead to back pain such as muscle spasms, disk problems, sciatica, arthritis, pregnancy, and trauma to name just a few.

Chronic back pain (pain that is ongoing and lasts more than three months) conditions are often the most debilitating and can really affect quality of life while requiring ongoing pain management. People can spend years trying to find the right mix of treatment in both the medical and holistic spheres. Medical pain relief can involve ingesting some very strong substances that can cause unwanted side effects or dependency.

Prescription painkillers are notoriously addictive, with opioids such as codeine, morphine, and oxycodone being the most powerful and most widely used. They are usually prescribed for people suffering with long-term pain because they block the nerve signals that transmit feelings of pain to your brain, bringing feelings of pleasure, which is why they are so addictive. Over time, your tolerance to these drugs can increase, requiring more of the painkiller to achieve the same effect.

Common side effects of opioids include nausea, drowsiness, dizziness, itching, sweating, depression, and a weakened immune system. It is no surprise, then, that many people are reluctant to take such medication long-term and instead look for alternative pain relief. One of these alternatives is cannabis.

Cannabis helps to alleviate back pain through its cannabinoids. Cannabinoids have analgesic (pain-relieving) and anti-inflammatory properties and work by suppressing pain signals that are sent to the brain while also reducing inflammation. The effects cannabis has on pain are rather complicated but to put it simply, science believes cannabis acts on specific pain pathways in the body.

There is a wealth of evidence available on the use of cannabis as a solution for chronic pain conditions such as back pain, arthritis, multiple sclerosis, and cancer. One example is a 2017 survey carried out in the US that found when used as a substitute for other pain relief medication, 97 per cent of those surveyed managed to reduce their use of opioids. Furthermore, 81 per cent of the participants agreed strongly that cannabis alone was more effective at treating their condition than their regular medication. Chronic pain accounts for most prescriptions of medical marijuana. So, let's have a look at the best ways to use cannabis for pain relief.

Cannabis and Pain Relief

In terms of effective pain relief there are two options: inhaling or edibles. Topicals such as oils, lotions, and even transdermal patches don't penetrate the skin into the bloodstream and have been found to be largely ineffective for intense pain like back pain.

Edibles will give you pain relief but take a long time to kick in as the cannabis has to be broken down and passed into the bloodstream via digestion, so they are not ideal for sudden intense attacks of pain. Once they have onset, however, edibles do have a longer lasting effect than inhalation and so can be used at regular time intervals like medicinal pain relief to provide a steady constant base of pain management for chronic unrelenting pain conditions.

Inhaling is the preferred choice of many and for good reason. Inhaling allows cannabis to be absorbed directly into the bloodstream giving quick relief, ideal for chronic pain that manifests suddenly. Smoking or vaping allows you to feel the benefits of pain relief when you need it and then wears off relatively quickly, allowing you to continue with your day/work/everyday tasks unaffected.

If the episodes of pain fluctuate in strength, then inhaling is also ideal as you can alter the amount of cannabis smoked accordingly. Smoking or vaping throughout the day is a convenient way to keep a baseline of pain management while giving you the motivation to keep positive and get things done as constant back pain can cause depression, fatigue, and a lack of motivation and enjoyment of life.

Find the Right Strain

So, what cannabis strains are best for treating and managing the symptoms of back pain? It really depends on what kind of pain you have. Is it constant and dull? Acute and unpredictable? Do you have any further side effects from the pain such as depression or insomnia? Here are a few of the most popular and widely available strains that are considered effective at managing back pain to give you an idea.

OG Kush – An indica-dominant psychoactive strain with high levels of THC (23 per cent) and low levels of CBD (one per cent). It gives a euphoric high, relieving pain and muscle spasms.

Gorilla Glue – A well-balanced hybrid strain with high levels of THC (25 per cent). It is a strong strain that will leave you couch-locked for a few hours and is a good choice for serious back injuries that produce a chronic pain condition. It is also a good choice for those suffering with associated insomnia as its strength induces a deep peaceful sleep.

ACDC – A sativa-dominant hybrid that is high in CBD (16-24 per cent) and low in THC (0.4-1.2 per cent). The high CBD means it has hardly any psychoactive side effects but it is a brilliant pain killer for chronic pain conditions.

Any budtender worth their salt in your local dispensary will be able to guide you to a perfect strain, perhaps with a little trial and error. That really is the beauty of cannabis — it can be personalised if you are prepared to do your research and sample a selection of strains in order to find the perfect fit for you and hopefully the perfect solution to your pain predicaments. ●

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 Outley Cr.
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 Cassina 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 & Tobacco
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 Prestons (New South Wales)
2/4 Avallli Rd.
Prestons, NSW 2170
(02) 3824 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 Neilson 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

Hydro 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 Cutting Hydroponics
252 Oxford St.
Bondi Junction NSW 2022
(02) 9369 3928

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 Uralia 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 2154
(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.
Fishwick 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 Ct.
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.
Tweed Heads 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

Warrarong Hydroponics Centre
240 Cowper St.
Warrarong NSW 2502
(02) 4274 8001
warraronghydro@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.
Summer 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 Cr.
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 3/191
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 Cr.
Raceview QLD 4305
(07) 3294 3253



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

Hyalite Varsity
Unit 1/10 John Duncan Cr.
Varsity Lakes QLD 4227
(07) 5593 7535

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 28/20-22 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 Kerry 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

Chocoback 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
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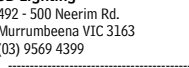
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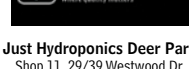
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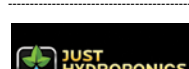
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ten FACTS ON GREEN BEANS

by Philip McIntosh

Green beans, pole beans, French beans, string beans, snap beans... whatever you want to call them, they are quite often green and they are beans.



- 1 The green bean, *Phaseolus vulgaris*, is a common annual found in gardens and on farms both large and small throughout the world.
- 2 Originating in the highlands of Central America, the green bean has been cultivated in that part of the world for thousands of years. Along with corn and squash, the climbing bean is one of the Three Sisters of Mesoamerican agriculture.
- 3 The genus name *Phaseolus* goes way back in origin to a Greek word for "cowpea," and from there ended up meaning "bean" (essentially) in Latin.
- 4 It's always fun to run across a plant name attributed to Carolinus Linnaeus, the founder of binomial nomenclature. He classified the green bean as *P. vulgaris*. The specific epithet *vulgaris* means "common."
- 5 A bean plant generally falls into one of two informal categories based on growth habit. The beans we are talking about are runner beans, also known as pole beans, as opposed to bush beans that have a much shorter and compact form.
- 6 There are more than 100 varieties of green beans, some tall, some short, some more suited to colder climates or less sun than others, some with fat pods, others flat or wrinkled. The pods containing the seeds come in shades of green, yellow, and purple, or may be multicoloured.
- 7 A closely related edible bean is *P. vulgaris* var. *coccineus*, known as the runner bean (formerly *P. coccineus*), often grown for its vibrant red flowers.
- 8 The scarlet runner is a perennial, further adding to its attraction as an ornamental (so long as winters are cold).
- 9 What's with the "string?" Before breeding programs pretty much eliminated it, bean pods had a tough fibrous string along one pod seam (hence the name string bean). In early cultivars, and some of today's heirloom varieties, the string still exists but can be removed (or the beans cut up) to make the pods more digestible.
- 10 Okay, what about the "snap?" One way to remove the string from a stringy bean pod is to snap off one end and pull on it to remove the string. A healthy fresh bean rewards the preparer with a satisfying snapping sound when de-stringing.

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