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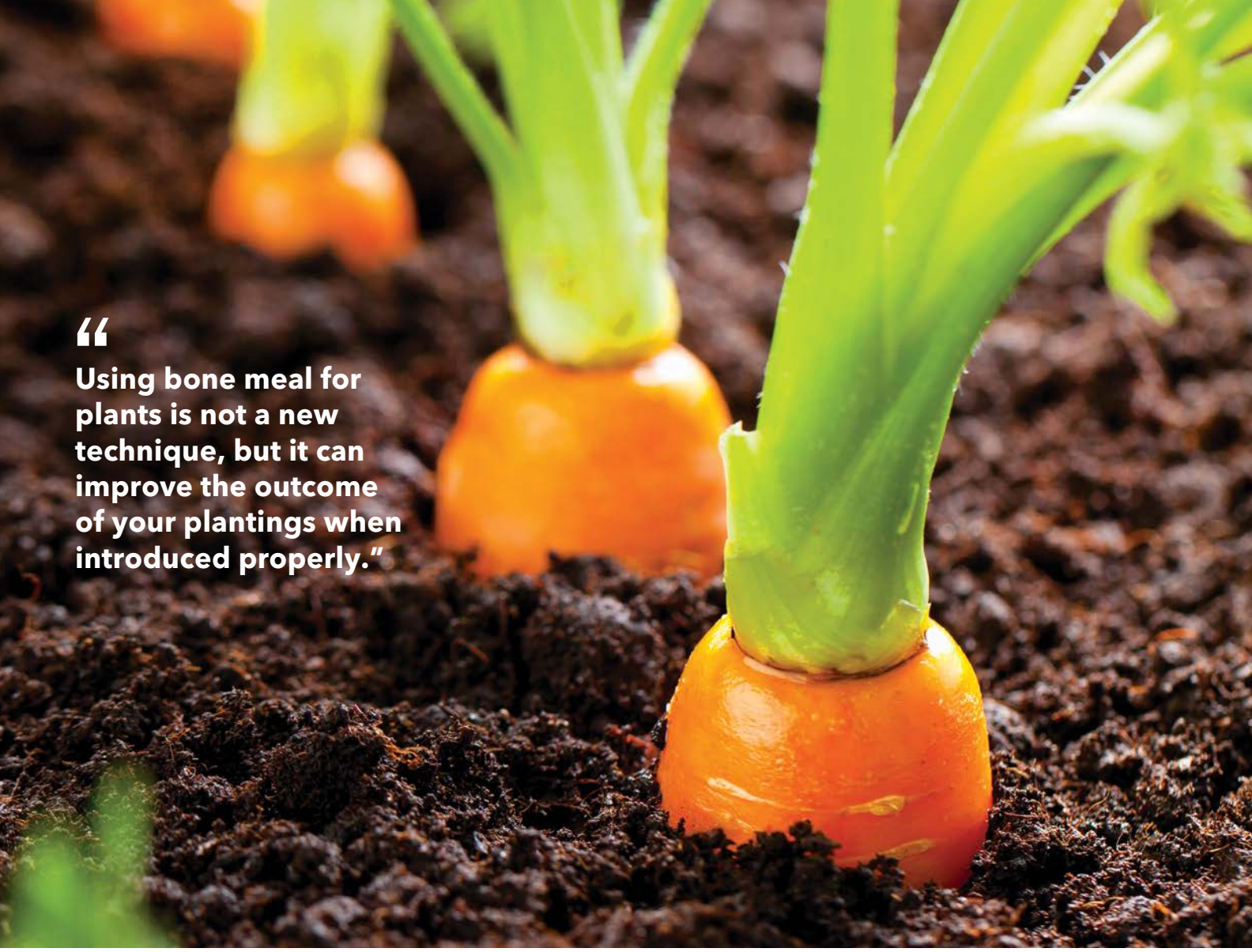

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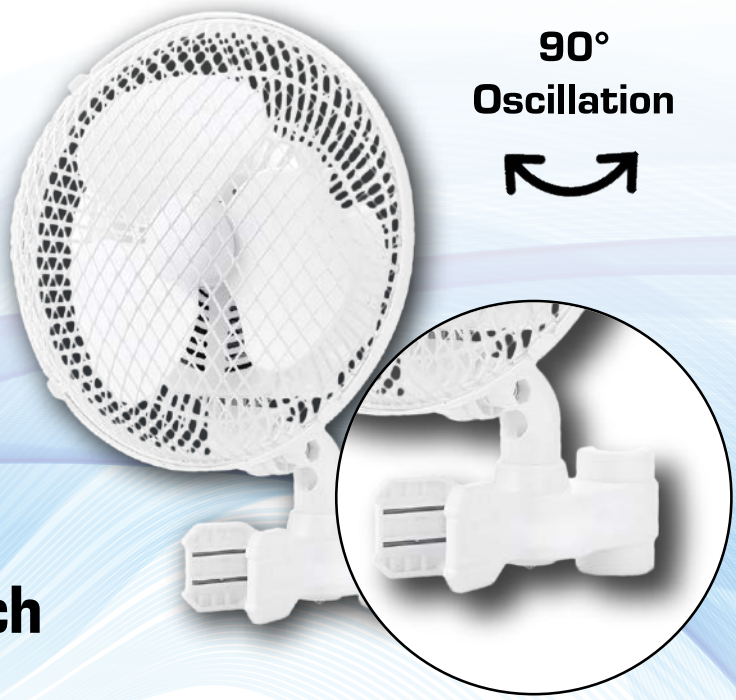

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“It’s at times like these we should re-evaluate our relationship with the natural world and adjust our behaviour to be more harmonious rather than damaging.”

from the **EDITOR**

TG **Toby Gorman**

If there is one virtue gardening instills in people, it is patience. There is no instant gratification, no immediate results, and sometimes what you get out of it is far less than what you put into it.

I’ve always found avid gardeners travel through life at a different pace than a lot of other people. Gardeners are people who will sit through an entire sunset, will walk instead of drive if they can, and have a comforting level-headedness and easy-going nature about them. They are quietly confident.

You don’t hear much about gardeners in the news. This world that is bent on breakneck production, rapid growth, consumerism, social chaos, choking traffic, and unabated pollution whizzes right past the world of gardening. It has no time for a slow, steady pace.

But maybe it will. In these trying days of COVID-19, we’re getting a glimpse of what life could be like if we all slowed down a little bit and took a deep breath. In China, with factories closed, something amazing happened in just a few weeks. Satellite images showed how quickly blue skies and fresh, clean air moved into the largest cities, previously known for choking toxic smog. In fact, around the globe, Mother Nature moved quickly to begin repairs. With people staying home, carbon emissions have dropped as much as 25 per cent in some places. We’ve been given signs over the past few years to cool our jets, so to speak. Devastating fires in Australia, Europe, western Canada, and the US, similarly devastating floods, a loss of biodiversity, and other signs all indicate we may have gone too far.

It’s at times like these we should re-evaluate our relationship with the natural world and adjust our behaviour to be more harmonious rather than damaging. If we choose not to, the challenges we face now could pale in comparison to what comes next. Cancelled flights, suspended sports seasons, and stock market plunges are not what we need to be focusing on. We need to be focusing on what we can do to improve our place in this world, and, if you ask me, following the example set by how gardeners travel through this world may be a step in the right direction.

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bare **ROOTS**

Featured Contributors

Kathryn M. Van Druff is a freelance writer and marketing specialist with her own business, Dances with Words. She has years of experience writing about gardening, landscaping, and home design topics. Kate is also an avid home gardener, wife, and mother to two daughters and a border collie.

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/Frankenstein mix.

Contributors

Lee Allen
Eric Hopper
Monica Mansfield
Philip McIntosh
Shannon McKee
Dr. Lynette Morgan

CULTIVAR

A **cultivar** is the most basic classification category of cultivated plant taxonomy. Most cultivars originate from human cultivation, propagated through cloning, cutting, or grafting, and generally cannot be grown from seeds from the original plant. Most cultivars are either agricultural food crops or ornamental plants. Ornamental cultivars, such as roses and azaleas, are cultivated to enhance a particular flower shape, size, or colour. Almost all agricultural food crops are cultivars; desirable characteristics include abundant yield, pleasant taste, and resistance to disease.

The term cultivar was created by the botanist Liberty Hyde Bailey as a combination of the words cultivated and variety. Plants that can be considered as cultivars include:

- **deliberate hybrids**
- **accidental hybrids in cultivation**
- **selection from existing cultivated stock**
- **selection from variants within a wild population and maintained as a recognisable entity solely by continued propagation**

With these methods of propagation offspring will retain the characteristics of the parents for the next generation. Plants grown from the seeds of cultivars will not necessarily retain the properties of the mother plant.

Check out Lee Allen's article on page 48 for more information.

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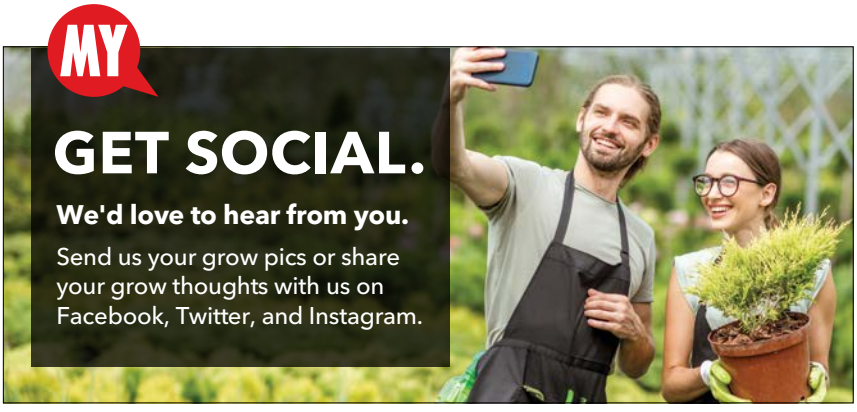
Great article! As you say: environment is always the best foundation and prevention. But yeah, longer growing seasons and unpredictable weather make fungal issues almost unavoidable sometimes…

@valaregb

Plant some Datura and transfer [the hornworms] to those plants. They are really cute and become cool 'hummingbird moths' that are fun to watch early in the morning and late in the evening.

James Michael

Yes can be... Depends which elements used and if OMRI listed. What doesn't make it organic is the genetics that have been reversed to produce a female seed. No matter how much organic (nutrients) given to a plant, the genotype will never be legit organic...



Article Archives

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

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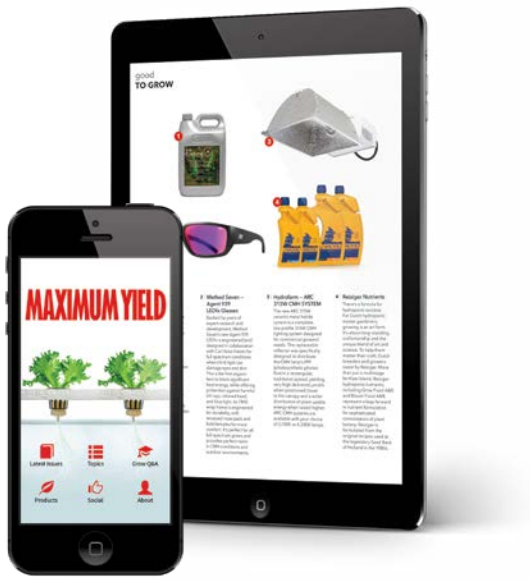

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DO YOU HAVE A QUESTION FOR A GROWER? Email *editor@maximumyield.com* to get an answer.

ask a **GROWER**

by Eric Hopper

Q. I'm just getting my NFT setup started but I have some concerns. If I wanted to grow something like hot peppers and tomatoes in my growroom, should the nutrient water be separate systems? I don't want spicy tomatoes. Or is this even an issue with NFT systems?

– Dan

A. Thank you for your question. Growing tomatoes in the same hydroponic system as hot peppers will not create spicy tomatoes. In fact, a wide variety of vegetables can be grown in the same hydroponic system and share the same nutrient reservoir without issue. The only catch is all the plant varieties within the system should have similar stages of growth and development. Issues arise in multi-crop hydroponic systems when the nutrient requirements differ greatly. For example, a small pepper plant in its early stage of vegetative growth will have very different nutrient requirements than a tomato plant that is mature and producing fruit. Simply put, when growing different types of plants in a hydroponic system, make sure they have similar stages of growth and a comparable duration to maturity.

It is also important to mention that growing tomatoes and hot peppers in an NFT system could be more difficult than in an alternative hydroponic system. Commercial NFT systems are typically used to grow small, leafy green crops such as lettuce. These plants have relatively small root masses and mature relatively quickly. Large plants, with relatively long durations to maturity, tend to create big root masses, which can inhibit the flow of the nutrient solution in NFT gutters. The hydroponic systems typically used for tomato and pepper production are top-fed and ebb-n-flow. These systems are customisable to meet the increased requirements of moisture and nutrients. They also are more suitable for larger plants with robust root systems. If you plan on growing tomatoes and hot peppers in an NFT system, it may be wise to seek out a dwarf variety with the shortest duration to maturity. Shorter stature plants will generally have a smaller root mass and will be more manageable in an NFT system. I hope this answers your question.

As a side note, for those who are interested in growing spicy tomatoes, you will not have to wait long. Plant physiologists in Brazil and Ireland are currently researching the use of gene-editing tools to create the world's first spicy tomatoes.

Keep on Growing,
Eric Hopper

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

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FACTS

Climate Change Means Fruit Trees Blooming Sooner

It's a microcosm of climate change, but new data out of Spain's Catalonia region suggests fruit trees are blooming earlier than they were decades ago. According to data from the Meteorological Service of Catalonia (SMC), fruit trees in Tarragona are blooming about 15 days earlier than 50 years ago, and the fruits are ripening one month earlier. In the specific case of pears, they are doing so 37 days earlier than five decades ago. SMC director Eliseu Vilaclara highlighted high temperatures recorded this winter in Catalonia, specifically in the northern parts, where the average temperature in January 2020 was 8°C higher than the average for the month. In December 2019, this anomaly was even more remarkable in the high mountains, where temperatures were up to 10°C higher than usual. Also, this past February has been the warmest on record at the Fabra Observatory in Barcelona since data has been collected (107 years).

– lavanguardia.com

Demand for Purple Organic Heirloom Tomatoes Soars

With tomato season peaking, more demand is being noted for purple heirloom tomatoes. "This is probably our biggest heirloom year to date. Every year we've increased acreage by between five to six per cent because of our demand," says Alex Madrigal of Covilli Brand Organics Inc., which grows in Mexico. Madrigal notes purple heirlooms are now more popular. "A few years back we put a few into our mixed packs. Every year we trial newer varieties," says Madrigal. "And then we had customers asking if they could just get boxes of the straight purple pack." The dark heirloom is popular for a few reasons. "Purple produce carries more anti-oxidants, more than any other colour. It's also stunning. Chefs really like working with purple vegetables," Madrigal says. He also thinks purple is popular with consumers because the flavour is milder and not as acidic.

– hortdaily.com

Study Shows Cruciferous Vegetable Ingredient Prevents Cancer Growth

A recently published study shows how an ingredient in vegetables like broccoli and cabbage prevents the growth of cancer cells. The research, published in *Scientific Reports*, was done by scientists at Okayama University (OU) in Japan. It shows a class of compounds called 'isothiocyanates' (particularly benzyl isothiocyanate (BITC)) effectively stops the growth of tumours in lab rats and mice, however, the exact mechanism behind its ability to do so is unknown. Isothiocyanates are abundantly found in cruciferous vegetables including cauliflower, cabbage, kale, Brussels sprouts, broccoli, and similar green leaf vegetables. A research team spearheaded by Professor Nakamura Yoshimasa and Associate Professor Moriya Hisao at OU recently used yeast cells to explain how BITC can abate the development of cancer. This study is the first to explain the anti-cancer properties of BITC in detail, using a novel screening system within yeast cells. This system can be used in the future for screening other anti-cancer drugs.

– freshplaza.com

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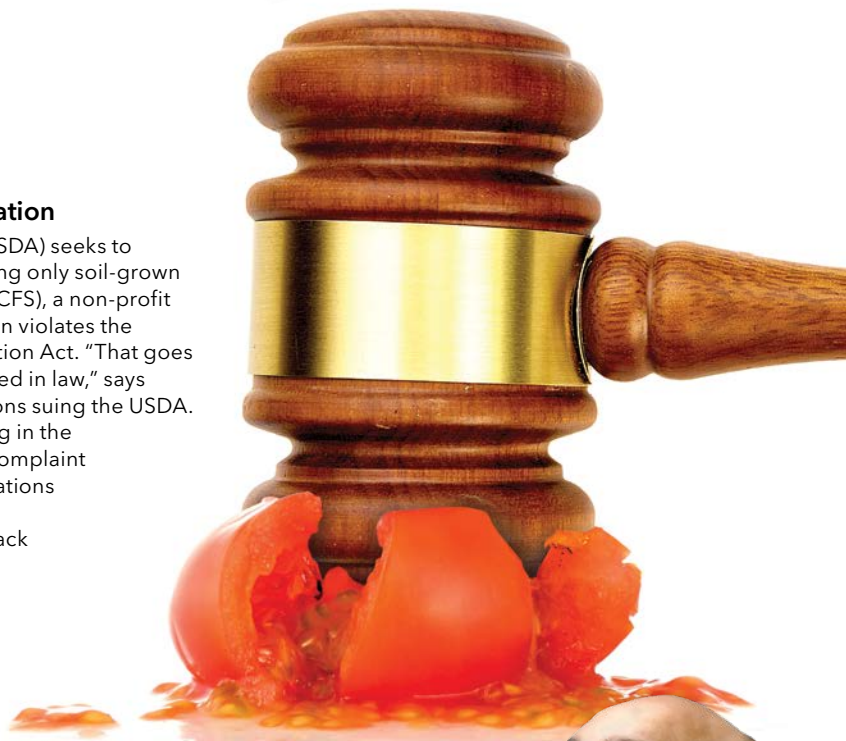
Discarded Mattresses Helping Refugees Grow Food in the Desert

British scientists have succeeded in cultivating tomatoes, peppers, aubergines, and herbs in the desert using discarded mattresses bound for landfill. The innovative system, which was tested in a refugee camp in Jordan, could be rolled out to every shelter in the world, helping millions of people thrive in barren landscapes. Since aid workers often discard thousands of used foam mattresses in refugee camps across the globe, University of Sheffield scientists began developing foam "soils" in their labs in hopes of using old bed materials as a growing medium. The research team, led by Professor Tony Ryan, is made up of experts in hydroponics. The project gives people the tools and techniques they need to grow their own food and gain future employment as well as boosting mental health and greening the camp. In turn, scientists learned from the refugees whose use of the foam in real-world conditions has demonstrated its potential to grow crops more sustainably.

– *goodnewsnetwork.org*



Group Sues USDA over Hydroponic Organic Certification

A lawsuit against the United States Department of Agriculture (USDA) seeks to forbid organic certification of hydroponic crop operations, arguing only soil-grown crops can legally qualify as organic. The Center for Food Safety (CFS), a non-profit group, claims cultivating plants hydroponically in nutrient solution violates the requirement to "foster soil fertility" of the Organic Foods Production Act. "That goes against a basic organic principle, and those principles are encoded in law," says Sylvia Wu, an attorney for CFS as well as several other organisations suing the USDA. Controversies over hydroponic production have been percolating in the organic community for years, but the plaintiffs decided to file a complaint after the USDA rejected their 2019 petition to exclude such operations from organic certification. Organic hydroponic growers are disappointed in the lawsuit and believe its accusations reflect a lack of understanding of their production methods, says Lee Frankel, executive director of the Coalition for Sustainable Organics.

– *capitalpress.com*

Depression Linked to Lack of Fruits and Vegetables

University of Toronto researchers found that a lower intake of fruits and vegetables is associated with a higher incidence of depression in both men and women. The same study also found that middle-aged and older women who immigrated to Canada were more likely to suffer from depression compared to Canadian-born women. Fruits and vegetables are rich in various minerals and vitamins that are known to reduce the plasma concentrations of C-reactive protein, which is associated with low-grade inflammation. Important nutrients affect brain chemistry, impacting mood, memory, and cognitive function. About 95 per cent of your serotonin – the neurotransmitter that regulates sleep and appetite, but also mediates mood – is produced in the gastrointestinal tract, which is lined with more than a hundred million nerve cells. The results also suggest men were more likely to experience depression if their diet consisted of high-fat food and lower levels of omega-3 eggs.

– *freshplaza.com*

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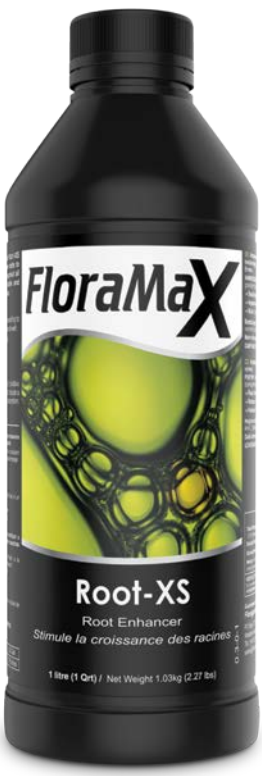

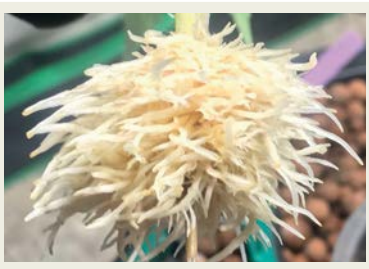

Explosive root growth.
Photo credit - P.B., Detroit, Michigan

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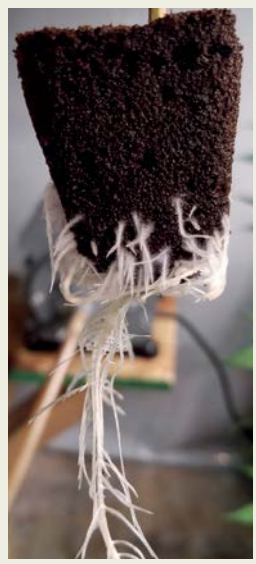

Cutting at Day 5.
Photo credit - B.D., Detroit, Michigan

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2 | **Fluence SPYDR 2 Grow Lights**

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3 | **Professor's Nurients Organic pH Up & Down**

Optimal pH range is crucial for successfully growing plants. Professor's Nutrients pH Up & Down is a must-have for any hydro system. Plants are only able to absorb nutrients when the pH level lies within the correct range, creating optimal conditions for vigorous growth, bud development, and large harvests. When pH levels fall out of range, plants lose their ability to absorb essential nutrients needed for healthy growth. A result of pH problems is nutrient lockout, which can cause plant deficiencies, slower plant growth, and smaller yields.

4 | **FloraMax Roots-XS**

FloraMax's Roots-XS is a leading-edge root accelerant that promotes super-healthy vegetative growth and explosive root mass. Growers report stall-free and drama-free transitions through all phases of growth allowing you to get ahead of the curve when transplanting and pruning. Roots-XS runs extremely clean and won't clog drippers, foam up in the reservoir nor create foul odours or biofilms. Furthermore, this organic hybrid additive will not affect the working nutrient pH in the reservoir.

5 | **Ozi Magic Bud Swell**

Bud Swell is a diverse blend of soluble seaweed, beeswax extract, vitamins, and plant extracts, combined with selected high-quality mineral salts. Bud Swell is the perfect plant booster for organic growers, boosting the plant's ability to promote the building blocks for maximum plant growth. Bud Swell is the latest formula upgrade from Ozi Magic's research team, combining high-quality essential metabolites with soluble organic plant extract and pure mountain spring water. Bud Swell is perfect to use with organic mediums, coco fibre, and organic soil blends.

6 | **Sol-Sense 315W CMH Kit**

The Sol-Sense all-in-one 315W CMH kit integrates a patented lamp preservation mechanism designed to reduce lamp stress and improve operational safety. It features a remote dimmer so it can operate as a propagation, vegetation, or flowering light. This CMH kit has a low-frequency square wave digital ballast (which reduces total harmonic distortion by 5-10 per cent), plus patented output control to maintain maximum PAR value over the life of the lamp. The kit also includes a detachable reflector shade.

7 | **ExHale Original CO2 Bag**

The ExHale Original CO2 Bag is designed for small to medium-sized growing spaces. These bags are ideal for gardeners who use grow tents or those growing in a roughly 4x4-foot area. In fact, the ExHale Original CO2 Bag is guaranteed to provide CO_2 to a 4x4-foot space (or 128 cubic feet) for six months. On average these CO_2 bags will raise the CO_2 level by 500 ppm above ambient air levels. Always remember, if your space is larger, simply add more ExHale bags.

8 | **Growhard – Squid Power**

Squid Power is a totally organic, highly concentrated liquid fertiliser used to supplement hydroponic crops as well as a variety of soil-grown vegetables, fruits, and flowering trees. Squid Power improves fruit, flower size, and aroma without the use of chemicals. It's made from the by-product of locally sourced southern squid using a unique critical extraction process rather than enzymatic cold digestion or heat treatment, making it highly soluble. Squid Power can be used as a foliar spray, nutrient additive, organic soil enricher, or microbe stimulator.

9 | Bio Diesel Aloevate

A 100 per cent natural plant tonic containing hundreds of vitamins, minerals, and enzymes, Aloevate is made from blended desert plant extracts. It contains natural salicylic acid (silica), auxins, amino acids, saponins, and enzymes that enhance micro-life, protect the root zone, and break down any dead roots and unused mineral salts to keep the plant roots clean and functioning at peak performance with healthy microbe colonisation. Aloevate improves your plants' size, vitality, and overall growth rates while protecting them from disease. Available in one-, five-, and 20-litre sizes.

10 | Growhard – Pro Grow UFO LED 300W

The new Pro Grow 300W UFO LED blends quality SMD diodes from both Samsung (blue) and OSRAM (red) with an efficacy of more than 2.1 µmols/J. Pro Grow UFO LED's emit 4,000 Kelvin full-spectrum light with an industry leading CRI of 91.8. Coupled with ultra-reliable Optimum drivers, the light weight and durable die-cast aluminium housings offer cool, fanless, and silent operation. Extended reliability is assured with IP-55 water resistant, cleanable housings. With a PPF output of 630 µmol/s, the power draw is a low 1.25 amps per unit.

11 | Cyco Dr. Repair

Another nutrient from Cyco's line of Platinum Series products, Dr. Repair is an additive growers can use throughout both the vegetative and flowering phases to help ease plant stress from the environment and prevent chlorosis. Dr. Repair has balanced amounts of urea-based nitrogen, which is key in forming amino acids and the reparation of missing chlorophyll molecules. It also contains chelated iron (in the form of iron EDTA). A necessary component in the production of chlorophyll, this infusion of immediately available and pure iron works to reverse chlorosis.

12 | FloraMax Clone Spray

FloraMax Clone Spray is a foliar spray that improves strike rate and rooting speed, while promoting vegetative growth in clones and seeds. Extremely safe and easy to use, Clone Spray also contains a wetting agent that aids in nutrient uptake and absorption. Fast becoming the choice of numerous commercial cloneries, users report "personal best" levels of performance and drama-free transitions into subsequent phases of growth. Clone Spray contains no plant growth regulators and will not burn your leaves.

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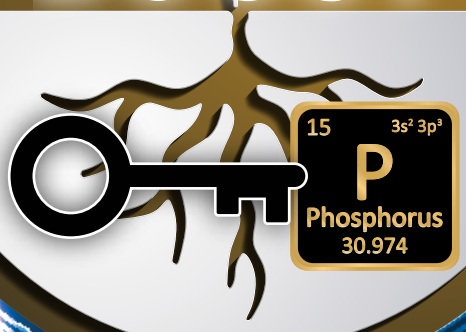

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Rhizo Boost will also protect your plants agains pathogens, and all that while building beneficial flora within the plants root zone for your plants to flourish.

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The Science Behind BONE MEAL

by Kathryn M. Van Druff

Bone meal is a common garden supplement, but what is it, why is it so widely used, and what plants benefit the most from it? All of these questions can be answered when you understand the science behind bone meal.

It's no secret the harvests we reap are a direct result of the crops we sow and how we care for them. All things considered, watering, weeding, pest control, and soil quality all factor into the flowers, plants, fruits, vegetables, and herbs we can expect to enjoy during the growing and harvesting seasons. Using bone meal for plants is not a new technique, but it can improve the outcome of your plantings when introduced properly. Natural bone meal fertiliser can correct a deficiency in phosphorus or calcium in your garden soil, yet that is just one of its many helpful properties. Here's the scoop on what bone meal is, how and why it works, and how you can use it in your garden.

WHAT EXACTLY IS BONE MEAL?

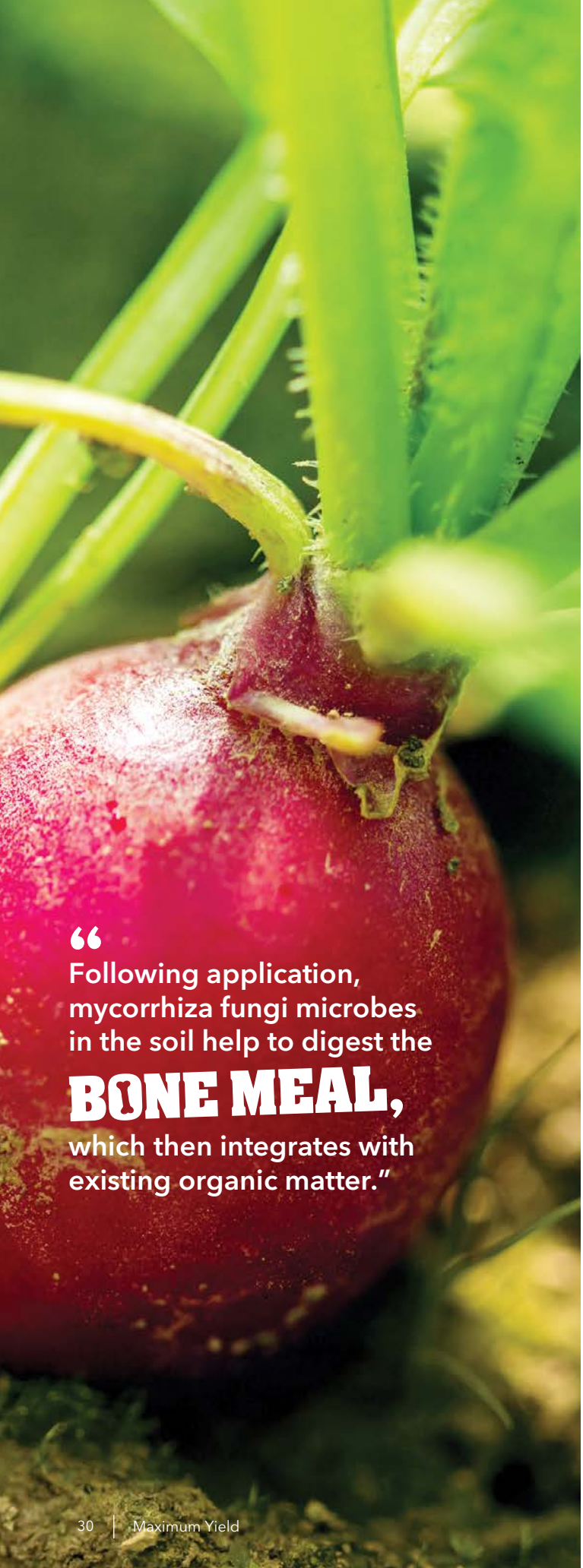
Bone meal fertiliser consists of defatted ground animal bones and byproducts repurposed from slaughterhouses. The finely and coarsely ground bone fragments act as a slow-release fertiliser delivering phosphorus and protein to plants, flowers, shrubs, and trees.

As a natural fertiliser, the nitrogen-phosphorus-potassium (N-P-K) ratio for bone meal is not always consistent. Sometimes the range may be on the low side, such as 3-15-0, while other times it can be as high as 2-22-0, or somewhere in between. The nitrogen concentration itself isn't truly high enough to provide all the plants need, but bone meal is a certainly good source of phosphorus and calcium.

THE SCIENTIFIC BREAKDOWN OF BONE MEAL

Akin to its namesake, bone meal fertiliser begins as discarded bones, usually derived from animal slaughterhouses in the meat industry. To make the bone meal, meat bone waste products are steamed and ground down into powder or tiny particles for use in the garden. In addition to phosphorus, calcium, and minimal nitrogen, bone meal may contain minerals such as zinc, magnesium, and iron, among other trace elements.

Following application, mycorrhiza fungi microbes in the soil help to digest the bone meal, which then integrates with existing organic matter and fortifies the soil with plant food, ready for root uptake. The plants give their thanks by giving the mycorrhizae sugars and amino acids in return. The increased phosphorus and amalgamation of organic components can result in stronger and more prolific roots, better ability to winter over, and quicker plant growth to maturity. Production can also increase as plants absorb more nutrients during the slow release of the bone meal's key ingredients.



“Following application, mycorrhiza fungi microbes in the soil help to digest the **BONE MEAL,** which then integrates with existing organic matter.”

BENEFITS OF BONE MEAL

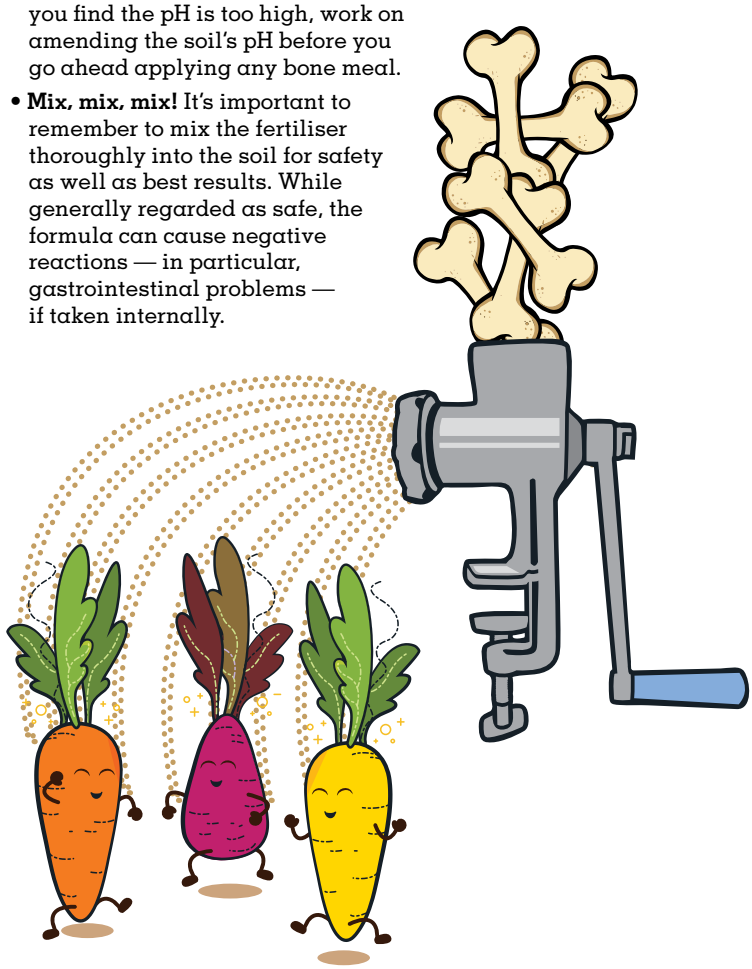
Bone meal fertiliser is widely accessible and easy to apply no matter if you’re a seasoned farmer or an amateur home gardener. The benefits of using bone meal in the garden can leave a lasting impression with precise application and care.

- **Bone meal is easy to apply.** This fertiliser is a cinch to use, even for novice gardeners. For best results, add it to the soil before planting, preferably at the bottom of the planting hole, or even atop your compost pile. You can also mix it into the soil surrounding existing plants and watering over top once per season if needed.
- **Bone meal can provide phosphorus to depleted soil.** As long as the pH of the soil is below 7, the phosphorus levels can improve with the addition of bone meal. If the pH is 7 or above, the roots cannot absorb the phosphorus from the soil.
- **Soil becomes more fertile with bone meal.** Amending soil with bone meal encourages growth, flowering, and better production.
- **Bone meal creates balance.** When added to soil along with fertiliser with high nitrogen content, bone meal can help produce the right blend of nutrients in the soil.
- **Organic farms and gardens can use bone meal.** Organic bone meal abides by the requirements of organic farming. This natural fertiliser can help plants and crops within the guidelines of organic agriculture.

SPECIAL BONE MEAL CONSIDERATIONS

As with any good thing, bone meal comes with its own precautions as well. Here are five special considerations to keep in mind about using bone meal fertiliser.

- **Check the soil’s pH first.** The pH must be below 7 for the plants’ roots to be able to absorb the bone meal. Should you find the pH is too high, work on amending the soil’s pH before you go ahead applying any bone meal.
- **Mix, mix, mix!** It’s important to remember to mix the fertiliser thoroughly into the soil for safety as well as best results. While generally regarded as safe, the formula can cause negative reactions — in particular, gastrointestinal problems — if taken internally.



> "USING BONE MEAL for plants can inspire remarkable improvements in your garden, from more vigorous root growth to more prolific blossoms and fruit or vegetables."

- **Monitor usage.** Although bone meal is relatively forgiving, it's important to monitor how much you're using. Adding too much bone meal won't scorch your plants in the way that blood meal can with burned leaves and other damages. Bone meal does, however, run the risk of chlorosis, a loss of the green pigment in leaves that occurs as a result of reduced chlorophyll production. One application during the growing season will likely do the trick for your needs.
- **Don't forget the butterfly effect.** Note you may wish to avoid powder-based, water-soluble bone meal formulas if you have ponds, fountains, or other areas where runoff would be problematic. The phosphorus in the fertiliser could lead to overgrowth of algae blooms that could rapidly affect the balance of the ecosystem.
- **Wear a dust mask.** Although it's unlikely you would come across contaminated product for your own gardening needs, you can search for bovine-free blood meal if you prefer. Wearing a dust mask when working with bone meal is an easy and inexpensive extra step with merit for peace of mind.

Interestingly, bone meal used to be dietary supplement for livestock, particularly for cows; however, the advent of bovine spongiform encephalopathy (BSE), more widely known as mad cow disease, required immediate cessation of those practices. Studies found traces of infected spinal cord, brain matter, and other nervous system components could survive production processes into the packaged bone meal, which cows ate and then became infected. The risk of contracting the human variant, Creutzfeldt-Jakob disease (CJD), centres on consuming tainted meat, although inhaling contaminated bone meal dust particles may also transmit the disease, according to some studies.

Thanks to the widespread awareness and updates to farming and meat processing operations, incidence of disease is significantly low. While the epidemic largely took place in the United Kingdom, routine testing practices world-wide aim to prevent another outbreak.

ADDING BONE MEAL TO SOIL

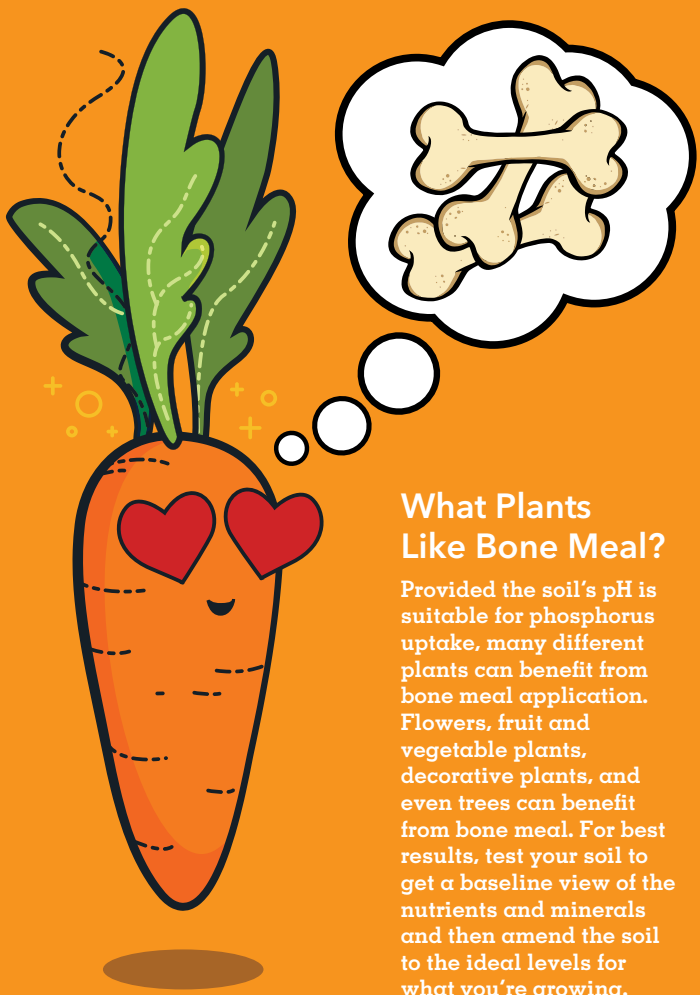
Bone meal can make a noticeable difference in the quality and condition of your plants. Consider adding bone meal to soil for a better growing experience. Follow these steps to incorporate bone meal into your gardens.

TIP: Before you begin adding bone meal to soil, first test the soil's quality, including the pH level. If the soil pH is 7 or greater, you must first tackle the issue of the high acidity of your soil. Phosphorus uptake occurs only when the pH level is below 7 in a more acidic state.

HOW TO ADD BONE MEAL TO YOUR GARDEN

- **For New Plantings:** Dig a hole the appropriate size for your plant and sprinkle a few tablespoons of bone meal into the bottom of the hole and complete your planting accordingly.
- **For Existing Plants:** Gently sprinkle and mix a few tablespoons of bone meal into the soil surrounding your plant and mix it in with a hand trowel. Water appropriately for the type of plant.
- **For Compost:** Sprinkle a bit of bone meal into your compost heap to add nitrogen and heat up the pile.

When in doubt, follow the instructions on the bone meal packaging. Using bone meal for plants can inspire remarkable improvements in your garden, from more vigorous root growth to more prolific blossoms and fruit or vegetables.



What Plants Like Bone Meal?

Provided the soil's pH is suitable for phosphorus uptake, many different plants can benefit from bone meal application. Flowers, fruit and vegetable plants, decorative plants, and even trees can benefit from bone meal. For best results, test your soil to get a baseline view of the nutrients and minerals and then amend the soil to the ideal levels for what you're growing.

Bone Meal for Flowers

Use bone meal fertiliser for flowers like roses, hydrangeas, tulips, and lilies. Giving bulbs a burst of phosphorus in the fall can help to increase root growth for a better spring blooming season. Adding bone meal for bulbs can also encourage more plentiful and showier blooms. For best results, add the bone meal directly to the planting hole or incorporate it as close to the roots as possible.

Bone Meal for Fruit and Vegetables

Tomatoes, peppers, potatoes, onions, and other bulb-like or root vegetables can all benefit from the extra phosphorus in bone meal. Fruit trees could benefit from added phosphorus if the soil is not already replete with nutrients. Remember sandy soils will call for more phosphorus.

Remember to test your soil prior to applying any additives. Check the requirements for the plants you're growing and work to find the right balance in your soil composition. Also, bear in mind you'll only need to do one application per growing season as bone meal takes about four months to move through your garden and into the plants.

by Alan Ray

Much like building a strong house, growing healthy plants begins with a good foundation: the soil they grow in. Alan Ray explores the differences between types of soils and what to do if your dirt isn't giving your plants the nutrients they need.

The Importance of good Soil health

"T'is more to this than meets the eye" is an old saying which never rang more true than when referring to the earth beneath our feet. Consider this statement by Howard Warren Buffett, formerly of the US Dept of Agriculture: "There are more living organisms in a tablespoon of highly organic soil than there are people on the planet." That is a mind-melting statistic strongly confirming we inhabit a living, breathing, planet whose mysteries are as many and varied as the life it supports.

Just as incredulous, studies have revealed a mere one-acre of healthy earth can contain as much as forty-tons of living organisms known as a soil-food-web. Invisible life sustaining visible life. With gardening, it is the secret life below that allows the life above to grow.

Dirt Poor

Before planting, make sure your little Eden isn't running a food-web deficit. Dead dirt, in effect. It doesn't take a horticulturist to realise live plants won't thrive in dead dirt.

For the home grower, good gardening starts with good, nutrient-stocked soil. Left alone, plants pretty much grow by themselves. That's their job. Our job as good stewards of the garden is to work and create a healthy environment in which our plants can flourish and reach their full potential. That begins with their substrate.

A little sweat equity now will pay big dividends later in addition to reducing the extra effort required trying to keep plants healthy in poor soil. Working the earth and prepping the soil before planting also helps put you in-tune with your garden. This doesn't mean you become one with your plants while levitating over the lettuce, but it does speak to the foundations of good gardening that will go a long way toward ensuring a happy you and a healthy harvest.

"For the home grower, good gardening starts with good, nutrient-stocked soil."

Healthy Plants Require Healthy Soil

Good soil does everything for your plants, bad soil doesn't. It supplies the necessary nutrients while providing your plants the soil best suited for their particular root systems. It is wise to get the right soil for your plants. Some plants, such as cacti and other succulents, need a sandy soil while others, like the iris, coreopsis, and fern, grow well in clayey soil. Wisteria likes a loamy dirt. Make time to learn what soil type your garden plants require and prepare accordingly.

Essentially, soil is an assemblage of particles consisting of three minerals (clay, sand, and silt) in varying proportions along with some liquids and gasses. The percentage of each mineral helps determine the soil's consistency. The darker the soil, the richer it is with organic matter. See page 36 for a quick reference chart of general soil types.

"It's important to get the correct soil type for your particular plants and to make sure they have the proper pH balance."

Soil Types

- **Loam** — There are some variations on loamy-soil but as a rule of thumb, loam consists of around 40 per cent sand with about 40 per cent silt and 20 per cent clay. Loam is a softer soil and a good general-purpose dirt.
- **Sand** — No mystery here. Sandy soil allows for good aeration (oxygen supply) and quick draining. Perfect for most water retaining succulents requiring a fast run off.
- **Silt** — With its tiny particles, silt compacts tightly and stifles aeration. However, this also enables the soil to retain water and nutrients. Plants that like a clayey soil will thrive in a silty one. Roses, butterfly bushes, and many perennials flourish in silty soil.
- **Clay** — Clay is comprised of tiny, flat, and flaky particles making water drainage slow. Clayey soils also compact quite tightly when dried, making it difficult for some plant roots to penetrate. However, clay has its fans. Goldenrod and black-eyed Susans being two of the many.

Evaluating Your Soil's pH

It's important to get the correct soil type for your particular plants and to make sure they have the proper pH balance. Though pretty adaptable, most plants like a pH between 6 and 7.

Having the correct pH balance cannot be more important. Proper pH allows for the uptake of important nutrients. Improper pH levels can negatively affect that uptake by allowing too much of one nutrient and not enough of another to be absorbed. Moreover, nutrients not used can build up in the soil and potentially starve your plant of them. Balance your soil.

When Dirt Needs Help

Few gardens come with magic ground, a perfect balance of pH, and correct nutrients. Often, they need a little help from the gardener. You can nearly always bring a poor soil back to good health and up to speed by simply adding some organic matter.

Evaluate your soil using a readily available soil tester. This tool can give you the moisture content and pH level of your dirt. If your pH level needs adjusting or you feel you may have nutrient deficiencies in your soil, there are easy ways to correct them. Your local extension office can evaluate your soil for deficiencies.

Troubleshooting Your Soil

- **Thick Clay** — With too clayey a soil you can add some pea-sized gravel to help prevent it from becoming too solid and aid in drainage. Be careful adding sand. It can help some types of clay but also turn others to concrete. Sphagnum peat moss is good for loosening up clayey soil.
- **Nutrient Deficient** — Lacking good nutrients is an easy fix as well. Composting can be a gardener's best friend. Compost is merely broken-down organic matter you can make at home. Composting is all natural and can quickly improve soil health by introducing good bacteria and microorganisms that promote healthy soil with improved nutrients and aeration.
- **Too Alkaline** — Reduce alkalinity and raise the acidic level of your soil by adding cottonseed meal to your dirt.
- **Too Sandy** — Add decomposed manure, grass clippings, and leaves as well as humus (decomposed plant material). Do not use fresh manure. It should have no odour.
- **Too Acidic** — Spread about 1.4 kilograms of ground limestone for every 100 square feet of average soil – 1.8 kilograms if it is pretty sandy.

By adding mulch (decomposed organic matter) you are amending the soil to restore balance. A mulch pile is worth its weight in healthy produce.

General Information

When it comes to gardening, there is no exact science. Well... there probably is but I don't know it. These are merely some basic guidelines to get you going in the right direction in hopes it will help improve your garden soil and provide your plants with the environment they need to grow and flourish as nature intended.

Specific modifications may be necessary for your particular soil type. Preparing your garden area weeks before you sew will give your plants a healthy head-start on the upcoming growing season. Don't be afraid to do a bit of research either because a garden is where digging up a little dirt can be a good thing.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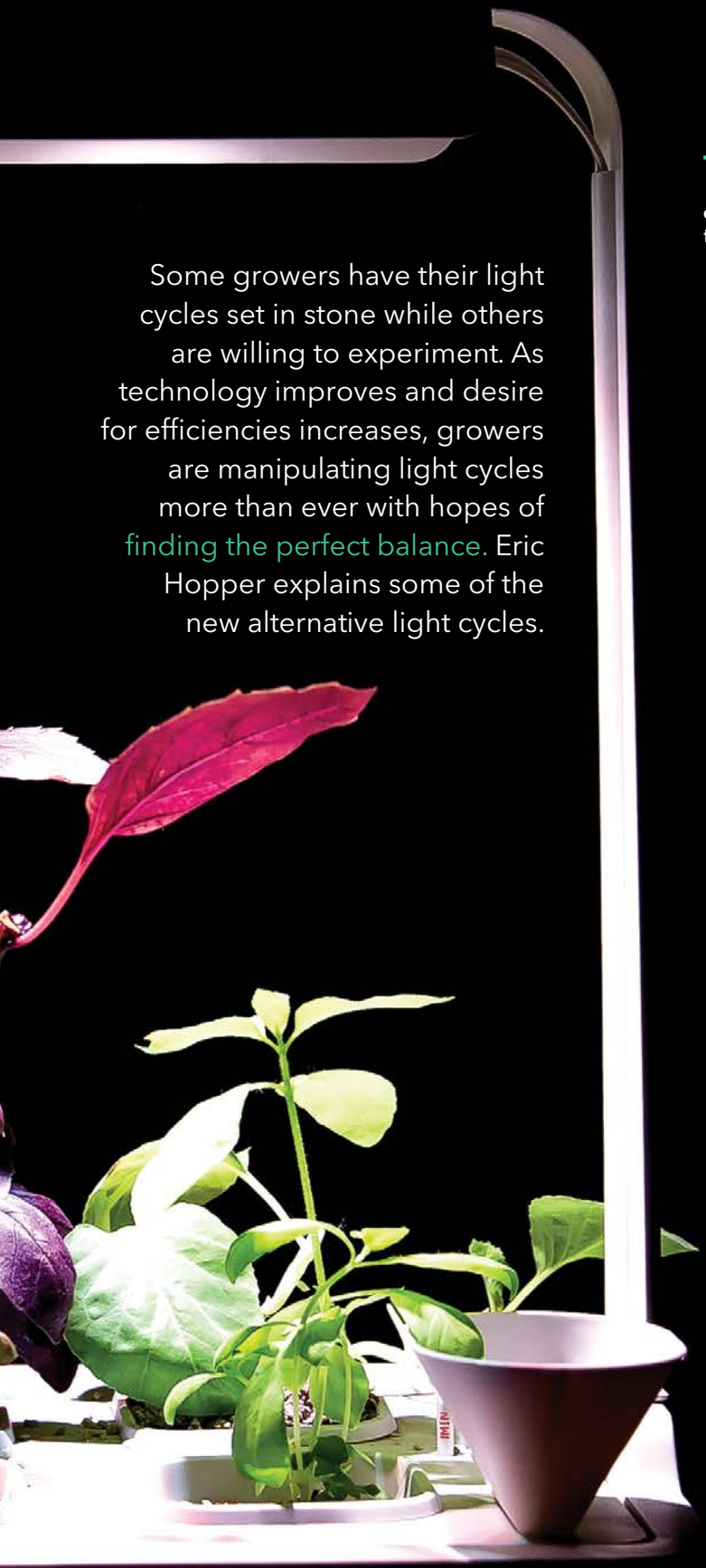
THE GAS LANTERN ROUTINE

... AND OTHER ALTERNATIVE LIGHT CYCLES

BY ERIC HOPPER

Some growers have their light cycles set in stone while others are willing to experiment. As technology improves and desire for efficiencies increases, growers are manipulating light cycles more than ever with hopes of finding the perfect balance. Eric Hopper explains some of the new alternative light cycles.



The heightened level of control over all environmental factors is arguably the biggest advantage of indoor horticulture. In an indoor garden, the horticulturist has ultimate control over the atmospheric conditions, watering schedule, nutrition, and lighting. In short, the horticulturist has control over all the inputs for the chemical reaction commonly known as photosynthesis. By manipulating any of the inputs for photosynthesis, growers automatically influence the growth and development of plants. The heightened control allows a grower to provide his or her plants with conditions that maximise photosynthesis and would not normally be found in nature. This can equate to faster growth rates and larger yields. Our cumulative knowledge of indoor horticulture has established a set of standards for growing indoors. Put another way, there are specific ranges in temperature, humidity, CO_2 levels, nutrition, and lighting that are considered optimal. And for good reason, as these standards are tried and true. However, indoor horticulturists' quests for efficiency and effectiveness have them continuously experimenting with alternative environmental conditions. It is the heightened control offered only by indoor horticulture that allows for experimentation with environmental conditions that would rarely, or never, exist in nature.

One of the factors that can be manipulated beyond those found in nature is lighting. In nature, light cycles are determined by the rising and setting sun. No two days have the exact same duration of light and dark hours, as they change slightly every day. In a light-tight indoor garden, a grower can create any sort of light cycle he or she desires. Although erratic light cycles will most likely stress the plants and cause undesirable effects, there are some indoor horticulturists who achieve success with alternate light cycles.

The Standard in Light Cycles for Indoor Gardens

Before discussing alternative light cycles for indoor gardens, it is important to mention the standard in lighting cycles for artificial horticultural lighting. Most indoor growers employ a 24/0, 20/4, or 18/6 light/dark cycle during vegetative growth. These cycles dictate the lights on or daytime durations are 24, 20, or 18 hours and the lights off or night time durations are zero, four, or six hours, respectively. Though the optimal lights on and lights off duration for vegetative growth seems to differ depending on who you ask (or the particular species of plant), it seems that the vast majority of indoor horticulturists use a 24/0, a 20/4, or an 18/6 light cycle for vegetative growth.

The standard for the flowering or blooming light cycle in an indoor garden is a 12/12 light cycle. This means the lights are on for 12 hours and off for 12 hours in every 24-hour light cycle. This standard cycle for flowering or blooming is largely agreed upon by indoor growers and is employed for both effectiveness and convenience.

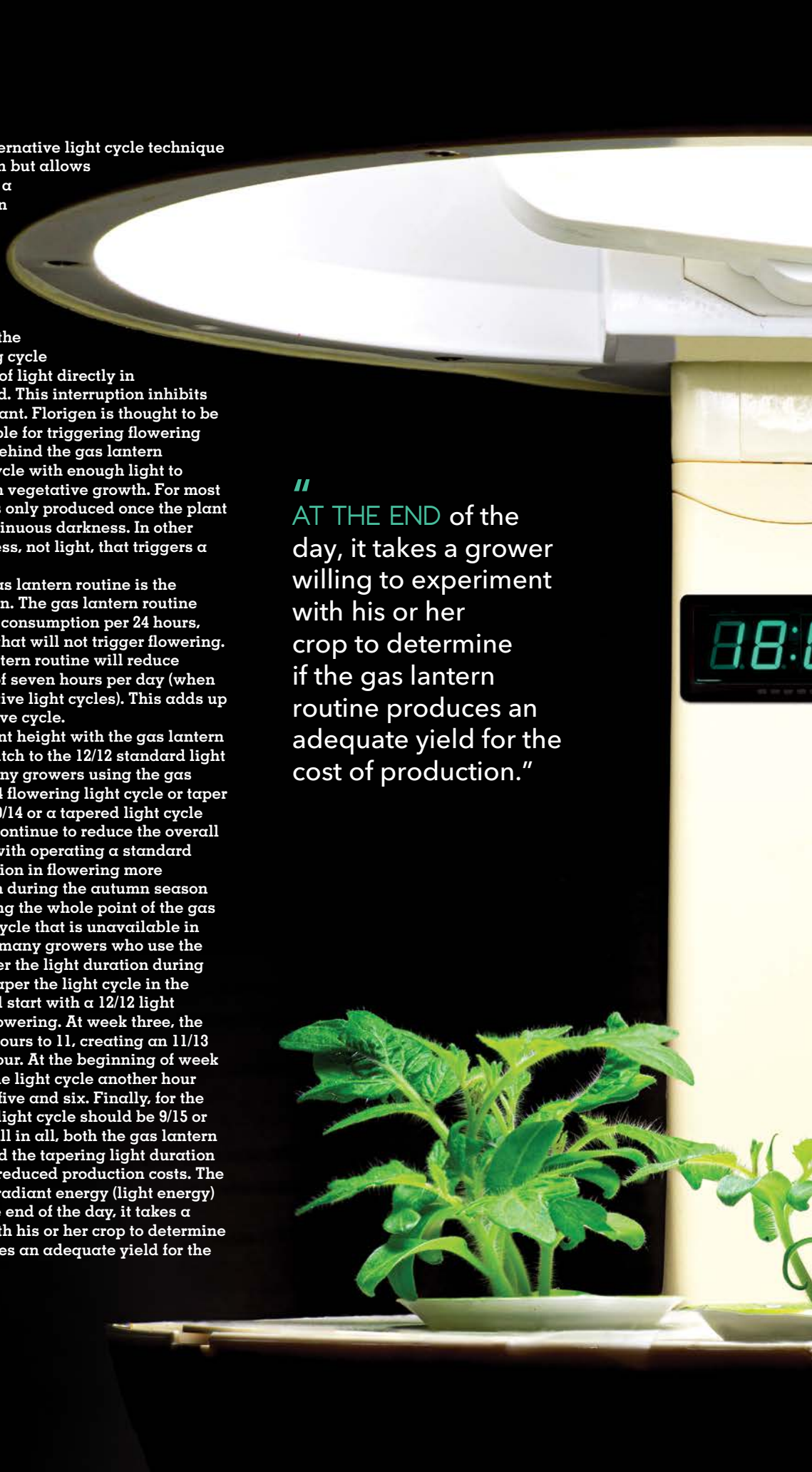
The standard light cycles used by indoor growers are based solely on a 24-hour day, which makes sense because that is the cycle that plants have evolved in for millions of years. However, some alternative light cycles manipulate this 24-hour cycle to trick the plants into thinking there is more than one light cycle in a 24-hour period. Some alternative light cycles used by indoor growers actually replace the 24-hour cycle with an 18-hour cycle.

Gas Lantern Routine

The gas lantern routine is an alternative light cycle technique that reduces energy consumption but allows the plants to continue to grow in a vegetative stage. The gas lantern routine follows a 24-hour clock in the following way: 12 hours lights on, followed by 5.5 hours of lights off, one hour of lights on, and then 5.5 hours of lights off. The gas lantern routine is similar to the standard flowering 12/12 lighting cycle with an interruption of one hour of light directly in the middle of the lights-off period. This interruption inhibits florigen production within the plant. Florigen is thought to be the flowering hormone responsible for triggering flowering production in plants. The logic behind the gas lantern routine is to interrupt the dark cycle with enough light to trick the plants into remaining in vegetative growth. For most photosensitive plants, florigen is only produced once the plant has experienced 12 hours of continuous darkness. In other words, it is the amount of darkness, not light, that triggers a plant's flowering response.

The largest advantage of the gas lantern routine is the savings in electrical consumption. The gas lantern routine reduces the amount of electrical consumption per 24 hours, while maintaining a light cycle that will not trigger flowering. When used correctly, the gas lantern routine will reduce electrical usage by an average of seven hours per day (when compared with standard vegetative light cycles). This adds up to close to 200 hours per vegetative cycle.

After achieving the desired plant height with the gas lantern routine, a grower can simply switch to the 12/12 standard light cycle for flowering. However, many growers using the gas lantern technique employ a 10/14 flowering light cycle or taper the flowering light duration. A 10/14 or a tapered light cycle during the flowering stage will continue to reduce the overall energy consumption compared with operating a standard light cycle. A tapered light duration in flowering more closely mimics the light duration during the autumn season (which is sort of ironic considering the whole point of the gas lantern routine is to use a light cycle that is unavailable in nature). Regardless of the irony, many growers who use the gas lantern routine prefer to taper the light duration during the flowering stage. In order to taper the light cycle in the flowering stage, a grower should start with a 12/12 light cycle for the first two weeks of flowering. At week three, the grower should reduce the light hours to 11, creating an 11/13 light cycle for weeks three and four. At the beginning of week five, the grower should reduce the light cycle another hour to create a 10/14 cycle for weeks five and six. Finally, for the last two weeks of flowering, the light cycle should be 9/15 or nine hours on and 15 hours off. All in all, both the gas lantern routine for vegetative growth and the tapering light duration for flowering offer the benefit of reduced production costs. The counter argument to this is less radiant energy (light energy) equates to reduced yields. At the end of the day, it takes a grower willing to experiment with his or her crop to determine if the gas lantern routine produces an adequate yield for the cost of production.



> "AT THE END of the day, it takes a grower willing to experiment with his or her crop to determine if the gas lantern routine produces an adequate yield for the cost of production."

"INDOOR HORTICULTURISTS' quests for efficiency and effectiveness have them continuously experimenting with alternative environmental conditions."

18-Hour Days

Another alternative light cycle employed by some indoor growers is the 18-hour daylight cycle. The theory behind the 18-hour day is a plant can only process a certain amount of light per 24 hours and as the light cycle continues, a plant's efficiency of absorbing light decreases. Put another way, it is theorised that during a normal 24-hour light cycle, plants will achieve the fastest growth rates during the first 50-60 per cent of the light hours. The growth rates will then diminish rapidly and the last 20-30 per cent of the light hours only produces minimal growth. By reducing the length of the day from 24 hours to 18 hours, a grower can create an environment where the plants receive enough light hours to achieve peak growth and still enough radiant energy (light energy) to produce comparable yields.

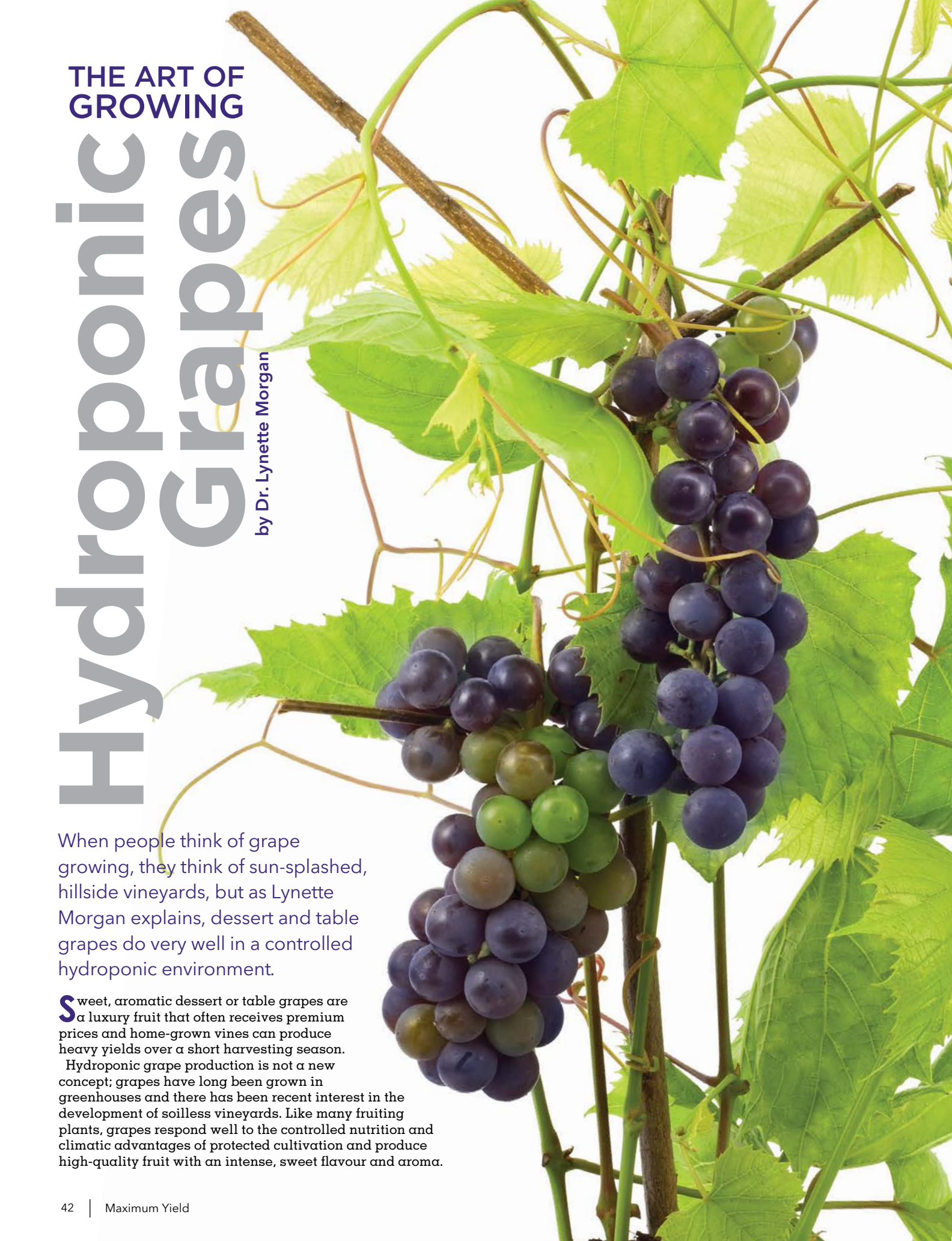
In order to experiment with an 18-hour daylight cycle, a grower will need a programmable digital timer or an analog 18-hour timer. The vegetative cycle would have a light cycle of 14/4 or 14 hours lights on and four hours lights off. During the flowering stage, the plants would need at least 12 hours of darkness so a 6/12 light cycle (six hours on/12 hours off) would be used. The benefits of operating an 18-hour day in an indoor garden include reduced electrical costs and shorter vegetative and blooming durations. A reduction in the duration of time to harvest equates to more harvests per year. One disadvantage of operating an 18-hour day is the lights will come on and turn off at different times each day. This can be inconvenient to a grower's feeding and watering schedules. Lastly, it should be noted that although some indoor growers swear by an 18-hour day, most professional growers still operate light cycles on a 24-hour clock.

Indoor horticulture is all about control. Having absolute power over the environmental conditions is what makes indoor gardening stand apart from outdoor gardening. With the control offered only in an indoor environment, cultivators have been able to experiment with and fine-tune all the factors that contribute to a healthy, productive garden. Though the standard light duration used by most professional growers exists for a reason, there are many cultivators willing to experiment with photosynthesis's most important input: radiant energy (light energy). For photosensitive plants, it is the duration of the dark cycle that initiates florigen production and, in turn, the plant's reproductive processes. By manipulating the duration of the dark period with the gas lantern routine, growers can significantly reduce electrical costs during the vegetative stage of growth in their gardens. As if manipulating a 24-hour clock wasn't enough, the use of digital timers allows a grower to get even more inventive and experiment with just about any day/night length he or she desires. Experimentation is the process that collectively shapes the future of indoor horticulture. Who knows… it just may be your experimentation that leads to the next standard in light duration for horticultural lighting.

THE ART OF GROWING

Hydroponic Grapes

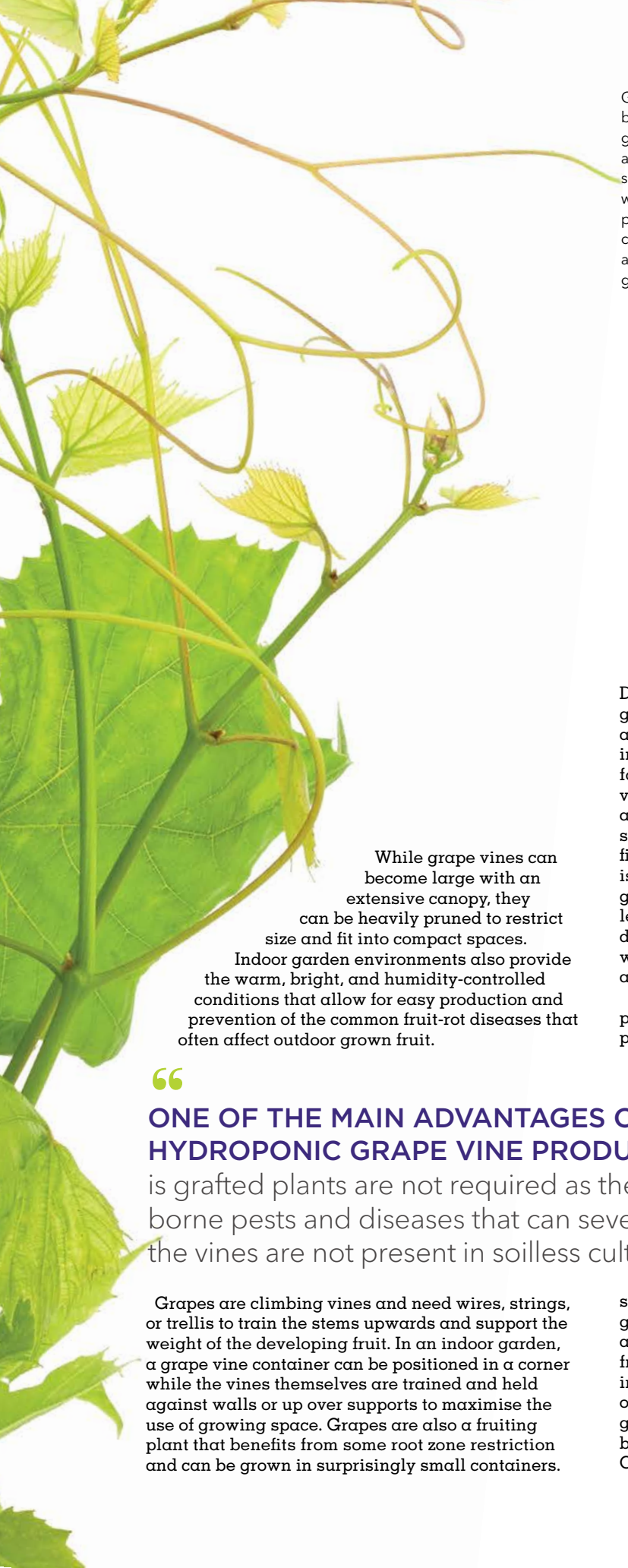
by Dr. Lynette Morgan



When people think of grape growing, they think of sun-splashed, hillside vineyards, but as Lynette Morgan explains, dessert and table grapes do very well in a controlled hydroponic environment.

Sweet, aromatic dessert or table grapes are a luxury fruit that often receives premium prices and home-grown vines can produce heavy yields over a short harvesting season.

Hydroponic grape production is not a new concept; grapes have long been grown in greenhouses and there has been recent interest in the development of soilless vineyards. Like many fruiting plants, grapes respond well to the controlled nutrition and climatic advantages of protected cultivation and produce high-quality fruit with an intense, sweet flavour and aroma.



Grapes have long been grown in greenhouses, but are also well-suited to the warmth and protected climate of an indoor garden.

While grape vines can become large with an extensive canopy, they can be heavily pruned to restrict size and fit into compact spaces. Indoor garden environments also provide the warm, bright, and humidity-controlled conditions that allow for easy production and prevention of the common fruit-rot diseases that often affect outdoor grown fruit.

> "ONE OF THE MAIN ADVANTAGES OF HYDROPONIC GRAPE VINE PRODUCTION is grafted plants are not required as the soil-borne pests and diseases that can severely affect the vines are not present in soilless cultivation."

Grapes are climbing vines and need wires, strings, or trellis to train the stems upwards and support the weight of the developing fruit. In an indoor garden, a grape vine container can be positioned in a corner while the vines themselves are trained and held against walls or up over supports to maximise the use of growing space. Grapes are also a fruiting plant that benefits from some root zone restriction and can be grown in surprisingly small containers.

Dutch buckets or growing containers of at least 45 centimetres in depth are suitable for well-pruned grape vine production, filled with a free draining substrate such as perlite or a coco fibre/perlite mix. Drip irrigation is commonly used for hydroponic grape production and provides a good level of moisture, while at the same time allowing for some dry down of the substrate between irrigations; this assists with the production of fruit with a high compositional quality and optimal sugar levels.

One of the main advantages of hydroponic grape vine production is grafted plants are not required as the soil-borne pests and diseases that can severely affect the vines are not present in soilless cultivation. Cuttings can be taken from any good dessert grape variety and, once roots have formed, established into a hydroponic production system. Hardwood cuttings from healthy vines are typically taken in late fall or winter from outdoor-grown plants as grapes do not grow true to type from seed. New buds will start to sprout in spring after roots have formed and at this stage the new young plant is ready to establish into a hydroponic system; alternatively young vines can be purchased and the growing medium carefully removed before planting. There are a huge number of different grape varieties ranging in fruit size, colour, and sweetness and with subtle differences in flavour. Table or dessert grapes are commonly white, black, or red in colour, however, green types also exist with popular greenhouse varieties that are suitable for indoor gardening being Black Hamburg, a well-flavoured, dark-skinned type, and Chasselas, an early season grape that produces well in pots.

TRAINING

Training and pruning are essential for indoor grape vines — without suitable growth restriction and control, hydroponic vines can become extremely vigorous and soon lead to jungle-like conditions within a confined space. There are a few different methods of grape vine training, however, for greenhouse and indoor spaces either the cordon or fan method work well. The fan system involves training shoots that develop from the main stem up against a wall with two trained out vertically and one horizontally, these are then cut back to just two to three buds per shoot; numerous new shoots will then form that can be selectively trimmed to give an attractive fan shape.

The cordon method of training is simpler, takes up less space, and involves allowing just one or two stems to develop that are trained into position. From these stems, side shoots will develop (eventually these become the spurs), which have the growing point removed two buds from the permanent stem. Grapes and leaves are produced on these side shoots that are cut back each year, building up a fruit spur and keeping the vine compact. As part of the training process, any excess tendrils should be removed as they form. Tendrils are thin, twisted stem-like growths the plant uses to cling and climb as it scrambles up over surfaces. Tendrils can get tangled up with the fruit bunches and are best removed to allow the training system to support the plant and prevent the plant's assimilate being diverted away from developing fruit production.

Apart from supporting the vine and fruit, along with regular training and pruning to maintain vine shape and restrict vegetative growth, dessert grapes often benefit from some thinning of the fruit bunches. Commercially produced greenhouse grapes are thinned to not only create a perfectly shaped and uniform bunch, but to also increase the average size of the berries; sweetness is also improved with thinning. Thinning is best done when the grapes are still very small and with long-bladed scissors (avoiding touching the surface of the grapes helps to retain the bloom on the surface of the fruit).

POLLINATION AND GROWING CONDITIONS

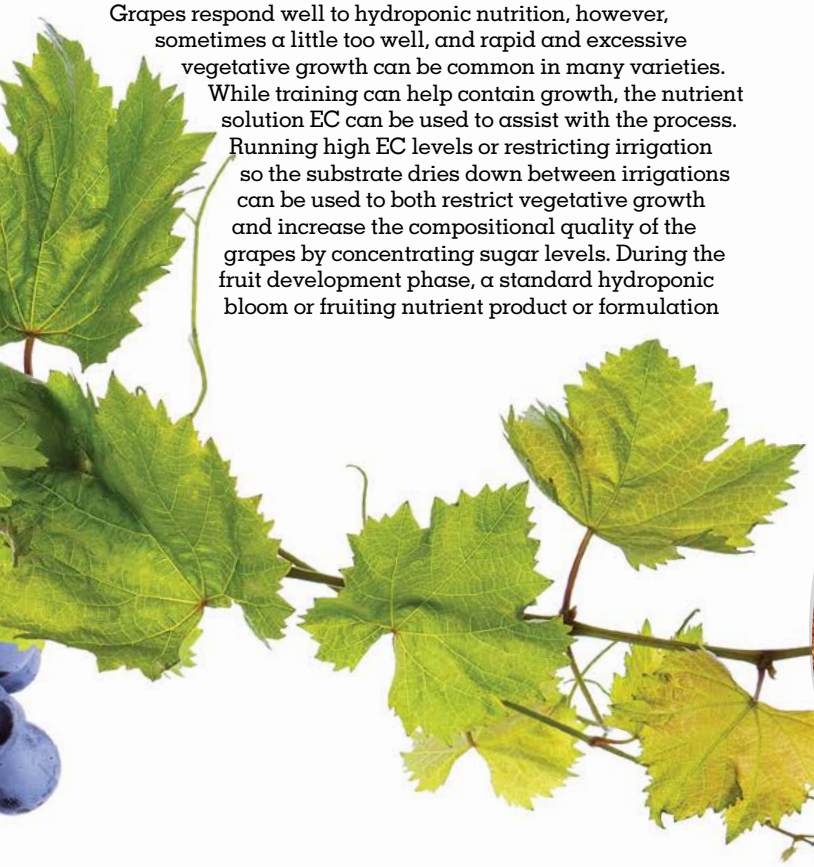
Indoor-grown grapes will need some pollination assistance in much the same way as tomato flowers require hand pollination or stem shaking to release the pollen. Pollination can be achieved by shaking the flowering stems vigorously or by stroking each bunch of flowers to cause pollen transfer. Alternatively, a small brush can be used on the flowers for the same purpose.

“**INDOOR-GROWN GRAPES WILL NEED SOME POLLINATION ASSISTANCE** in much the same way as tomato flowers require hand pollination or stem shaking to release the pollen.”

Grape vines need similar amounts of light and day length as other fruiting vines like tomatoes and cucumbers. The environment needs to be warm with optimums of 22-28°C suitable and avoidance of high humidity particularly when the vines are in fruit and prone to rot diseases. Good levels of air flow up and under the canopy are also required, and training of shoots should facilitate air circulation around the developing grape bunches. Grapes require a cold winter dormancy period as part of the life cycle — this is usually achieved by cutting the vine back after fruiting and taking the containerised plant outdoors to overwinter.

NUTRITION REQUIREMENTS

Grapes respond well to hydroponic nutrition, however, sometimes a little too well, and rapid and excessive vegetative growth can be common in many varieties. While training can help contain growth, the nutrient solution EC can be used to assist with the process. Running high EC levels or restricting irrigation so the substrate dries down between irrigations can be used to both restrict vegetative growth and increase the compositional quality of the grapes by concentrating sugar levels. During the fruit development phase, a standard hydroponic bloom or fruiting nutrient product or formulation with high potassium levels will assist yield and fruit quality, while maintaining high light levels will ensure the plants produce sufficient assimilate for high brix (sugar levels) fruit and maximum flavour. Electric conductivity levels in the 2.0–2.4 range are suitable for young vines with an EC level up to 4.0 for those in fruit. Some care needs to be taken with irrigation, however, as excess moisture levels or irregular watering during the late-fruit developmental stages can cause fruit to split. Irrigation should be gradually reduced during the fruit-ripening stages to help prevent this from occurring.



Top: Grape vines need support for the vines and fruit.

Middle: Grape vines can be grown in suitably sized pots, buckets, or containers.

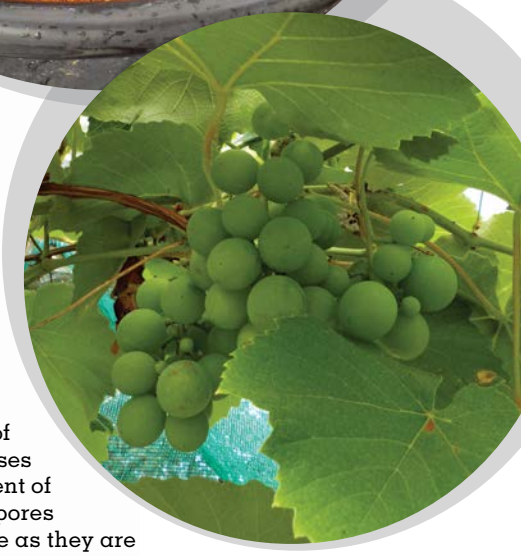
Bottom: Although they need a little pollination assistance, indoor grape vines set fruit easily.

HARVESTING HYDRO GRAPES

Grapes are a fruit that need to be fully ripened on the vine to achieve maximum flavour and sweetness. For dessert varieties, sampling a few fruit when fully coloured will determine when they are sweet enough to harvest. A hand-held brix meter, to measure fruit sugar levels, is also a useful tool for assessing when to harvest table grapes. Bunches should be cleanly cut from the plant with scissors and not pulled form the vine as this can cause tears and stem damage. Grapes that appear to be slow to mature and colour can benefit from some additional heating during this stage, particularly at night.

PESTS AND DISEASES

Indoor grapes are prone to the same pests as many other fruiting vines such as tomatoes, including whitefly, aphids, mealy bugs, and occasionally mites under low humidity conditions. The main issue with some grape varieties is fungal pathogens, specifically mildew and botrytis (grey mold). Mildew can be devastating on grape vines and lead to defoliation. The main method of control is growing resistant varieties and using a good rate of ventilation and air movement under and through well-pruned vines.



Protectant fungicide sprays can also be used for mildew control. Botrytis or grey mold mainly affects the ripening fruit under conditions of high humidity and causes fruit rot and development of grey-brown, ash-like spores that spread the disease as they are released into the air. Botrytis is largely a cool-season pathogen and suitable levels of heating, humidity control, ventilation, and air movement are the main methods of prevention.

A well-controlled, pruned, and trained grape vine can make a valuable addition to a growroom and be trained up against a suitable wall or over tall supports. The quality and flavour of the fruit under hydroponic nutrition and in an optimal environment can be far superior to outdoor-grown fruit with opportunities to maximise sweetness and grape size by manipulating factors such as EC, nutrients, moisture levels, and climate.

Elevate Yourself: Cannabis-Infused Massages, Lotions, and Oils

by Nicole Skrobin

The daily grind, pain, or stress can wear you down, leaving you feeling less than your best. Fortunately, cannabis-infused therapeutic massages, known to provide physical and mental relaxation, are becoming more accessible.

On a weekly basis, how often do you feel stressed, anxiety, or pain? If you experience any of these symptoms at least three times a week, how do you manage them and prevent your day from being negatively affected? Not only are there a multitude of natural medicines to try for symptom management, such as cannabis, there are also alternative therapies like massages, which can alleviate uncomfortable symptoms while improving your well-being. For decades, massages have been known to provide therapeutic benefits, physical and mental relaxation, and tranquility. However, with the addition of cannabis-infused topical products, your massage experience could be taken to a much higher level. Keep reading to find out why specialised cannabis massages can positively impact your mood, well-being, and quality of life.

The Increasing Prevalence of Cannabidiol and THC-Infused Products

Cannabis is a medically, therapeutically, and nutritionally beneficial plant whose variety of cannabinoids can provide mental and physical improvements while helping consumers feel like the best versions of themselves. Although cannabis contains several cannabinoids, two of the most recognisable and widely-used ones are cannabidiol (CBD) and tetrahydrocannabinol (THC).

While CBD has stolen the attention and interest of people worldwide, especially elderly adults and parents of ill children who have been searching for a natural medicine, THC has shown to be beneficial too.

The Progression of Using Infused Cannabis Products

Nowadays, there's a plethora of skincare, body-care, cosmetic, and health and wellness products containing numerous cannabinoids, but especially CBD and/or THC. Many of these products are used for personal and professional purposes, especially by massage therapists. Due to the vast medicinal capabilities of CBD and THC, different infused oils, lotions, gels, and creams are being used more often at massage clinics, spas, homeopathic businesses, and by consumers at home.

Benefits of Combining CBD and THC with Massages

We have our own reasons for consuming cannabis, be it for medicinal or recreational purposes. When cannabis is combined with therapeutic massages, though, it can help you achieve the relief and beneficial effects your mind, body, and inner self crave.

Because of the many advantages of massages and their calming effects, numerous people with different medical conditions and diseases have taken an interest in this form of therapy. Here are some health issues that, according to the Mayo Clinic, can be relieved after undergoing a massage:

- anxiety
- headaches/migraines
- digestive disorders
- muscle spasms
- soft tissue injuries or strains
- stress-related insomnia
- fibromyalgia
- sports injuries
- arthritis
- menstrual cramps
- acute or chronic pain

Besides massages delivering physical and mental relaxation, they can also reduce muscle tension, soreness, aches, and overall discomfort. Then, when cannabis-infused products are incorporated, your experience is likely to be elevated to a much deeper level.

Other popular reasons for getting massages is to feel relief from symptoms caused by a health issue, daily life, or consistent stress. As a massage client, you can experience several of cannabinoids' powerful benefits including their analgesic, anti-inflammatory, and anti-spasm properties, to name a few. Then, there are mental benefits that CBD and THC can specifically provide such as their anti-anxiety and anti-depressant benefits.

Cannabis Massage Expectations

Cannabis-infused massages aren't too different from traditional massages. You can expect to hear soothing music, smell the aromas of refreshing essential oils, achieve full-body and mind relaxation, while feeling tension, pain, and aches melt away.

"**There are mental benefits** that CBD and THC can specifically provide such as their anti-anxiety and anti-depressant benefits."

What may feel different is how you feel after your massage therapist applies different cannabis topical products.

In particular, CBD is known to deliver many non-psychoactive, non-toxic, and non-addictive medicinal and therapeutic benefits in addition to providing mellow effects. If you don't want to feel high during a massage, CBD topicals will suit your needs better. If you'd like to experience soothing psychoactive effects during your massage, a mixed CBD and THC-infused topical may be the right combination for you.

Furthermore, expect to experience relief and tranquility from a cannabis-infused massage, but also mental clarity that could help you achieve a deeper state of Zen. This is what all of us want at the end of the day, right? To live calmly and peacefully, get rid of pain, stress, and negativity, and embrace our true selves. Thankfully, cannabis can help us get there, and asking for cannabis topical products during your next massage could be just what your mind, body, and soul needs.

The Progression of the Massage Therapy Industry

The massage therapy industry continues to rapidly grow. It had an annual growth rate of 7.1 per cent from 2012-2017, and this industry keeps progressing. Although cannabis-infused massages aren't offered everywhere, variations of them are available in more places as compared to several years ago.

Where to Get Your First Specialised Cannabis Massage

Aside from massage clinics and spas, traditional massages are often offered at hospitals, medical clinics, physical therapy businesses, yoga studios, and even airports. However, more independent massage and spa businesses are riding the wave of specialised cannabis massages to accommodate the needs of interested consumers.

Although massages have been deemed a natural therapy that can improve one's well-being, when they're combined with cannabis topical products, the results can leave you feeling on cloud nine and wondering why these services aren't offered everywhere. If you have the opportunity to try a cannabis-infused massage, why not give it a try to experience all of its wonderful benefits? Do it for your health, well-being, and to achieve mental, physical, and spiritual gains.

GROWING HYDROPONIC STRAWBERRIES

Hydroponics is becoming recognised as the most productive and efficient form of food production. Whether grown indoors or outdoors in sunlight, hydroponic cultivation offers strawberry growers many advantages.

by Lee Allen

Strawberries are one of the best fruits for growing hydroponically. Not only do they taste better than most traditionally grown strawberries, they respond well to nutrient solution and can be grown at an elevated height. This has been a huge benefit for commercial growers as the picking rate is much faster and less tiring, while the cultivation of plants is easier.

"MOST TRADITIONAL GREENHOUSE CROPS ARE PREDICTABLE, BUT NOT STRAWBERRIES — although they are adaptable."

At the University of Arizona's Controlled Environment Agriculture Center (CEAC) and at Ohio State University (OSU), Dr. Chieri Kubota (who worked at CEAC and is now at OSU) decided to add sustainable strawberries to her greenhouse repertoire to research growing them hydroponically.

Growing up in Tokyo, she savoured fresh strawberries in the winter, a possibility she once referred to as "an unusual cycle against nature." She thought, "If fresh berries can be winter grown in Japanese greenhouses, why not in CEAC gardens?" Her ahead-of-its-time thinking paved the way to successful production in Arizona's blazing triple-digit summertime temperatures and, conversely, she refers to Canadian greenhouses (like Mucci Farms in Ontario with a humble beginning in a wooden frame poly greenhouse in the early 1960s) as a leader in the challenge of year-round production in cooler climates.

Kubota and fellow CEAC researcher Mark Kroggel designed an under-the-bench fogging system that helped by intermittently (three times an hour, for five minutes over three hours) spraying the crop in a greenhouse bathed in diffused light. Because nighttime temperatures are key for large and flavourful berries, they kept an optimum evening temperature at 10°C (anything higher increased acid content and made the fruit tarter). "The size and flavour of strawberries are more driven by the type of cultivar and the temperature than they are by nutrition and irrigation," Kubota says.

Nestled in Styrofoam troughs suspended waist-high in her greenhouse are long rows of lush green leaves protecting bright red berries. "Hydration is important because if the water doesn't reach the leaf tips at night, they get tip burn, an unsightly calyx at the base of the berries," says Kubota.

Kubota ended up at Ohio State University where she is now a professor of horticulture working in a 1,200-square-foot greenhouse studying the effectiveness of LED lighting on various food crops, particularly strawberries and tomatoes. Because there is a paucity of information about growing greenhouse strawberries, both the CEAC discoveries and the OSU findings are important to the emerging hydroponic berry industry as a whole.

Kubota is a strong proponent of indoor strawberry growing. Prior to her departure from CEAC, she emphasised: "In a greenhouse, both aerial and root zone environments can be maintained in an optimum range that maximises plant productivity — less water and nutrients required, no fumigation or pesticides needed, humidity and temperature controlled, and there's less stoop labour required to grow and harvest."

Although it's a subjective interpretation, her greenhouse berries taste better than off-the-shelf grocery store varieties. "Supermarket strawberries look good cosmetically but flunk the flavour test as growers trade off taste for extended shelf life," she said. "The goal is to establish off-season hydroponic production of a value-add, year-round crop that will actually taste good."

In an interview with the University of Arizona News Bureau, Kubota explained her experiments with optimal growing conditions were aimed at producing sustainable, off-season, hydroponic berries, slow-growing them because they accumulate more brix content (sugar) in the fruit. "Most traditional greenhouse crops are predictable, but not strawberries — although they are adaptable," she said.

Research has shown strawberries prefer a daytime temperature range of between 18-24°C, then get cooled down at night to maintain fruit quality. A previous *Maximum Yield* article ("How to Grow Four Types of Berries Hydroponically," August 2017) noted hydroponic strawberries were "relatively easy to grow" — if flowering, pollination, and fruiting all went according to plan — but their counterparts, like blueberries and raspberries, grown in soilless greenhouse environments "require more in the way of time and effort."

Healthy strawberries stay healthy with at least six to seven hours of daily sunlight and a pH between 5.8-6.2.

The CEAC scientists are currently planting California cultivars bred for yield and disease resistance — what their growers called high-maintenance/low-yield, but very flavourful varieties. Coordinator Dr. Gene Giacomelli says: "We're growing new cultivars now and when they reach maturity this fall, we'll start monitoring them through the winter production cycle, looking at number and quality of fruit and its sugar content. We'll be looking at two things, how different cultivars respond and their root zone growth."

a brief
HISTORY OF

APPLES

by Philip McIntosh

From origins in the mountains of Kazakhstan to prominent mentions in the Bible and other literature, apples have taken their place atop the fruit kingdom. They're also really good for you.

An apple a day may or may not keep the doctor away, but people tend to like them a lot, which is good, because apples are a tasty and nutritious fruit that comes in many varieties. The apple *(Malus domestica)* is a member of the rose family that also includes pears, peaches, plums, cherries, and even almonds. You can tell they are related by taking a close look at their similar and quite attractive flowers. Apples are good source of vitamin C, a small amount of protein, and a dose of naturally occurring sugar. Any fat or cholesterol? Nope. Apples also contain phytochemicals such as quercetin, a flavonoid with antioxidant and anti-inflammatory activity, and pectin, a soluble fibre, which keeps the digestive tract working "smoothly" so to speak.

Although the famous Granny Smith was first cultivated in Australia by Maria Ann Smith in 1868, the apple originated a long way from Australia. Unlike the case with some other agricultural plants (corn and hemp, for example) that have been intensively and selectively bred by humans for centuries, the original apple tree, *Malus sieversii*, can still be found in its native habitat, the mountains of Kazakhstan.

The genus name *Malus* (with a long a) comes from the Latin word for apple. The similar word (with a short a) means bad or evil, which somehow through a mistranslation got mixed up in the Adam and Eve story. Although no specific fruit was mentioned in the earliest Bible story, it was simply a fruit from the "tree of knowledge," most people think of that tree as being an apple tree.

And what about that Jonny Appleseed dude? Well, we don't find large stands of apples along the midwestern US rivers he supposedly travelled. He did plant a lot of orchards west of Pennsylvania though. It is rather a fool's errand to grow apples from seed since they are so genetically heterogeneous. Only a few seeds out of a hundred (if you are lucky) will produce an apple tree similar to the parent, which is why commercial apples are invariably grown by grafting to keep the genetics consistent over time. But, Mr. Appleseed (real name is John Chapman) did plant a lot of apple orchards for the production of cider, which does not require strict adherence to what kind of apple is used. Apparently, there is only one of his original seed-grown trees left, located in the small town of Savannah, Ohio. There used to be a lot more, but they were cut down during prohibition to prevent cider production. Some of the seeds he planted did produce good fruit, however, and were later propagated using grafting, leading to the Golden Delicious among others.

One can find an apple for just about any culinary purpose. There are sweet-eating apples such as Golden Delicious, Fuji, and Gala, more tart ones best suited for pies such as Pink Lady, Jonathan, Northern Spy, and Granny Smith, and plenty of small sour ones for making cider. If those aren't enough for you, know that there are more than 7,000 varieties of apples, with about 15 varieties grown throughout Australia. Seems like it would be a fun idea to try them all.

distribution **LIST**

retail stores are listed alphabetically in each state

ACT

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

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

NEW SOUTH WALES

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

99 Trading
57 Hoskins Ave.
Banks Town NSW 2200
(02) 9790 1525

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Hyalite Prestons (New South Wales)
2/4 Avalli 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 Nelson St.
Wallsend NSW 2287
(02) 4965 6595

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

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

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

Indoor Sun Shop
745 Victoria Rd.
Top Ryde NSW 2112
(02) 9808 6873

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

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

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

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

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

Lux 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 Uralla Rd.
Pt Macquarie NSW 2444
(02) 6581 1272

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

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

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

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

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

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

Sydney Garden Supplies
187 Waterloo Rd.
Greenacre NSW 2190
(04) 1460 9241

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

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

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

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

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

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

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

VN Hydro
8 Robert St.
Belmore NSW 2192

Warrawong Hydroponics Centre
240 Cowper St.
Warrawong NSW 2502
(02) 4274 8001
warrawonghydro@hotmail.com

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

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

NORTHERN TERRITORY

Darwin Hydroponics
5/8 Andrews St.
Berrimah NT 0828
(08) 8947-2576

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

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

QUEENSLAND

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

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

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

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

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

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

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

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

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

Eye Lighting Australia Pty Ltd.
PO Box 306
Carole Park QLD 4300
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10 facts on MUSHROOMS

by Philip McIntosh

No goofy jokes about there being "a fungus among us," just 10 facts on mushrooms.

1. **Mushrooms** are classified in the kingdom Fungi, which can be pronounced with either a hard or a soft "g."

2. **Fungi** are unicellular or multicellular *Eukaryotes* (having nuclei in their cells), no chlorophyll, possessing cell walls, having asexual or sexual reproduction (or both), and obtaining nutrition through absorption.

3. **Fungi** can be grouped into one of three basic groups: yeasts (primarily unicellular, like the baker's yeast *Saccharomyces cerevisiae*), molds (fuzzy things growing on old stuff in the refrigerator), and mushrooms.

4. A **mushroom** is the fruit body of a fungus, usually in the group *basidiomycetes*, which includes the common button mushroom (*Agaricus spp*), oyster mushrooms (*Pleurotus spp*), shiitakes (*Lentinellus* or *Leninula edodes*), enokitake mushrooms (*Flammulina velupites*), and many others you see hanging off a tree or popping up out of the ground.

5. **Morels** (*Morchella esculenta*), which some consider the best gourmet mushroom, are ascomycetes but most folks call them mushrooms too.

6. **Mushrooms** are mostly water, but are a decent source of protein, vitamins D and B12, and a few important mineral elements. To top off their list of pluses, they are low in calories and fat and sugar free.

7. **Misidentified** wild mushrooms cause, on average, several deaths every year in Australia, with significantly more people suffering non-fatal, yet quite unpleasant symptoms (vomiting, mental confusion, diarrhea, abdominal pain, sweating, and salivating).

8. **Raw** button mushrooms contain agaratine, which causes cancer in laboratory animals. Cooked mushrooms are apparently not carcinogenic in mice, but more research is needed to assess the risk in humans.

9. **Portabella** (or portabello) mushrooms are good grilled and have a robust, meaty, flavour. The development of the portabella is worthy of a marketing Nobel Prize (if there is such a thing!). Portabellas are nothing more than button mushrooms allowed to mature to a much larger size.

10. **Ongoing** research suggests that certain mushroom polysaccharides, proteins, and peptides (small chains of amino acids), have immunostimulatory or anti-cancer activity. Drugs of fungal origin such as penicillin, statins, vasoconstrictors, and others have already been developed, so it is likely that mushrooms and other fungi will continue to be a source of medicinal compounds in the future.

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