PROFESSIONAL SECRETS FOR PLANNING A GREENHOUSE

MAXIMUM YIELD

JUL/AUG 2019

A COMPLETE GUIDE FOR THE MODERN GROWER

LOW-COST HYDRO
DON'T BREAK the BANK

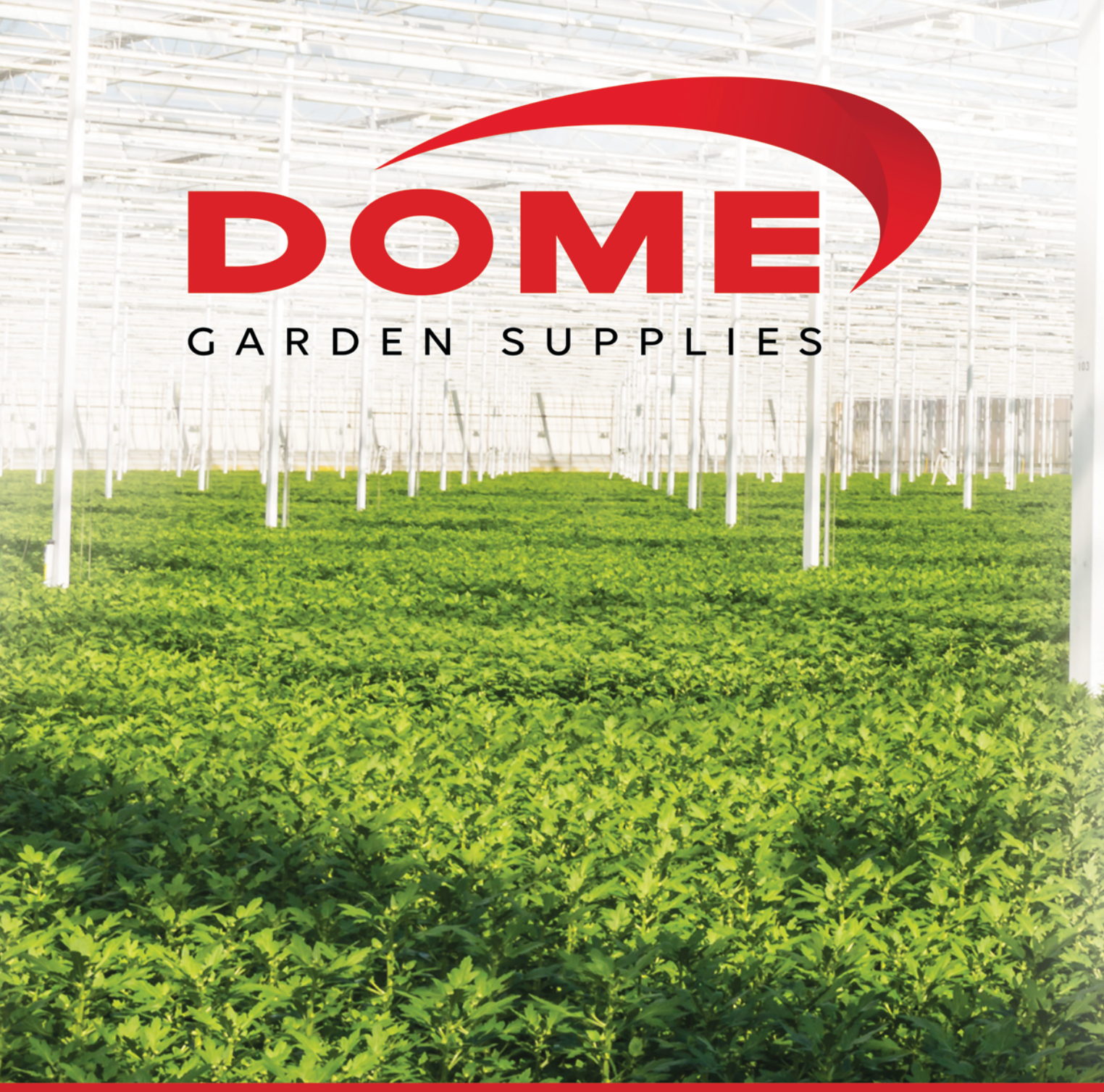
THE FUTURE IS NOW:
A.I. and Controlled Environment
AGRICULTURE

3 NICHE-MARKET HYDROPONIC CROPS

Enhancing Natural Plant
DEFENSES

Check Out the Newest
GROW PRODUCTS!

UNDERSTANDING
MICROCLIMATES



Dome Garden Supplies leads by sourcing and distributing world-renowned horticultural products.

AUSTRALIA

12 Pinnacle Road,
Altona North, VIC 3025

+61 3 9282 1988
+61 3 8080 0751
info@domegarden.com.au

2/4 Avali Road,
Prestons, NSW 2170

+61 2 9824 3400
+61 2 9824 3433
info@domegarden.com.au

1/10 John Duncan Court,
Varsity Lakes, QLD 4227

+61 7 5593 7535
+61 7 5593 7385
info@domegarden.com.au

domegarden.com

@domegardensuppliesau

USA

651 Barrington Ave Unit B,
Ontario, CA 91764

+1 909 980 2542
+1 866 420 2157
info@domegardensupplies.com

NEW ZEALAND

4/117 Montgomerie Road,
Airport Oaks, Auckland 2022

+64 9 275 6341
+64 9 275 6025
info@domegardensupplies.co.nz

BIOCANNA

The Bio Solution for growth and bloom

Created by Nature
Improved by CANNA

100% organic growing with BIOCANNA

Since its introduction in 2003, BIOCANNA represents the first organic certified solution for cultivating your favourite plants in an organic way. Please visit our website for more information.

WE SUPPORT JUSTDIGGIT

www.biocanna.com.au

AMINO® TREATMENT

STRONGER PLANTS

ENHANCE YOUR PLANTS DEFENCE SYSTEM

DISTRIBUTED BY
WWW.STEALTH-GARDEN.COM

WWW.HOUSE-GARDEN.COM.AU

FIRST FOR
HYDROPON
CRAFTSME

Reiziger / rye • zig • er /: The first hydroponic solutions for craftsmen.

Formulated from the original recipes created at the legendary Seed Bank of Holland in the 1980s, Reiziger rewards the hydroponic craftsman with unparalleled fruit and flower size with an enhanced flavour and aroma.

Search for the ship on the gold bottle.

REIZIGER.COM

NIC

EN


The first
hydroponic
solutions
for craftsmen
since 1984
REIZIGER
HOLLAND

Contact us for your nearest re-seller:

(03) 9335 3310

sales@whg.net.au

DUAL FUEL:

GROW LIKE THE PROS.

Dual Fuel is engineered for commercial gardens. Simple and easy to use throughout your plant's life cycle, it's the most effective and complete 2-Part Nutrient System on the market.

Using equal parts throughout all growth stages, there's no fumbling around with different measurements. It's easy to use for the beginner but has been formulated to meet the complex needs of the professional grower.

DUAL FUEL IS:

- Trusted by more Licensed Producers in Canada than any other nutrient manufacturer.
- Economically viable for commercial gardening applications.
- Simple and easy to use.
- Suitable for all automatic dosing systems.
- Grower approved.

THE PROS USE IT... SO WHY DON'T YOU?

GreenPlanet

The world's finest nutrients.

See the results of our products first hand on youtube:

GROWINGEXPOSED

www.growingexposed.com


MONSTA BUD
Celebrating 26 years in business.
Over 12 million litres sold!
"Licensed to Grow"
www.ozimagic.com.au
OMG
NOT ALL BEES ARE EQUAL

CO2 is a Necessary Tool for Indoor Gardening - Get yours Today!

The ExHale Cultivator is designed for small to medium grow spaces , or more specifically 1 ExHale Cultivator will provide 4-6 plants with the CO2 they need!

Patented genetics
6 months of CO2 guaranteed
20-30% increase in yield
Maintenance free
Made in the USA
No electricity
No Heat

Available from these fine distributors!

Great Lakes Garden Wholesale
CMP Wholesale
GreenPlanet Wholesale
BioFloral
The Original CO2 Bag
HydroFarm
EasyGrow Ltd Horticultural Wholesale
Dome Garden Supplies

THE ExHale HOMEGROWN CO2
exhaleco2bags.com

MAXIMUM YIELD

Features

GreenPlanet

GP3

GROW MICRO BLOOM

3PART NUTRIENT SYSTEM

Contact us for your nearest re-seller:
(03) 9335 3310
sales@whg.net.au

QUALITY FOCUSED, RESULTS BASED.

WHY?

GP3 provides greater flexibility than a 2-part nutrient. Grow, Bloom & Micro formulae are blended together in specific ratios during the various transitional stages of growth & flower. This method delivers true craftsmanship results and can be 'dialed in' for pheno specific nutritional requirements or climatic variables.

HOW?

Green Planet nutrients were developed and thoroughly trialed in thousands of North American licensed cannabis cultivation facilities. These real world trials form the basis of our unrivaled nutrient feeding programs.

See the results of our products first hand on youtube:

GROWINGEXPOSED
www.growingexposed.com

MAXIMUM YIELD

Contents

CYCO

OUTBACK SERIES

DEVELOPED FOR COMMERCIAL OUTDOOR / GREENHOUSE USE

AVAILABLE IN 10kg & 20kg BAGS

We at Cyco are proud to announce "The Outback Series"
Created with our outdoor commercial and greenhouse growers in mind giving the same high quality value for money product you are used to from our Cyco Platinum Series brand.

Cyco Vegetive is a unique blend of materials specially formulated for all your fertilising needs. A concentrated non-synthetic product, Cyco Vegetive promotes more vigorous, sustained growth for all plants.

Cyco Flowering is suitable for all flowering and fruiting plants as a specially blended fertilizer with boosted levels of soluble potash specifically added to aid flower and fruit development.

Cyco Seeweed Mix is manufactured by combining manure, kelp, fish emulsion to create a fertlizer that provides the perfect complex of micronutrients that complement the new Outback Series Vegetive and Flowering bases.

PROVEN AND TRUSTED FORMULA USED THROUGHOUT AUSTRALIA

- Outdoor
- Greenhouse

Commercial Grower

Home Gardener

USED BY THE BOTANIC GARDENS of ADELAIDE, AUSTRALIA

PROUDLY DISTRIBUTED IN AUSTRALIA BY

SJ ENTERPRISES Pty Ltd
PLATINUM SERIES

SJ ENTERPRISES Pty Ltd PLATINUM SERIES

HAWTHORNE GARDENING CO

eden HORTICULTURE

HYDROTEK HYDROPONICS

HortiTec Horticultura Tecnica

AUSTRALIA	UNITED STATES	UNITED KINGDOM	CANADA	SPAIN

FACEBOOK.COM/CYCO.FLOWER INSTAGRAM.COM/CYCO_NUTRIENTS YOUTUBE.COM/USER/MRCYCOFLOWER CYCOFLOWER.COM CYCOFLOWER.COM/FORUMS

sales-aus@cycoflower.com sales-usa@cycoflower.com sales-uk@cycoflower.com sales-canada@cycoflower.com sales-eu@cycoflower.com

“Indoors or out, more and more Australians are turning to hydroponic, vertical, urban, and traditional backyard gardening.”

from the **EDITOR**

TG **Toby Gorman**

Watching the evening news the other night, it was more than a little depressing to learn that virtually all of my favourite fruits and vegetables ranked in the most recent Dirty Dozen list.

What's the Dirty Dozen? It's a list of the foods with the most pesticide contamination, and you might be surprised what researches found. Kale, for instance, was the third worst for contamination according to the Environmental Working Group's annual list. According to the report, 92 per cent of kale samples were found to have the residue of two or more pesticides, with up to as many as 18.

Only spinach and strawberries ranked higher at two and one respectively. Nectarines, apples, grapes, peaches, cherries, pears, tomatoes, celery, and even potatoes rounded out the list.

What is more frustrating is the rising cost of these supposedly healthy items. In 2019, the price of fruit is expected to rise by three per cent while vegetables have already seen a six per cent rise. What does that mean? According to a recent report, an average family of four spends more than $14,000 a year on groceries, or 18 per cent of the total household budget. That's a lot of money to spend on groceries that are contaminated with pesticides.

If you're thinking it might be time to start growing your own produce, you're not alone. Indoors or out, more and more Australians are turning to hydroponic, vertical, urban, and traditional backyard gardening. In this issue of *Maximum Yield*, we advise on how to plan a greenhouse garden, help you understand microclimates in your outdoor garden, suggest low-cost hydroponic technology, and offer tips on how to enhance natural defenses for your plants so you can avoid those pesticides, save money, and eat healthier food. MY

GROWLUSH®

LET US TAKE CARE OF THE NIGHT SHIFT

TIMER BOX

Available in 2,4,6,8 ways

info@growlush.com 61 - 3 - 9546 9688 www.growlush.com

25

25 YEARS OF GROWTH

We're celebrating 25 years in the game and we couldn't have done it without you.

Since 1994 CANNA has been helping Australian and New Zealand hydroponic gardeners grow their favourite plants. The joy of helping you grow continues to inspire our people to create innovative products that make your life that little bit easier.

So to each and every customer who has supported us since 1994, we'd like to say something simple. Thank you.

Quality proves itself!

25 YEARS

CANNA

Thé solution for growth and bloom

25 Years Deserves

25% M

Get 25% more for free!

In 1994, Australians and New Zealanders took a set of humble Dutch hydroponic nutrients into their hearts and they've been loved ever since through successive generations.

To say thank you for your valued support over the last 25 years we're giving growers 25% more for free on selected CANNA products.

Visit any leading hydroponic shop today to find out more.

Quality proves itself!

1800 4 CANNA (422 662) **canna.com.au** **0800 4 CANNA (422 662)** **canna.co.nz**

25 YEARS

CANNA

Thé solution for growth and bloom

bare ROOTS

Featured Contributors

TreeFrog is the founder and co-inventor of Multiponics, an indoor gardening manufacturer and online boutique. He has a passion for pushing innovative ag-tech forward and is a consultant to the NASA-funded X-Hab project at the University of Colorado in Boulder.

Monica Mansfield owned an indoor garden store for 5 1/2 years before selling the business to start a seven-acre homestead with her husband, Owen. Monica is passionate about gardening, sustainable living, and holistic health. She writes about these topics and her homestead adventures on her blog, *thenaturelifeproject.com*.

Contributors

Chris Bond
Sara Elliott
Kent Gruetzmacher
Philip McIntosh
Dr. Lynette Morgan
Alan Ray

INDUCED RESISTANCES

Induced Resistances are responses triggered by the appearance of a pest, pathogen, or other agent. There are two types of induced resistance in plants: **systemic acquired resistance (SAR)** and **induced systemic resistance**. When a plant is expressing SAR, it will manufacture and produce a hormonal response, generating defensive proteins to protect itself as soon as it is exposed to any pathogen or pest. Induced systemic resistance is mostly associated with plants grown in soil as it is dependent on root contact with specific plant growth promoting rhizobacteria (PGPR) in the soil. Once this connection between the roots and PGPR is made, plants produce jasmonate and ethylene. They then release these hormones to both internally protect themselves from pests and externally signal there is a problem.

Check out Chris Bond's article on page 66 for more information.

MAXIMUM YIELD
AUS/NZ EDITION • VOL.17 NO.4
July/August 2019

Maximum Yield is published monthly by Maximum Yield Inc. No part of this magazine may be reproduced without permission from the publisher. If undeliverable please return to the address below. The views expressed by columnists are personal opinions and do not necessarily reflect those of Maximum Yield or the editor.

Publication Agreement Number 40739092
Printed in Canada
2339 A Delinea Place, Nanaimo, BC V9T 5L9
Phone: 250.729.2677; Fax 250.729.2687

***Maximum Yield* is distributed direct to retailers with distribution support from our partners**

Dome Garden Supplies
domegarden.com.au

Growlush
growlush.com

Holland Forge
hollandforge.com.au

House & Garden
house-garden.com.au

Hydroponic Generations
hydroponicgenerations.com.au

Nutrifield
nutrifield.com.au

Stealth Garden Supplies
stealth-garden.com

Way to Grow
way2grow.com.au

WHEREVER YOU GROW
HOWEVER YOU GROW

Grow year round while increasing efficiency with supplemental lighting.

Increase your yields up to 2X by growing vertical with stacked farming.

Fluence has the LED lighting solutions for achieving your growing goals, proven by more than **300 cannabis customers worldwide.**

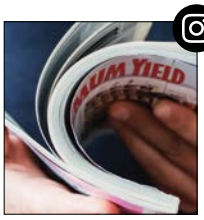
For more information visit **www.fluence.science**
or follow us on Instagram **@fluencebioeng**

FLUENCE
BY OSRAM

branching **OUT**

@cootermcdankerson

You have the most informative magazine for growers in general that I have read! Most others are ads with regurgitated trivial growing facts. Your magazine has ads of products that I would actually use and tips for a more advanced level grower. I ALWAYS learn something new from every Issue.



@ancient__roots

Finally started following my all-time favourite magazine! Still read old issues daily!

Essential Earth Products

Big thanks to *Maximum Yield* for the love in the latest issue. This publication has been a well-known supporter of our industry for many years, teaching avid gardeners the many avenues of cultivating award winning plants by harnessing the power of science. Additionally, their team is always super rad to work and party with!

@aquarius_grower

I always recommend *@maximumyield*. I've been reading their magazines since I started growing and the information is so valuable.

Nadeth

Hi! Thank you very much. I've learned a lot.

Article Archives

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

Ask the Experts

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

Free Digital Subscriptions

Sign up for our free digital subscription and you will receive *Maximum Yield* to your inbox every month. You will also receive a monthly digital newsletter so you can be the first to know what's happening in the industry. Prefer the print version of the magazine? Use your digital subscriptions as notifications for when a new issue is available at your local grow shop. Sign up online at *maximumyield.com/subscribe*.

Do you want to be featured?

Connect with us at:

MY *editor@maximumyield.com*
@maximumyield
@max_yield
@maximumyield
@maximumyield
maximumyield

NANOLUX

AUSTRALIA

LIGHTING SOLUTION FOR EVERY TYPE OF HORTICULTURAL APPLICATION

Next Level
Intelligent, Wireless
State of the Art
Horticultural Lighting
with Latest Technology
at Competitive Pricing

CONTROL THE GARDEN
FROM THE CLOUD

Nanolux Australia is proud to introduce the latest innovative lighting technology for the horticultural and hydroponics market. 1200w Full Spectrum Dual DE, 1200w Air Cooled DE, 1000w CMH, 600w/400v SEDE, 315 CMH, 600w & 1200w DE & 1000w SEDE. Cooler running, lowest profile, highest output, double jacketed DE lamps, brightest reflection, random start, cloud controllable 0-10v capability, manual output adjustable, safe ceramic receptacles, splitable, 7000v strike rate, variety of reflectors available. Nanolux is the only lighting brand in the industry that designs, engineers, manufactures, distributes, markets and sells its own brand.

Nanolux team brings over 40 years of experience in the horticultural and hydroponic industries. Contact or visit our office to receive a free catalogue showcasing this state of the art equipment.

Distributed in Australia by NANOLUX Australia Division of Excel Distributors Pty Ltd
Ph: 03 9495 0083 / sales@exceldistributors.com.au
For Wholesale inquiries contact Alan or Paul at our Wholesale Division

www.nanolux.com.au

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

ask a **GROWER**

by Dr. Lynette Morgan

Q In what form is magnesium naturally found in food such as sunflower seeds? There are so many different types of magnesium supplements. What do plants naturally do with magnesium? What is the bioavailability of the magnesium in food compared to supplements? Can you tell the difference in foods that have magnesium and the same foods that don't?

Thanks, Ralph

A This is a rather difficult question as the absorption of magnesium from different magnesium-containing compounds by humans is not only biochemically complex but still under investigation as there are many factors, apart from the type of magnesium supplement, that will play a role in this. In plants, magnesium is typically found as part of the chlorophyll molecule which is why deep green leafy vegetables such as spinach have high levels of magnesium. However, this magnesium is highly water-soluble and can be leached out into water during cooking or processing, thus reducing the magnesium content of the food. Magnesium is also found in high levels in unrefined whole grains, seeds, and nuts where it plays a role in carbohydrate storage and energy release. In mung beans, for example, about 90 per cent of the total cytoplasmic magnesium concentration is complexed with adenosine triphosphate (ATP). Adenosine triphosphate is the main source of energy in cells but must bind to the magnesium ion in order to be biologically active, thus magnesium is typically present in every cell type. In some plants, the concentration of magnesium differs depending on soil levels — thus the magnesium content of foods can vary slightly from source to source. The highest sources of plant-based magnesium are in seeds such as pumpkin kernels (307 mg per quarter cup), sunflower seeds (129 mg per quarter cup), and spinach (83 mg per half cup), with an adult requiring 300-400 mg per day. Surprisingly, humans often obtain some magnesium from water supplies, along with calcium, which are common elements found in hard water and many mineral or bottled waters.

With supplements there are no "different forms" of magnesium as magnesium is a chemical element, but there are different complexes to which the magnesium may be part of or bounded to. For example, supplements may be supplied as magnesium citrate, chloride, sulphate, carbonate, gluconate, or oxide as amino acid complexes and many others. Some of these magnesium supplement forms are designed to be better tolerated by the digestive system, thus improving uptake and reducing side effects, while others provide a more sustained release of the magnesium over time and prevent the occurrence of side effects. Any excess of magnesium taken as supplements is usually just excreted by healthy humans. Bioavailability is simply a term used to describe how much of the magnesium is typically absorbed by humans and how much is excreted by the urinary system; some magnesium-containing compounds are easier for the magnesium to be absorbed than others. Studies have found that magnesium from food sources such as almonds are just as bioavailable as from soluble magnesium supplements. However, while it is unlikely to obtain excessive levels of magnesium from food sources, this can occur with supplements, which in turn reduces the uptake of calcium in the digestive system.

The only way to tell foods that contain magnesium from those that don't is to check the food labelling — magnesium is often listed on packaging, particularly in foods where magnesium has been added in either during processing or as nutritional enhancement.

Kind regards, Dr. Lynette Morgan

LM **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.*

LIQUID GOLD

DISTRIBUTED BY
HOLLAND FORGE

PROFESSOR'S NUTRIENTS

www.professorsnutrients.com.au


PROFESSOR'S NUTRIENTS
www.professorsnutrients.com.au
PRODUCTS
HIGH
QUALITY
RESULTS
GO GREEN
PREVENTS & RESTORES COMMON DEFICIENCIES
GROW FAST
VEGETATIVE BOOSTER
FLOWER BOOST
PK ENHANCER
EXTREME BOOST
BULKING FORMULA

BIGGER IS BETTER

Take back control and make the decision to have quality and chemical free products - Choose Organics

DISTRIBUTED BY
HOLLAND FORGE

max
FACTS

Eating Organic Reduces Body's Pesticide Levels

A new University of California study found that eating organically grown food for one week can greatly lower pesticide levels within the body. Researchers found the levels of toxins decreased by an average of 60.5 per cent after six days of organic food consumption. Exposure to pesticides has been linked to many adverse health outcomes including asthma, infertility, hormone imbalances, and impaired cognitive development. This study followed four families from across the US (Oakland, Minneapolis, Baltimore, and Atlanta). From days one through five, participants ate as they normally would. From days six through 11, they followed a strictly organic diet, including condiments and spices. Urine samples were collected to test pesticide levels. The most significant decrease – a 95 per cent drop – was with malathion organophosphates, a highly toxic insecticide linked to brain damage in children. Neonicotinoids also saw a significant decrease – an 83 per cent drop.

– foodtank.com

Scientists Say Foam Grows Crops Faster Than Soil

Researchers from the new Institute for Sustainable Food at the University of Sheffield have found that crops planted in polyurethane foams at an urban farm grow two to 10 times faster than plants grown in soil. Using a network of pipes, nutrient solutions, controlled growing environments, and foams, scientists are growing everything from salad to tomatoes – demonstrating a potential solution to the global crisis of soil fertility. Some 24 billion tons of fertile soil are lost globally to erosion every year. So, experts developed specialist foams that chemically, physically. and biologically resemble soil. Professor Duncan Cameron, director of the Institute for Sustainable Food at the University of Sheffield, says: "The world is facing a crisis of soil fertility. If we're going to fix this, we need to do something radically different. Urban farms that use foam instead of soil could take a lot of pressure off existing agricultural systems."

– phys.org

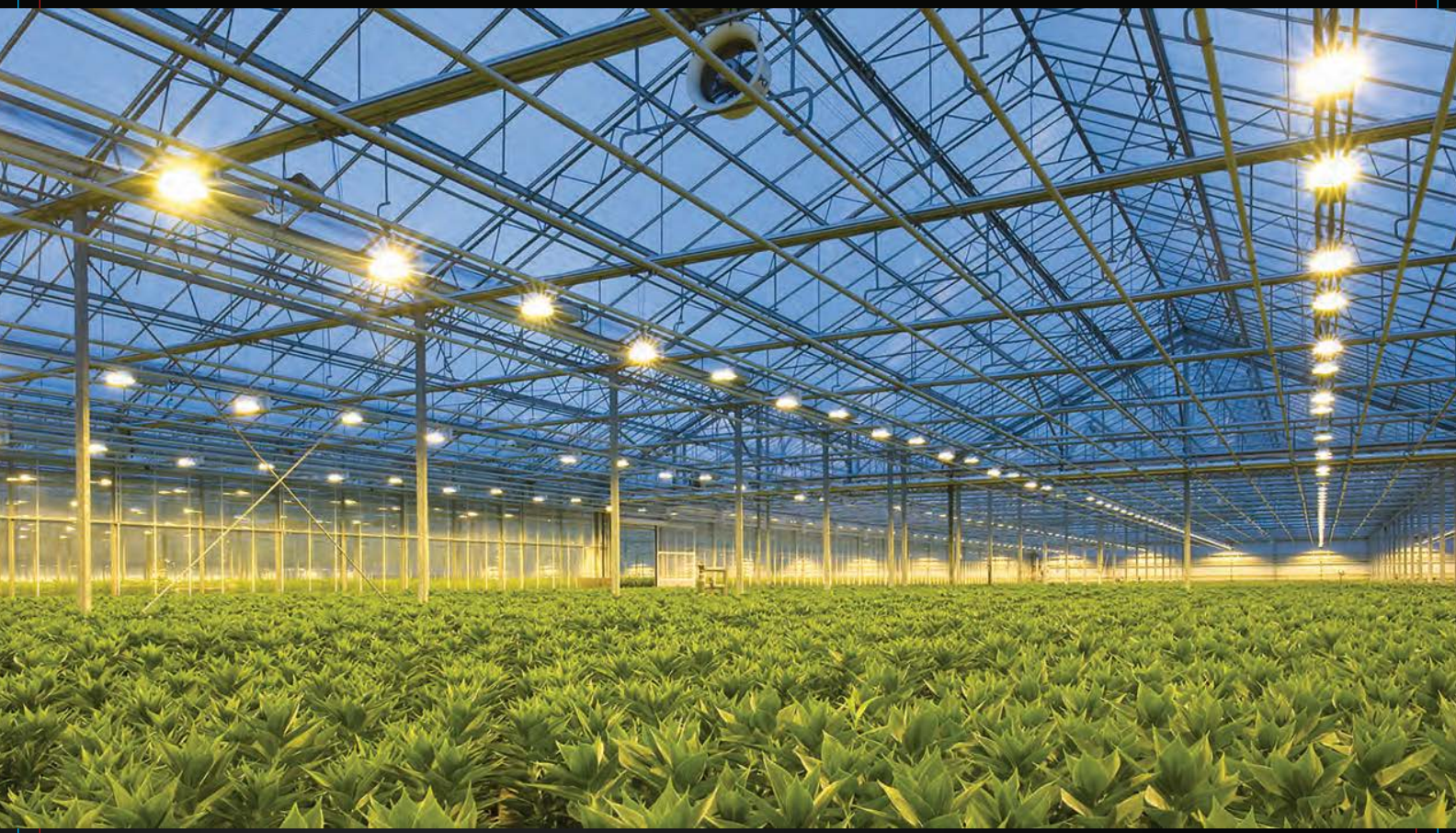
Plant Virus Helps Target Pests Beneath Soil

Researchers have discovered a particular plant virus can deliver pesticide molecules deep below the surface, targeting areas usually beyond pesticide reach. In an article published in *Nature Nanotechnology*, scientists detail how a biological nanoparticle – a plant virus – can deliver pesticide molecules deep into the soil. This means farmers and growers can better manage difficult pests like parasitic nematodes, which wreak havoc on plant roots deep in the soil. Because pesticides are sticky molecules, they strongly bond with organic matter in soil, making it difficult to penetrate deep down into the root level where pests like nematodes reside and cause damage. To compensate, farmers end up applying large amounts of pesticides, which cause harmful residues to build up in the soil and leach into groundwater. Researchers found Tobacco mild green mosaic virus can transport small amounts of pesticide down to 30 centimetres below the surface.

– sciencedaily.com

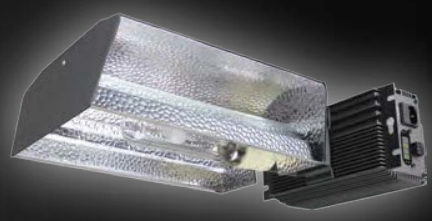
SOL-SENSE®

Precision Horticultural Lighting



ADVANCE YOUR YIELD

315W SOL-UNIT
[ALL-IN-ONE CMH KIT]



315W CMH KIT

650W CMH KIT

sol_sense

solsense

SOL-SENSE.COM

max
FACTS

Five Best Plants for Hydroponic Growing

If you're new to hydroponic growing, you might be wondering what to start producing first. Most growers will tell you the five best plants are lettuce, spinach, strawberries, bell peppers, and herbs. Each of the five grow very quickly and are easy to grow in nutrient solution. It's best to begin growing hydroponically by starting out slowly and run a few test crops first to make sure you've got handle on pH levels and the amount of nutrients to use. Lettuce will take about 30 days to grow with Romaine, Iceburg, and Buttercrunch being excellent choices. Spinach (including Savoy, Bloomsdale, and Smooth) will be ready in 40 days, while strawberries (Brighton, Chandler, and Douglass) normally take 60 days. Bell peppers take the most time, about 90 days until they're ready. Keep in mind peppers need about 18 hours of light per day.

– safebrand.com

Sanitation Key to Fighting Tomato Brown Rugos Fruit Virus

A nasty virus inflicting tomatoes (that has spread from Israel to Europe and North America in the last five years) shows no signs of stopping. The Tomato Brown Rugose Fruit Virus (ToBRFV) causes yellow to brown coloured wrinkled, necrotic spots on the fruit. It is seed borne and reportedly can be spread from plant to plant mechanically during production. Countries already affected are launching research programs and trials to try and overcome the virus, while some countries without the virus have implemented stricter import regulations on tomato and pepper seeds. Controlling viruses has never been easy. One of the problems with ToBRFV is it is highly contagious, and the research to date has not found the causal agent. However, industry professionals point out that there are ways to help control the spread of ToBRFV. Sanitation in all areas is the key they say, especially in controlled greenhouse environments.

– freshplaza.com

The Most Common Mistake for Hydroponic Newbies

So, you've got your new ebb and flow system ready to go and you're excited to get growing. If you're like many other new hydroponic growers, you're most likely to forget one thing about your system: the pH level. And the pH level just happens to be one of the most important factors in growing healthy plants hydroponically. For the most part, your plants exist almost entirely thanks to a nutrient solution. If that solution is too alkaline or too acidic, your plants will experience nutrient deficiencies or just die. The thing to do is get a very good pH meter and monitor the level at least once a day. Should the pH level move in one direction or the other, steps need to be taken immediately to bring it back to balance (for whatever crop you're growing). Other newbie mistakes include buying cheap or improper lighting and using the wrong type of nutrients.

– Maximum Yield Staff

sensi PRO

BIO DIESEL

MORE TRICHOMES - MORE BUD - MORE FLAVOUR

HEAVY YIELDS WITHOUT CHEMICALS

www.biodieselnutrients.com.au

Size Does Matter

CANNABOOST Accelerator

Get a 22% sellable increase in bud yield from your favourite fruiting and flowering plants in less flowering time. CANNABOOST Accelerator is Holland's best-selling bloom booster scientifically proven to maximise bud growth, increase yield and enhance plant health. In a recent research trial on tomatoes, CANNABOOST increased weight by 22%. Safe for use in soil, soilless and hydroponic systems. Often imitated never equalled. Backed by science, proven by testing and validated by world record holder growers. **Quality proves itself!**

CANNA

Thé solution for growth and bloom

25 YEARS

WIN A HARLEY-D

25 Years of Good Times. Ride on.

We're celebrating 25 years of CANNA in Australasia and we couldn't have done it without you. To say thank you to all the Australian and New Zealand CANNA growers for supporting us we're giving you the chance to win an awesome limited-edition CANNA Black Harley-Davidson®.

Visit any leading hydroponic shop today for entry details. Your entry is 100% secure, 100% confidential and 100% safe.

Quality proves itself!

Terms & Conditions: Promotion period is 9:00am (AWST) on 01/05/2019 to 11:55pm (AWST) on 31/12/2019. The winner drawn and the retailer who sold the winning entry will win the major prize. Entry is open is open to all 18+ Australian and New Zealand residents. Major Prize is a custom CANNA Black Harley-Davidson Iron 883 (motorbike), including all statutory and on-road costs, valued at up to AUD $15,995/NZD $16,495 RRP (inc GST). Total prize pool is AUD $31,990/NZD $32,990. A random prize draw will occur 12:00 PM ASWT on 14 Jan 2020 at Level 2 11 York Street Sydney NSW 2000. Winners will be notified via email no later than 16 Jan 2020. Promoter is CANNA Australasia (ABN 28 779 708 969). For Full Terms and Conditions please visit www.canna.com.au or www.canna.co.nz. Authorised under Permits NSW No. LTPS/19/33006, SA No. T19/406 and ACT No. TP 19/02949.1

1800 4 CANNA (422 662) **canna.com.au** **0800 4 CANNA (422 662)** **canna.co.nz**

CANNA AVIDSON®

25 YEARS

CANNA

Thé solution for growth and bloom

good
TO GROW

1 | Grower's Choice Master Pursuit 1,000W CMH Grow Light

Grower's Choice introduces the Master Pursuit 1,000W CMH grow light system. It offers industrial-grade power with dual, ultra-high efficiency 500W CMH lamps. The Master Pursuit delivers deep canopy penetration with broad-true full horticultural spectrum from top to the very bottom. It is focus-designed for specialty flowering plants and bio-engineered to replicate and harness the full brilliance of the sun while enabling growers to mix spectral colour levels for optimal development for each stage of growth.

2 | Cyco Platinum Series Uptake

Another Platinum Series product from Cyco, Uptake is a source of humates in the form of humic acid which is a stage of decomposition of plant matter containing large carbon-based molecules that are receptive to bonding with heavy metals and minerals. The humic acid in Uptake is mixed with fulvic acid, and when mixed – as they are in this product – they create a versatile, more soluble solution that won't sit at the bottom of a tank, providing essential micronutrients.

3 | 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 bio stimulants that work exceptionally well in hydroponic and coco fibre media.

4 | CANNA Coco

CANNA's coco line is a proven winner when it comes to plant growth. The next generation CANNA Coco A&B Cocoponic nutrients combines grow and bloom nutrients into one A&B mix. The nutrients have a biotrophic effect and are so advanced they anticipate exactly what the plant needs. CANNA's Coco Professional is a top-selling substrate laden with essential Trichoderma for rapid growth. CANNA Coco coconut substrate guarantees a six to 10 per cent higher yield potential.

ALOEVATE

YOUR PLANTS TO A HIGHER LEVEL

★ **CONTAINS VITAMINS** A, C, E B1, B2, B3, B6 (Niacin) and B12! These vitamins reduce environmental stress, speed up growth rates and contain antioxidants and antibiotic properties to enhance overall plant vitality and protection.

★ **FOLIAR SPRAY** for instantly available Silica, Vitamins and minerals! Use as a stand-alone foliar or add to favourite mix. The Saponins contained act as a natural wetting agent, helping minerals to be absorbed efficiently for maximum results.

★ **MEGA MICROBE** food that will support larger population growth and more colonies of beneficial bacteria and Fungi! Enzymes speed up the breakdown of organic matter and enhance nutrient cycling.

★ **NATURAL SILICA** that is instantly plant available and wont effect your pH! Salacylic Acid creates thicker cell walls, with higher weight and water holding capacity for stronger branches, increased photosynthesis and flower yields.

★ **PERFECT FOR SOIL** contains a full range of over 20 organic trace elements inc. Zinc and Selenium, providing full spectrum plant nutrition. Saponins a natural wetting agent also helps penetrate dry hydrophobic soils.

BIODIESELNUTRIENTS | #BIODIESELNUTRIENTS

www.biodieselnutrients.com.au

5 | WHG – Adjust-A-Wings 315W CMH Kits

Featuring high intensity, high reliability, and unrivaled spectral output, the Adjust-AWings 315W CMH light kit comes neatly boxed and includes a class-leading 4K lamp which uses bespoke Japanese arc tubes and XOS borosilicate jackets. Lamps have been matched perfectly to the specialist ultra-high frequency (150KHz) e-ballast. It's ideal for small grow spaces and mixing between HPS lamps to provide complete spectral diversity (CRI of 96.5). It will help increase terpene and essential oil production. It's available through the Wholesale Horticultural Group.

6 | CANNA Classic

A keystone to CANNA's success in the horticulture industry is the outstanding performance of professional CANNA Classic Vega and CANNA Classic Flores two part (A&B) ready-to-use nutrient range. Use Classic for plants grown in all hydroponic systems and mediums where the required nutrients must be added to the irrigation water. CANNA Classic ensures healthy, lush green growth and heavy yields by precisely controlling the uptake of nutrients during the growth, flowering, and fruiting stages of fast-growing plants.

7 | Hy-Gen Budlink

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

8 | Reiziger Grow Food A&B

Grow Food A&B is a two-part nutrient designed for use in all hydroponic growing media including both recirculating and non-recirculating systems. It contains no sulphates, chlorides, carbonates, excess soluble salts, or other undesirable elements to damage plants or the environment. Reiziger Grow Food A&B is a balanced, fast-acting formula to instantly promote healthy, energetic new growth, and root development. Maximum nutrient absorption and water penetration is guaranteed with large quantities of rapidly absorbable nitrate nitrogen and high-grade magnesium and calcium.

9

10

11

12

9 | CANNA Rhizotonic

For more than 20 years, CANNA Rhizotonic has held the title of Holland's No.1 organic root stimulant. With advanced oligosaccharide chemistry and bio-growth additives, it accelerates new root growth, thus reducing the growth cycle significantly in fast-growing plants. It protects against sickness by armour plating plants against pathogens. Rhizotonic contains a carefully integrated and balanced formulation of the finest Norwegian seaweed extracts, no less than 60 bio-growth stimulants, plus essential B vitamins boost overall plant growth, guaranteeing a superior, more powerful plant for bigger harvests.

10 | 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.

11 | Cyco Dr. Repair

Another nutrient from Cyco's trusted 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 | Hy-Gen Coco Starter Pack

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


THC®
TOP QUALITY
THC®
RHP
Certified for
Horticulture
THC®
PRO
PLUS
BUFFERED
THC®
PRO
LITE
BUFFERED
COCO LITE
coco 70/30 perlite
50L
THC
grow
A
THC
grow
B
THC
bloom
A
THC
bloom
B
THC
COCO
THC
COCO
www.thc-au

AUSTRALIA

Growing Benchmark™

With THC nutritional products you're getting 30 years of experience in a bottle as well the most concentrated cutting edge mixes packed with only the purest pharmaceutical grade minerals and organic compounds. THC advanced base mixes are formulated from the original Dutch recipes used by the industry pioneers in the 80s and are made now under licence in Australia with Australian water for all Australians. Get your hands on this leading, best performing base mixes with advanced additives and RHP substrates to supercharge your garden and gain growers advantage from your local horticultural outlets....

...and LEAD THEM ALL!

Distributed by:
Excel Distributors Pty Ltd
+61 (0)3 9495 0083
sales@exceldistributors.com.au

ustralia.com

THE ORIGINAL

SWEET 'N' STICKY BUD XL

Accelerating Natural Flavour and Aroma's

House & Garden Bud XL has the unique ability to extract sugars from the leaves of the plant and transfer them to the fruit. Therefore, the fruit is made sweeter and its natural flavours and aromas are enhanced.

Bud XL will also increase the size and robustness of the plant's fruits, which in turn will result in an increase in the final yield. It has been known for a century that enzymes act as a transporter and distributor of sugars in the plant. Bud XL uses these enzymes to extract the sugars and give you, the grower, heavier and denser flowering sites.

DISTRIBUTED BY STEALTH GARDEN AUSTRALIA/NZ

WWW . HOUSE-GARDEN . COM . AU

Low-Cost Hydroponic Technology

by Treefrog

Drawing the Line Between Cost and Function

For growers who would like to get into hydroponics, cost or complexity need not be an issue. Treefrog explains how focusing on plant basics is key when purchasing your hydroponic equipment.

There are the basics any plant needs to survive, which are broken into four major categories: light, air, water, and food. Whether soil, hydroponic, or aeroponic, all gardens must provide these necessities, which can be met regardless of budget. Low cost and equipment quality won't affect crop yield or quality, so long as there is system functionality and the basics are met.

Major Components

The major components of any hydroponic system provide plants with each of the basic necessities mentioned earlier. Components should include such things as lighting or a greenhouse, a water pump, an air pump, and the appropriate tubing and fittings. These four major components can provide plants with everything they need, so long as there is a container for support and delivery of water and nutrients.

To begin growing with hydroponics, gardeners only need to build a reservoir for mixed nutrients and a container for the plants out of repurposed and recycled products such as plastics.

Pre-Built Systems

If startup cost isn't an issue, the easy way is to purchase a pre-built hydroponic system. There are plenty of grow systems on the market and many have the major components worked into their design to provide a complete working hydroponic grow container and reservoir. However, these pieces only need to provide functionality, which can be achieved by repurposing virtually anything such as a storage bin or recycled plastic bottles.

Functionality can be built into any system with the proper components.

DIY Systems

Low cost doesn't mean low functionality, so don't let high costs prevent you from starting or expanding your own hydro garden.

By using components that provide the basic necessities such as light, air, nutrients, and water to the plants as needed, inexpensive DIY gardens also deliver plants everything they need to thrive. Functionality can be built into any system with these major components as long as the right balance of air and water is given to the plants. In other words, roots should not be over- or under-watered. Providing enough air is critical to prevent overwatering. An example can be seen in raft (a.k.a. deep water culture (DWC)) hydroponic systems where plant roots are submerged in water and nutrients at all times, with ample aeration provided through the use of air pumps and air stones. Finding this balance between air and water is critical to the performance of every hydroponic system, regardless of cost, design, or complexity.

"When given the proper functionality and environment, yields and quality are easily maximised **without breaking the bank.**"

Any good system design provides the right mix of air and water, which should be tweaked and perfected for the best results. Another example is a flood and drain (a.k.a. ebb and flow) system, where a table resting above the reservoir is flooded periodically on a timer. These parts can be built using your own materials, just be sure to provide the accessories. High functionality is not only possible, but easy to achieve by thinking through your system and the plants you are growing.

Conclusion

Be sure to start your own hydroponic garden off right by purchasing the basic necessary components such as water and air pumps, drains, and clean tubing. When given the proper functionality and environment, yields and quality are easily maximised without breaking the bank. Most plants want somewhere around a 6.0 pH and a nutrient mix density between 400 and 1,000 parts per million. Be sure to keep the system and components disease-free by thoroughly cleaning between crops.

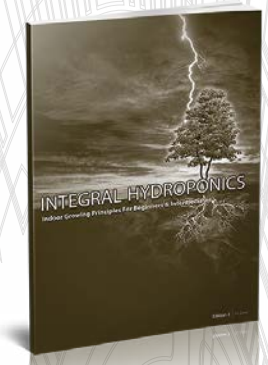
Don't let costs deter you from exploring or expanding your garden into hydro. The market is full of high-cost systems that will work well, but price and complexity should not intimidate you. Simply giving plants their basic necessities can be a simple way to grow great hydroponics.

HOW TO PLAN A GREENHOUSE *garden*

If you're thinking about building a greenhouse, Monica Mansfield outlines what you'll need to get the most out of your indoor grow space, from the different greenhouse structures to automation.

by Monica Mansfield

With proper planning and design, a greenhouse can add a whole new dimension to your garden. It can extend your seasons, allowing you to start plants earlier in the spring and harvest crops through the coldest months of the year. It gives you a place to start seeds, propagate cuttings, and store patio plants in winter. By controlling the environment, you can even grow plants that wouldn't normally do well in your zone.



Grow with Glow

MED TEK
Pure and Simple

G.Low (Glow), the author of Integral Hydroponics, a book that has guided many thousands of Australian growers to success, brings you Med-Tek.

About Med-Tek

1) The Med-Tek range was developed over years of extensive crop trialing, in conjunction with plant tissue and medicinal oil profile analysis run through U.S. based laboratories (Wallace Labs, The WercShop, Analytical 360, Infinite, Steep Hill).

2) Med-Tek formulations are created with both yield and quality parameters in mind.

3) Formulations are fully compliant with best practice Californian, Oregon, Colorado and Washington State Med production standards.

4) Quality is at the forefront of our business philosophy; quality formulations, quality ingredients, quality in production and quality information to consumers and retailers alike.

5) Integrity is at the forefront of our business philosophy. We focus on integrity in marketing and the information we provide.

6) Wherever possible we innovate and/or improve on existing technologies to offer consumers more bang for their buck. For example, our bloom booster resin elicitor, 'Connoisseur Blooms', when compared to two similar products on the Australian market, offers far better value for money through the dilution rate (1 ml/L) or through the initial purchase cost. As another example, Med-Tek 'Resin Finish' is a new generation flushing/finishing agent that as far as we know is unique to the market.

7) Knowledge is power! The Med-Tek website (medteknutrients.com.au) is undoubtedly the industry's most grow information rich site on the web today. You'll find by looking at the 'grow info ' section on the the site menu that there are numerous links to scientifically based articles on all things 'Med' and 'hydro'. These articles span, in total, hundreds of thousands of words. This body of work has been put together over the last 10-15 years by G.Low (Glow) and much of it has been migrated from his personal website, manicbotanix.com, which has long been seen as reputable, trustworthy source of information by North American, UK, European and Australian growers.

PK ELICIT
Biostimulant PK Booster

CONNOISSEUR BLOOMS
Bloom Booster Resin Enhancer

RESIN FINISH
Flush Cycle Elicitor for Oozing Goodness

MED TEK

Distributed in Australia by Accent Hydroponics

medteknutrients.com.au
Follow us on Instagram @ medteknutrients

Made in Australia

Types of Greenhouses

There are two main types of greenhouses: lean-to and freestanding. Lean-to greenhouses attach to the side of another building, while freestanding greenhouses are a completely independent structure. There are advantages and disadvantages to each.

While lean-to greenhouses have easy access to electricity, water, and heat, they also offer limited space, light, ventilation, and temperature control.

Freestanding greenhouses provide more light, however, they will need their own separate heating system which can be costly.

"THE IDEAL LOCATION FOR YOUR GREENHOUSE IS A SPOT THAT GETS A LOT OF SUN ON THE SOUTH OR SOUTHEAST SIDE OF YOUR *home.*"

Choosing the Right Location

The ideal location for your greenhouse is a spot that gets a lot of sun on the south or southeast side of your home. If you plan on using your greenhouse during the hot summer months, placing it on the north side of a deciduous tree will provide shade during the hottest part of the day. In the winter, the tree's leaves will fall and allow more light to get through.

Choose a level, well-drained area for your greenhouse. Lay it so the length runs north and south. This way, it will receive as much sun as possible during the winter months.

Make sure you have access to water and electricity. Your life will be much easier if you can automate watering, temperature control, and ventilation.

Greenhouse Size

There are many things to consider when deciding on the size of your greenhouse. You'll want to include enough space for future expansions, bench space, walkways, and storage space.

It is easier to control temperature in a larger greenhouse. Temperatures in smaller greenhouses can change quickly if someone opens a door or forgets to open a vent. If you build as wide as possible, it will be easier to expand the length in the future.

Consider what you will need to use your walkways for. Will you need just enough space to walk between rows and work at the benches, or will you need enough room for a wheelbarrow? Typically, 60 to 75 centimetres should give you a walkway wide enough to push your wheelbarrow.

Will your benches be off to the side or down the middle of your greenhouse? Side benches can be as narrow as 60 to 90 cm wide, while centre benches could be as wide as 1.83 metres.

How many plants do you intend to grow? A 15-cm pot needs about one square foot of space, so if you grow 100 plants, you'll need 100 square feet of bench space. A good rule of thumb is that two-thirds of your greenhouse will be bench space, and one-third will be walkways.

How tall are the plants you'll be growing? If you are just starting plants, then an eave height of 1.5 m will work fine. However, if you plan on growing taller plants or trees, you will want to increase the height.

"You'll want to include enough space for future expansions, bench space, walkways, and storage space."

Materials

There are many building materials to consider when constructing your greenhouse, each with advantages and disadvantages. Frames can be made from wood, aluminum, plastic, or iron. Coverings can be made from glass, fibreglass, acrylic, double-wall plastic, and film plastic.

Although glass can be costly, it will last a lifetime if there are no accidents that break it. Glass is strong, transparent, retains heat and humidity well, and provides a weather-tight structure.

Fibreglass is less expensive, strong, lightweight, and takes harsh weather well. However, as it ages and degrades, it will turn yellow and allow much less light to get through.

Acrylic is UV- and weather-resistant, lightweight, and won't yellow, however, it is expensive, easily scratched, and gets brittle with age.

Plastic has become a popular choice with gardeners because it is inexpensive and yields results similar to expensive glass greenhouses. An added benefit to homeowners is plastic greenhouses are viewed as temporary structures and will most likely not raise the value of your property for tax purposes.

You can choose from double-wall plastic or plastic film. Double-wall plastic is rigid, durable, and usually coated with a UV-inhibitor to make it last longer.

Plastic films can be made of polyethylene (PE), polyvinyl chloride (PVC), and copolymers of these materials. Polyethylene will last one to three years, while PVC and copolymers with UV inhibitors will last longer.

Heating and Cooling

To control the temperature in your greenhouse, you'll need to install heating and cooling systems. For most plants, night temperatures of 12-18°C and a maximum daytime temperature of 30°C will do. If you simply want to protect your plants from frost, then setting your thermostat to 4°C will be adequate.

Remember to account for the microclimates within your greenhouse. The spaces near walls, the floor, ventilation, and any kind of opening will be cooler than the rest of the area.

To heat your greenhouse, you can use a space heater, hot-water or steam system, electric heater, forced-air heater, or radiant heat lamps above plants. A space heater with a few circulating fans is an inexpensive option for smaller greenhouses.

Arguably the most efficient system for small greenhouses is a forced-air furnace that distributes heat through ducting or a plastic tube system. The tube is placed as high as possible down the length of the greenhouse to distribute heat evenly so there are no cold spots.

To cool your greenhouse, you can use evaporative cooling systems, fogging and misting systems, or shade cloth. Evaporative cooling and fogging systems both increase humidity and work well in drier climates. If your humidity gets higher than 90 per cent, your plants will start having issues and you should bring in a dehumidifier to bring humidity back down between 70 and 85 per cent.

Evaporative cooling systems, also known as swamp coolers, pass hot air though a soaked screen or spray of water to cool it down. Foggers and misters work well, however, can be high maintenance when emitters clog.

Shading your greenhouse will also bring the temperature down. Trees planted on the south side will offer afternoon shade. You can also use a shade cloth, roll up screen, or paint a compound directly on the glass.

"Automate everything. If you don't, you will be tied to your greenhouse, opening and closing vents throughout the day and hand watering all of your plants daily. "

Greenhouse Ventilation

Proper ventilation is essential in your greenhouse. It circulates the air and keeps the temperature even. It also exchanges the stale air for fresh air and replenishes CO_2.

Vents, intake and exhaust fans, and oscillating fans will create enough air flow for a healthy environment.

Without air flow, warm air would rise to the top of the greenhouse and cool air would settle at the bottom.

By placing fans in diagonally opposite corners, you will move air in a circular motion and keep temperatures uniform throughout the greenhouse.

Intake and exhaust fans work together to exchange stale air for fresh air. The fans you choose should be powerful enough to change the air about once per minute.

Vents are helpful when moving air. When the warm air rises and escapes through the roof vent, cool air will be drawn in through the side vents.

"REMEMBER TO ACCOUNT FOR THE MICROCLIMATES WITHIN YOUR greenhouse."

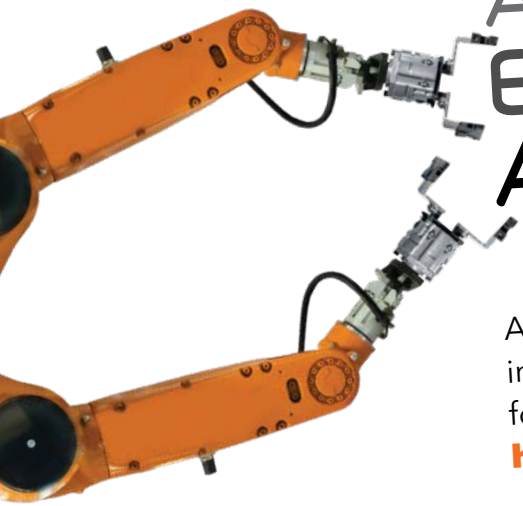
Automation

Now that you have all the pieces in place, do yourself a favour and automate everything. If you don't, you will be tied to your greenhouse, opening and closing vents throughout the day and hand watering all of your plants daily. The more money you invest in automation technology, the easier your life will be.

You can hook your heaters, cooling system, fans, and vents up to a thermostat that will turn them off and on depending on the temperature. Humidistats will regulate humidifiers and dehumidifiers to keep your humidity levels in check. Automatic watering systems will ensure your plants never get too thirsty.

A greenhouse is a wonderful addition to any garden. Though it can be costly up front, once it is set up and automated it will extend your growing season, give you space to propagate, and allow you to grow tropical plants you may not have been able to grow otherwise.

ARTIFICIAL INTELLIGENCE AND CONTROLLED ENVIRONMENT AGRICULTURE



by Kent Gruetzmacher

As the role of controlled environment growing increases in agriculture, so does the opportunity for artificial intelligence. **But can AI replace the human touch?** Kent Gruetzmacher investigates.

As both a process and vocation, controlled environment agriculture (CEA) is intimately entwined with technology. As CEA gets increasingly sophisticated through technological advancements, how these developments will affect horticultural processes and, in turn, world food supplies, remains largely unknown. At the forefront of new frontiers in CEA technology lies artificial intelligence (AI), which can potentially forever change the way humankind procures fresh produce, largely by replacing human labour with mechanised production.

We live in a world increasingly dependent upon, and defined by, technology. This notion rings true in almost every facet of day-to-day life in the 21st century, including communication, entertainment, and work. Similarly, for those living in the Western world, this same technology contributes to meeting our general human needs, as food is readily available for most people at grocery stores and beyond. Yet, our current food subsistence patterns are far from infallible and the technologies that make commercial agriculture possible are falling short on several fronts. These shortcomings are evident in pesticide- and preservative-laden food sources as well as hungry human populations in less-fortunate regions of the globe.

Over the last few decades, CEA production has grown leaps and bounds in its scale and capabilities. Many believe CEA practices such as urban agriculture and vertical farming will eventually help resolve global food crises. This positive outlook is largely because of technological advancements in "smart" environmental controls and LED lighting, which have made CEA production viable, as well as profitable, on a commercial scale for the first time. Sophisticated irrigation systems have also drastically reduced the amount of human labour required in propagating crops. For many CEA advocates and technology authorities, AI is the next phase in streamlining and sophisticating agricultural procedure as well as global subsistence patterns.

Why Artificial Intelligence?

There are several reasons why AI has so much potential in the world of CEA. These reasons mainly have to do with notions of horticultural processes and labour efficiency. Today, automation is already an essential element in most CEA growing, and its benefits are related to both consistency and efficiency in operations. For example, smart controllers take much of the guesswork out of troubleshooting environmental issues, while fertigation systems accomplish irrigation in a controlled and effective fashion. Artificial intelligence has the capabilities to take these advancements even further.

Technology authorities postulate that AI can potentially circumvent human interaction with horticultural processes and garden maintenance almost in their entirety. According to *agfundernews.com*: "Hypothetically, it is possible for machines to learn to solve any problem on Earth relating to the physical interaction of all things within a defined or contained environment… by using artificial intelligence and machine learning." The important take away here is the idea AI systems can learn as well as make choices based on the objective constraints that dictate rational human decision making. Concerning both production and labour, this avant garde theory pushes notions of CEA automation to their absolute extremes. This AI learning concept postulates robots would be at the controls of environmental and irrigation systems that currently require human intervention in the way of fine tuning and decision making. Also, AI could circumvent human error from these processes by removing the human labour needed to grow CEA crops.

"Artificial intelligence applications in CEA are entirely data driven – machines both gather, as well as use, this information as the basis of machine learning."

While these ultramodern appraisals of AI and CEA cultivation can seem somewhat alarming, many see a real potential benefit in the technology, namely because humans are, well, undependable. The industry is traditionally plagued by labour shortages in jobs that aren't very attractive to even the most entry-level employees. Many companies, in CEA and beyond, understand the struggles of finding dependable help for their businesses, with tech retail giant Amazon currently employing more than 100,000 robots in its warehouse operations. In agriculture, there are several robots being developed that can handle more rudimentary CEA garden chores such as leaf pruning. When it comes to AI learning applications and high-level jobs in CEA, it's worth noting even the most rudimentary human error in fertilisation or irrigation can have devastating effects on crops. Large vertical farming companies are aware of this and are currently implementing AI help in certain facets of their operations.

Sensors and Data Analytics

Artificial intelligence applications in CEA are entirely data driven — machines both gather, as well as use, this information as the basis of machine learning. This sort of remote sensing, data compiling technology is already widely popular in more advanced CEA operations, especially regarding soil and air sensors. These technological advancements are used to measure moisture levels in grow mediums, and temperature and humidity levels in the air, while giving cultivators real-time updates on the working analytics of their operations. Commercial agriculture operations are taking notions of remote sensors and data analytics to the extreme by way of drone sensing. Some commercial farms use drones to fly over fields of crops and take precise readings of growth patterns and environmental conditions. This data informs growers, in real time, what sort of elements their garden is lacking or burdened with — allowing them to make proactive decisions in counteracting potential problems. For the time being, drone technology in commercial agriculture is still being utilised to inform rational decision-making in the human mind — but many feel these processes would be integral with informing data matrices in the "minds" of AI machines.

"For many CEA advocates and technology authorities, AI is the next phase in streamlining and sophisticating agricultural procedure as well as global subsistence patterns."

Artificial Intelligence and Machine Learning

Potential advances, as well as drawbacks, of AI applications for CEA can be drawn from current mainstream research — such as with IBM — into the technology's capabilities regarding commercial agriculture. As *agfundernews.com* reports: "Interviews with some of the IBM project team members … revealed that the team believed it was entirely possible to 'algorithm' agriculture, meaning that algorithms could solve any problem in the world." While IBM's claims are grandiose and positive in nature, they are not entirely unreasonable. Major computer tech companies such as Google and Pandora already utilise algorithms to isolate relevant data, make decisions, and cater to human needs. However, all these algorithmic applications depend upon objectively derived, predictable points of data in informing the machine learning process.

When it comes to creating algorithms for agriculture, researchers have been running into countless problems stemming from the unpredictability of the natural world. There are countless variables contributing to weather patterns around the globe; the nuances of these factors are far beyond the scope of human understanding. This notion is relevant because humankind cannot program machines to learn about environmental systems that we don't yet understand, and AI cannot make the critical step in accounting for anomalous factors in weather or crop production. Therefore, our technology is only as strong as the data we supply it with via our own knowledge.

While issues with environmental predictability that plague AI applications in traditional agriculture may not seem to affect CEA production as intensely, there are still factors that make AI fall short in controlling CEA growing in its entirety. For instance, many greenhouse gardens are still largely at the mercy of Mother Nature and present challenges with anomalous weather patterns. Similarly, indoor growing operations experience problems with such irregularities as equipment failure and power outages, which only human intervention can fix.

Controlled environment agriculture crop production is only as strong as the equipment and human labour supporting it, so the balance between these two continues to shift under the pressures of new advancements with technology such as AI. This notion presents an interesting crux in modern cultivation processes, as automation can provide a more efficient platform for consistency than with human labour. However, machines cannot account for the rhythms of the natural world or other operational variances.

Many accomplished horticulturists understand the intuitive touch it takes to produce exceptional crops — this intuition comes as a feeling rather than as a form of objective knowledge or data. AI and other technological advancements in CEA growing have their place in today's horticultural processes, yet cannot match the capacity for creativity explicit in the human mind.

HEMP

HEALTH & INNOVATION

AUSTRALIA'S LARGEST

HEMP & CANNABIS EXPO
OCTOBER 12 & 13

BRISBANE CONVENTION AND EXHIBITION CENTRE

EXHIBITOR BOOTHS ON SALE NOW! DON'T MISS OUT!

CONTACT: info@hhiexpo.com.au

FOOD HEMPIRE

ENVIRONMENTAL & ECO-FASHION SHOW

HEALTH & BEAUTY

INDUSTRY & INNOVATION

MEDICINAL & DR CONSULTATIONS

HHIEXPO.COM.AU

THC TILBA HEMP CO

OMG NOT ALL BEES ARE EQUAL

CLOUD CAVE .COM.AU

Epilepsy Action Australia

SPEAK YOUR TRUTH

GROWING niche-market HYDROPONIC CROPS

by Dr. Lynette Morgan

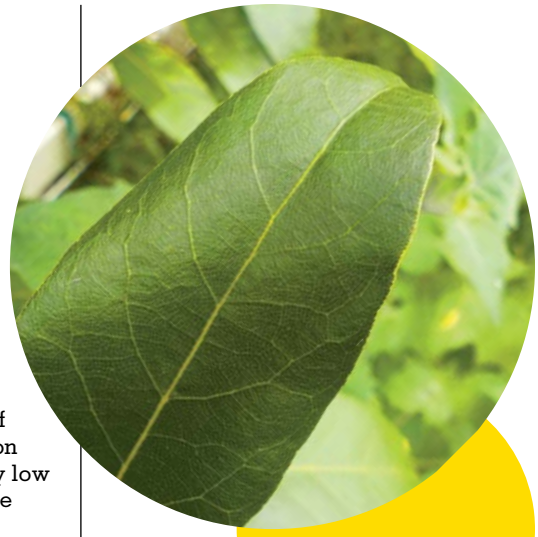
Ginseng — Bay — Tarragon

A patient hydroponic grower can make some money with high-value niche crops like ginseng, bay, and tarragon. Dr. Lynette Morgan examines the pros and cons of growing each cultivar.

For many, indoor gardening is an exciting hobby, one that often leads to the possibility of setting up a profitable business using new skills and knowledge. While hydroponics is the basis of many successful commercial enterprises, selecting the right crop is essential and, given the high intensity but limited area of many indoor gardens, niche-market crops are usually a good option. Crops that currently receive the highest returns in local markets include those such as ginseng, bay, tarragon, and saffron, all of which are suited to both hydroponics and indoor cropping. While a high rate of return per pound may look lucrative, growers also need to take into account the difficulty of the crop, yields per square foot, time to harvest, and availability of information on hydroponic cultivation. Some of the most highly priced niche crops are relatively low yielding and slow to mature, so growers need to weigh up all these factors before deciding which to grow.

French Tarragon

French tarragon (*Artemisia dracunculus*) has long been a staple hydroponic herb and is relatively easy to grow. It is a perennial bushy plant with slender branching stems and smooth olive green, narrow leaves. The flavour of tarragon is strong, sweet, aromatic, and reminiscent of anise and licorice and has been growing in popularity as a culinary flavouring. While French tarragon does receive considerably higher prices per pound than most other herbs (currently around $16/lb), it is slow to produce good yields and can take up to a year before regular harvests of fresh-cut product can be taken and the foliage is light in weight. French tarragon, being a long-lived perennial plant, is suited to free draining media bed systems with substrates such as perlite as the plant is intolerant of high moisture levels.



Bay leaves may be sold as a fresh or dried product.

> “SOME OF THE MOST HIGHLY PRICED NICHE CROPS ARE RELATIVELY LOW YIELDING AND SLOW TO MATURE.”

A warm, well-lit environment is required to prevent tarragon plants going into dormancy which halts growth and, in an indoor garden, tarragon can be grown year round. Tarragon has similar nutritional requirements to other slower growing herbs such as rosemary and thyme, with an EC of 1.6-1.8 for mature plants and 1.0-1.2 for young plants, cuttings/root divisions, or plants just coming out of dormancy.

Bay

Bay leaves, sold both fresh and, more commonly, as a dried product, are produced by the Bay tree (*Laurus nobilis*) a native of the Mediterranean region where it can reach heights of more than 12 metres. Under hydroponic cultivation for fresh herb production, young trees are regularly trimmed to restrict height. Fresh bay leaves currently receive around $30/lb and are used to flavour a wide range of dishes. Bay is a slow-growing tree, best suited to being individually planted into containers with a drip irrigation system. Small plants are generally started as cuttings and potted on as they grow in size. The growing point of young plants needs to be removed to encourage branching and stem development for higher yields of individual leaves as the plants grow to a harvestable stage. Bay trees are fairly hardy and can survive cool conditions, but for maximum growth, they do best in a warm, dry, high-light environment with EC levels maintained in the 2.4–2.6 range. While bay is relatively disease free, it is prone to attack by mealy bugs which can either be manually removed for small plantings or sprayed regularly with neem oil.

> “BAY IS A SLOW-GROWING TREE, BEST SUITED TO BEING INDIVIDUALLY PLANTED INTO CONTAINERS WITH A DRIP IRRIGATION SYSTEM.”

Top: Removing the growing point of bay trees helps control height and increase branching. **Bottom:** Bay is a tall growing tree, however, height can be restricted by regular trimming and leaf removal.

Ginseng

American Ginseng (*Panax quinquefolium L.*) is a relatively new crop to hydroponic production and one which has considerable potential to increase both yields and quality of the harvestable product. Dried ginseng root is reported to receive $500-$600 per pound, however, the plant is slow growing and low yielding compared to most other fast turn-around hydroponic crops. One of the main advantages of ginseng is that it must have a very low light, cool environment and is thus suited to indoor production where these factors can be easily controlled. American ginseng is native to the cool, shady hardwood forests of eastern US and Canada and since the 18th century, has been hunted down and dug from the wild to supply markets, often exported to Asia. However, the high prices and demand for ginseng combined with its slow rate of growth and reproduction has meant that wild populations are often dug at an early age before flowering and seed production has occurred, thus the plant faces extinction in the wild. Due to the high prices paid for wild ginseng, cultivation of this crop has become more widespread with most systems still being soil based. Cultivated plants are a long-lived crop, with the roots becoming larger each year until harvest, often in the fourth year — at this stage roots are usually forked and around 10 centimetres long and 2.5 cm thick. Mature plants are between one to two feet tall and enter into a dormancy phase in autumn when the leaves turn yellow and stems die back.

Propagation of ginseng is somewhat time consuming as the seed requires at least 12 months of after-ripening (stratification at low temperature) before germination will occur. However, for quicker crop establishment, growers can start with one- to two-year-old roots which are precisely spaced to maximise plant density in the growing area.

While starting a crop from young roots is more expensive than raising planting stock from seed, it reduces the time to harvest and allows only healthy roots to be selected for planting out.

A potentially profitable option for indoor hydroponic growers with limited space is to not grow ginseng for harvest of the mature product (which then needs to be carefully dried before sale), but to propagate from seed and sell only one- to two-year-old roots to other growers. Ginseng seedlings can be grown at a much higher density than mature plants and respond well to hydroponic nutrition — this allows the production of high-health planting stock which has not been in contact with soil and is well suited to further soilless production. Starting with stratified seed which is usually for sale in fall, this needs to be sown a 1 to 2.5 cm, with an average germination rate of 70 per cent. Seed beds containing a mix of fine grade perlite and coconut fibre and a high-quality, low-mineral water source are suitable for the germination process

Hydroponic Systems for Ginseng

Hydroponic systems for ginseng have had limited research, however, there is potential to improve yields and growth rates through climate and root environmental control as well as optimal nutrition. Ginseng requires low light levels (heavy shading is used for outdoor crops) with light saturation occurring in both seedlings and mature plants at about 150 micromoles m-2 s-1 (1) which is around 7.5 per cent of full sunlight. Too much light will reduce yields, burn leaves, and lead to plant decline, while excess shade depresses the yield potential. Much of the photo assimilate produced by the ginseng leaves ends up in the thickened root system, however, the yield of the roots can be increased by up to 25 per cent if the flowering stems are removed as they form. Temperatures for ginseng are similar to those for other cool-season crops, around 20-23°C. Growing mediums for ginseng must be free draining, but at the same time not impede the development of the forked roots — coconut fibre, or mixtures of fibre and perlite under drip irrigation are suitable. Overly wet substrate conditions should be avoided as these attract fungus gnats, the larvae of which can damage the roots and introduce infection. Some research has also indicated that for high-quality root production, ginseng can be grown aeroponically without the requirement for any growing medium. Spraying roots for 30 seconds every 10 minutes in the light period, and for 30 seconds every 30 minutes during the dark, has been stated as a suitable frequency. Ginseng can be prone to root rot and physiological disorders, so the use of disease-free root stock is recommended along with high quality water sources and solution disinfection. There is little information on suitable nutrient ratios or elemental levels for hydroponic ginseng, however, a low EC of 0.5-1.1 has been suggested for solution culture system. A high concentration of potassium has also been stated to result in an increase in ginseng root growth.

Harvesting ginseng roots at the end of the growth period occurs when they have reached a fresh weight of around an ounce. Harvesting needs to be carefully carried out as damaged roots receive lower prices than intact ones. After harvest, substrate grown roots need to be washed then dried in drying rooms with forced air to ensure mold growth does not occur. Once dried, roots can be packed and stored until sold.

Profitable hydroponic crops for indoor growers are worth a little investigation into market prices and cultivation techniques, taking into account yields, growing space, and time to maturity. However, many opportunities and a diverse range of crops exist within niche markets, even if some trial and error may be needed to perfect a new commercial enterprise.

> “THERE IS POTENTIAL TO IMPROVE YIELDS AND GROWTH RATES THROUGH CLIMATE AND ROOT ENVIRONMENTAL CONTROL AS WELL AS OPTIMAL NUTRITION.”

Top: French tarragon is slow growing but receives high prices on the fresh herb market. **Bottom:** Ginseng has shown increased root growth when exposed to high concentrations of potassium.

"Gardening is cheaper than therapy and you get tomatoes." —Anonymous

The Trouble with Growing Tomatoes Indoors Using LEDs

by Alan Ray

Anyone who ever found themselves while losing themselves in a tomato garden knows truer words were never spoken. Unfortunately, growing tomatoes indoors with LED lights isn't therapeutic at all.

A Girl with a Bad Reputation

Up until the late 1800s, and for years after, the tomato was considered poisonous by the majority of people across the world. In Europe, for example, the upper crust of society ate from plates containing lead. The highly acidic juice from the tomato would leach lead from the plate and, as a result, a high number of people died from lead poisoning. Naturally, they blamed the tomato.

Being botanically classified in the deadly Nightshade family didn't do much to instill consumer confidence, either. Once confirmed they were not poisonous but delicious and so culinary friendly, the love affair with the tomato began in earnest. Tomatoes have become one of the most popular vegetables (technically a fruit) in the world and grown in some 85 per cent of outdoor gardens.

Growing tomatoes indoors, however, is another matter.

LED There be Light

To better understand the relationship between growing tomatoes indoors and light emitting diode (LED) lights, I sought the expertise and wisdom of lighting maven and researcher Carey Mitchell, professor of horticulture at Purdue University in West Lafayette, Indiana. The good professor was kind enough to cram me into his hectic schedule between his teleconference with NASA and grading finals.

Professor Mitchell has spent years experimenting with LED lights and their viability as an alternative light source to high intensity discharge (HID) lights. These include metal halide (MH) and the high-pressure sodium (HPS) lamps used in commercial indoor growing.

I explained to the professor the article I was writing involved growing tomatoes indoors for the home gardener using LEDs. His first words were: "Well, they're going to have a hard time doing that. Tomatoes are a high-light species and you'd have to put all the LED lights in the world to those. That's why the commercial hydroponic tomato production industry is greenhouse-based. They merely use electric lighting to supplement sunlight, especially in times of the year when the photoperiod is very short or it's very cloudy or it's snowing. Additionally, 98-99 per cent of that market is high pressure sodium lighting because it costs so much less to get into that initially."

Mitchell went on to say LEDs are so expensive to begin with that it is still cheaper to use HPS lighting, despite the fact they cost 75 per cent more to operate. He also noted HPS lights help heat the greenhouse. I chimed in that seems like an expensive way to heat a greenhouse. The professor agreed, but also noted heat was one of the perks of using HPS lights. He stated their initial fixture costs are so much less than LEDs and that they get "good stimulation of yield," so it is still more economically feasible. Moreover, the residual radiant heat is used to offset the enormous cost of heating a greenhouse with natural gas or additional electricity when the photo period is very short or during cold or cloudy periods.

LED Advantages

LED lights are becoming more efficient as their ability to economically convert electricity into photons increases. While currently somewhat low, they are getting better at it. According to Mitchell there are advantages that LEDs hold over other light sources. He said the secret is they emit practically no heat and can thereby be placed much closer to the plants without scorching them, which results in reduced electrical costs.

One drawback to using LEDs in a greenhouse is they can block out the natural sunlight from the glass panels, so it becomes a trade-off as to when the benefit of their light is overshadowed by the sunlight they block out.

"Completely indoor, like vertical farms, are almost all LEDs...or at least they are going to be," Mitchell says. "This is because with LEDs you don't have to worry about the fixtures blocking solar. The problem with LEDs right now is the fixture costs. I think they are three to five times more expensive per fixture than HID lights like MH and HPS, but they are getting cheaper."

Go Green

Mitchell stressed these aren't fruiting vegetables being grown commercially with LEDs, these are quick-turning, leafy green crops like lettuce, kale, and arugula. Quicker yet are baby greens and the even-faster-maturing microgreens, as they require practically no light. "For the most part, tomato, cucumber, and eggplant are high-wire plants and tend to require a lot of light," Mitchell added.

When I asked what mistakes indoor growers seem to make most often, Mitchell was hesitant to think of them as mistakes, but more a lack of knowledge. Not having the right light prescription for your plants combined with high humidity can create some leaf burn and other issues. This is bad news for the commercial grower because this renders the greens unmarketable.

"You can get lighting prescriptions from the different companies, but you know, it takes more than light to grow plants. It takes carbon dioxide. It takes nutrients, water; it takes the correct temperature; it takes humidity and so all those things factor together," says Mitchell. "It's still a fairly young industry so there are risks involved in any new crop you might try to grow without having the experience. So, a lot of these companies are doing what are called light recipes, but I'd say it's really growth recipes you need to work out that include that litany of environmental factors that interact with light."

Mitchell stated that because the photoperiod of tomatoes is so long, they are one plant that doesn't do well indoors. For the home grower, if you wanted to grow some grape or cherry tomatoes or a few dwarf species with LEDs you may get some tomatoes. There are light banks available (even LEDs) that may work on those types but not so much the standard tomatoes we see in the garden. They just don't do well under solely artificial light conditions.

"So right now, the cards are not there for growing indoor tomatoes productively and certainly not commercially. For the home grower, as I said, you could probably grow some cherry tomatoes on a very small scale in your basement, that might work," says Mitchell. "If you ask someone else, say someone at an Extension office, they may see growing tomatoes indoors differently." As a researcher, Mitchell says his views are purely objective. "I just know the state-of-the-art for LEDs right now and it's just not there for growing tomatoes. Sole-source lighting works well for greens and that's why they grow them. For the homeowner, if you have a greenhouse and supplement the natural light with LEDs you can get a decent yield."

"**The problem with LEDs** right now is the fixture costs. I think they are three to five times more expensive per fixture than HID lights like MH and HPS, but they are getting cheaper."


still helping you grow
“tomatoes”
your #1 growing resource.
Reach your growing goals with educational articles, the latest products and technologies, how-tos, tips and tricks, and more from our team of indoor growing experts.
MAXIMUM YIELD
growing with you since 1998
maximumyield.com

understanding the

MICRO CLIMATES

in your summer garden

The average suburban land parcel may look uniform when considering climate and gardens, but if you look closer, you'll notice there any many different stories to find. Sara Elliott helps you identify these microclimates and utilise them to their potential. **by Sara Elliott**

Any English teacher will tell you there's no new story plot under the sun, while most gardeners will explain that new plots are everywhere under the sun, just waiting for the right conditions to produce their own green, growing stories. The summer garden is chock-full of drama that often has ramifications long after the growing season is over. Microclimates are one character, or characteristic, of the summer gardening story.

WHAT'S SO IMPORTANT ABOUT MICROCLIMATES?

Ecosystems are made up of many niche environments. This wonderful diversity results when organisms are drawn to or adapt to small but always significant changes in their surroundings. Microclimates, or unique climatic profiles within a small area, play a role in this. It may look as though the conventional suburban backyard is pretty lacking in exploitable changes in climate and other growing conditions, but that's not true. Your summer landscape is rich with microclimates. Even better, when you understand them and stop being such a stickler for geometric precision in some of your planting strategies, microclimates can help you become a better gardener. Let's look at how it works.

CREATE THE CLIMATE YOU NEED

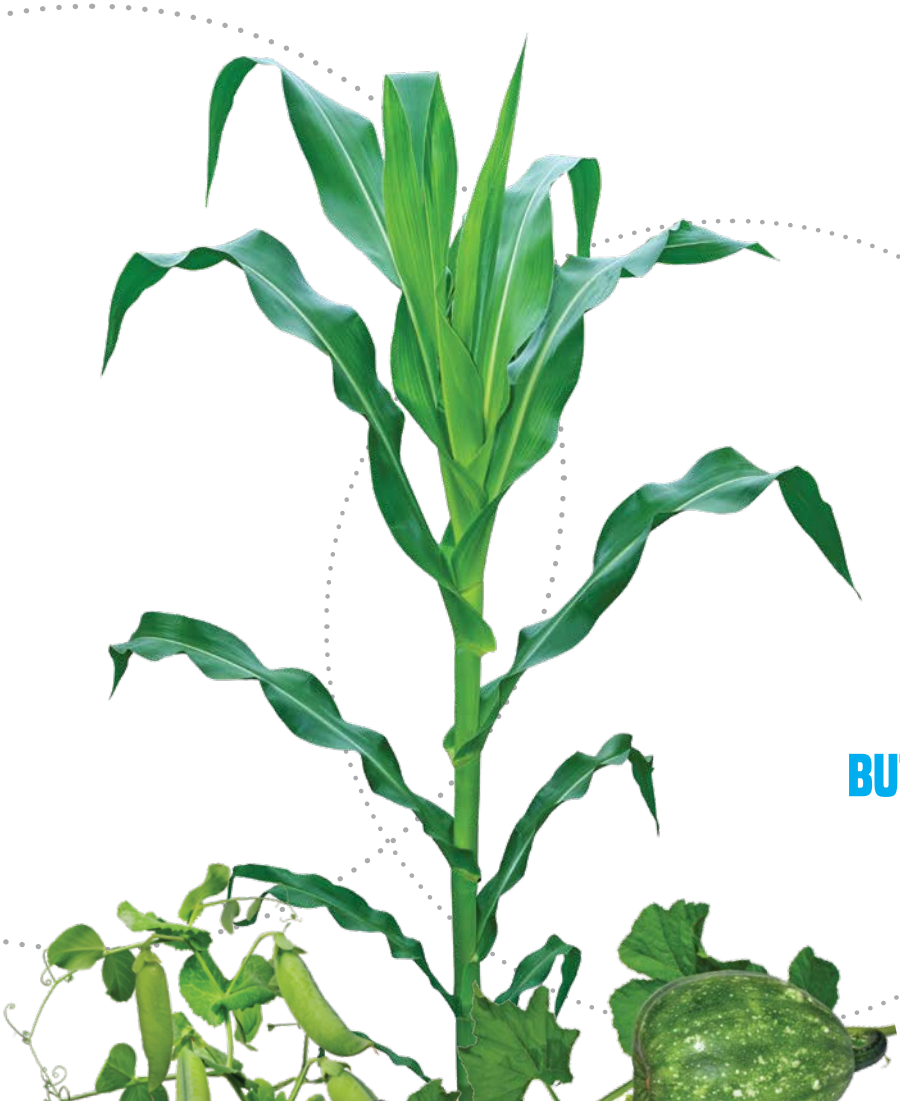
The term "microclimate" may sound like a newfangled marketing ploy, but this approach to cultivation has been around for centuries. One elegant example of creative microclimate modification is the classic three sisters planting model used by the Iroquois Indians as early as the 1300s, according to the *Old Farmer's Almanac*. You've probably heard of it. On the surface, it's a companion planting strategy for corn, beans, and squash: the corn provides a support for the beans; the beans contribute nitrogen; and the squash leaves offer cooling and moisture protection to the roots of all three plants during the summer heat.

In the cold, damp northeastern climate, the Iroquois planted the three sisters together on small hills, which warmed the early-season soil and kept it from becoming too wet. This plan fostered plants earlier and encouraged good drainage. The height differences and close proximity among the trio were useful, too. They produced a layering effect that improved light management and created an organic fortification against wind and heavy rain. The three sisters story shows us how small, focused plant and environmental choices, when combined, can produce impressive results.

While you're in the thick of performing gardening chores this season, start noting how microclimates work in your landscape. Here are some basic factors to keep in mind.

DIRECTION OR EXPOSURE — You've probably already observed a southern exposure has a long growing season and tends to be warmer and sunnier, while a western exposure is typically hot and dry. It's also obvious to even a casual gardener that northern exposures receive the least amount of sun overall, and eastern exposures usually receive gentle morning light and present fewer problems with afternoon heat. Understanding the benefits and drawbacks of different directional orientations is a key component of good microclimate management.

LIGHT, DAPPLED LIGHT, OR SHADE — Directional light exposure is a mainstay of light planning in the garden, but factors like the shade and shadows cast by structures, or the dappled light under a tree canopy, play a role, too. Even the stippling created by tall plants on their smaller neighbours has the potential to be useful, or detrimental, depending on the plants and planting strategies involved.



"This wonderful diversity results when organisms are drawn to or **ADAPT TO SMALL BUT ALWAYS SIGNIFICANT CHANGES IN THEIR SURROUNDINGS."**

HEAT — Great summer light often comes with the price of high afternoon heat. Heat in the garden can scorch plants directly, warm the surface soil to unhealthy levels, or rob the soil of essential moisture. Reflected heat from walls and dense hardscapes may also create unexpected hot spots. Careful plant selection, increased airflow, calculated mulching, strategic watering, and the use of row covers and other shade producing devices can help. The first step is to recognise what types of heat-related challenges you're dealing with.

MOISTURE — Today, drought is an issue in many areas throughout the country. It's always helpful to understand how much moisture your garden is receiving now, and where you should supplement through watering. Is it worth adding an irrigation system and controller, or are your trusty hose and a consistent watering schedule enough?

UNEVEN TERRAIN — Slopes, and high and low stretches, often result in dry spots, erosion problems, and boggy areas where water pools after a rain. The results of soil deficits, like too much clay or sand, or not enough organic matter, also become more pronounced in pitched or undulating gardens.

WIND — Good airflow is essential for plant health, but wind can be too much of a good thing. Staking plants for added support only solves part of the problem. In the summer heat, persistent wind steals moisture from plants through evaporation. Wind savvy plant selection and calculated wind breaks are very effective, but only if you suss out where they're most needed first.

"The term 'microclimate' may sound like a newfangled marketing ploy, but **THIS APPROACH TO CULTIVATION HAS BEEN AROUND FOR CENTURIES."**

ARE YOU A MICROCLIMATE GARDENER?

Think microclimate gardening is a potential hassle? Not so. Actually, you may already have a robust strategy in place…: in your lawn. Lawn seed blends offer a variety of cultivars of a particular grass, or a selection of complementary grasses. They're designed to thrive in different growing environments, like a shady location under a tree, the dry spot by a mailbox, or the high-traffic area in a tree lawn or along a driveway. These various grasses work together to provide uninterrupted coverage, even in challenging circumstances: where one grass dwindles, another flourishes. This is an example of savvy plant selection based on the anticipated microclimates in a particular landscape.

TOOLS AND TIPS

Although microclimates have an influence on your garden throughout the year, spring and summer are the prime growing seasons. This makes the microclimate characteristics impacting them a huge factor in the health and productivity of your garden as a whole. Now that you know a little about how microclimates can work for you, let's take a look at some useful diagnostic tools.

The 21st century is a great time to be a gardener if you like widgets and thingamabobs that make information gathering easier. The old ways are just as effective, though. Using wind socks and testing the soil's composition by taking a little nibble will still do the job. If you're in too much of a hurry to spend an afternoon watching the grass grow, or just love gadgets, here are some suggestions:

> "While you're in the thick of performing gardening chores this season, **START NOTING HOW MICROCLIMATES WORK IN YOUR LANDSCAPE.**"

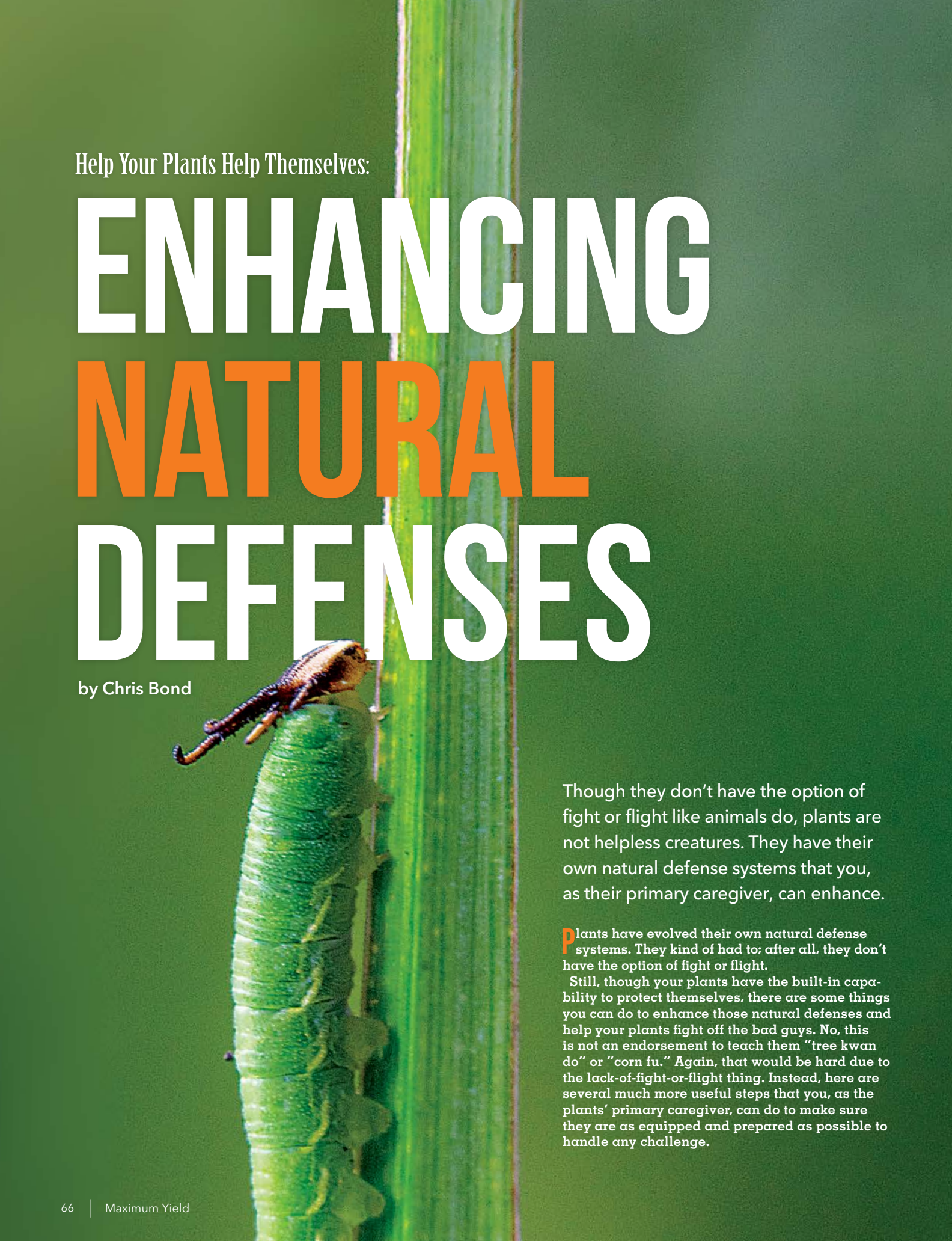
- **Moisture meters** — These instant-read probes check soil moisture and often include a pH analysis.
- **Sun meters** — Sun meters are particularly useful in determining whether a northern exposure, or typically shady spot, is getting enough light to sustain plants. Some are instant-read, while others take up to 24 hours to process and summarise their readings. Included in this group are photosynthetically active radiation (PAR) light level meters designed specifically to measure PAR in the 400-700nm colour range which is essential for plant photosynthesis.
- **Sun Seeker/Identifier Apps** — A sun identification app will give you a 3D view of the sun's solar path across your property, together with data-like rise and set times and solar direction for each daylight hour. It can be a good planning tool, especially if you're installing a new garden or reworking one after a major renovation.
- **Wind Speed Gauges** — If you think the breeze whistling through your side yard is moving at a pretty fast clip, maybe fast enough to dry out your prized roses, you can find out for sure using a handheld wind gauge that will also give you wind temperature and direction. Wait a few months, and the right unit will provide you with wind chill readings, too.
- **Weather stations** — Where the tools above gather specific but limited information, weather stations are designed to consolidate a number of weather related readings into one device. They're as close as you're going to get to a weatherman reporting from your backyard. A weather station is more expensive than a one-trick tool, but it's also more convenient to use. Here's why: a basic wired unit will often include information about precipitation, humidity, wind speed and direction, and ambient air temperature. High-end options can do all that plus deliver the information through a wireless network, or Bluetooth connectivity, to an indoor weather monitor. That way, you can view the data from the comfort of your couch, or in some instances, from a remote device like a tablet or smartphone.

If you've ever seen a tiny whirlwind of dead leaves spring up in a doorway, or scour a gutter of dirt and grit, you know the vagaries of weather can be small, but surprisingly powerful and efficient. Understanding how they work in your landscape can help you make the most of your gardening story by developing a plot that's worthy of your time and effort.

Help Your Plants Help Themselves:

ENHANCING NATURAL DEFENSES

by Chris Bond



Though they don't have the option of fight or flight like animals do, plants are not helpless creatures. They have their own natural defense systems that you, as their primary caregiver, can enhance.

Plants have evolved their own natural defense systems. They kind of had to; after all, they don't have the option of fight or flight.

Still, though your plants have the built-in capability to protect themselves, there are some things you can do to enhance those natural defenses and help your plants fight off the bad guys. No, this is not an endorsement to teach them "tree kwan do" or "corn fu." Again, that would be hard due to the lack-of-fight-or-flight thing. Instead, here are several much more useful steps that you, as the plants' primary caregiver, can do to make sure they are as equipped and prepared as possible to handle any challenge.

An Overview

The natural ability of plants to fight off pests is far more complex than most people would think. Plants can generate a wide array of hormones and antimicrobial enzymes, chemicals, and proteins in response to the unwanted presence of various pathogens. For example, some plants have shown the ability to manufacture chemicals that either inhibit insects from feeding or at least slow down their appetite. Some plants may also close their stomata to prevent the additional entrance of unwanted pests or diseases.

"Responses triggered by the appearance of a pest, pathogen, or other agent are known as **INDUCED RESISTANCES.**"

In other instances, some plants can also send nutrients to where they are under stress from insect or disease attack and simply outgrow the nemesis. Some can even kill off and drop the part of their anatomy under attack, kind of like how certain lizards can shed their tails.

Another tool in the plant defense arsenal is the ability to communicate with beneficial insects and even other plants when they sense they are about to be attacked or succumb to a wide range of stressors. To do this, plants emit volatile, organic chemicals to beckon specific beneficial insects based on which pests are attacking. This signaling power is not limited to the leaves or shoots either. Studies by the US Department of Agriculture show the roots can also emit signals to summon beneficial nematodes and bacteria to attack the pest.

Pleading for help is not the sole use of this communication. The hormones and chemicals released by distressed plants also act as a warning to other plants of what is happening to it. Studies confirm neighbouring plants pick up these signals and, in turn, start to ramp up their own defenses in anticipation of the oncoming onslaught.

Responses triggered by the appearance of a pest, pathogen, or other agent are known as induced resistances. There are two types of induced resistance in plants: systemic acquired resistance (SAR) and induced systemic resistance. When a plant is expressing SAR, it will manufacture and produce a hormonal response and generate defensive proteins to protect itself as soon as it is exposed to any pathogen or pest. Much like the human body will release antibodies when it detects an invader,

plants release salicylic acid in response to these stressful events in its life. Induced systemic resistance is mostly associated with plants grown in soil as it is dependent on root contact with specific plant growth promoting rhizobacteria (PGPR) in the soil. Once this connection between the roots and PGPR is made, plants produce jasmonate and ethylene. They then release these hormones to both internally protect themselves from pests and externally signal there is a problem.

Once initiated, different plant defense responses occur at different rates. Many of these are instantaneous or take only a few minutes to fully initiate. Others, such as some of the external signalling defenses, can take many hours.

The Basics

Just as you are not likely to fight off an onslaught of sickness-inducing germs effectively while sleep deprived, hungry, and thirsty, your plants will be better poised to defend themselves from a variety of pests and pathogens if their basic needs are met. So, first off, make sure that the plants are where they want to be. Many growers fight a losing battle by trying to get a plant to grow in an environment that it is not suited for. If your plant needs full sun, make sure it gets full sun. Without it, the plant won't be able to make enough food for itself. If your plant is meant to live in the shade, it will likely dry out or its foliage may burn if it is planted in full sun.

Also, make sure to locate your plants in a soil or soilless medium that is compatible with their types of root system, eventual root size, and water needs. Some plants can live in water or constantly moist soils; many cannot. If they cannot tolerate wet feet, your plants will not be able to fight off root rot.

Consider the plants' nutritional needs, too, as your plants have different nutritional needs at different stages of development. Just as a human infant is not ready for steak, your young seedlings cannot tolerate grown-up doses of fertiliser. When your plants are older, they will likely need different levels of certain nutrients as they go through their various vegetative and flowering or fruiting stages.

"Your plants will be better poised to defend themselves from a variety of pests and pathogens if their **BASIC NEEDS ARE MET.**"

Once these basic needs are met, your plants have a fighting chance to make use of their own naturally occurring defenses. There is nothing wrong, however, with wanting to even the odds — or even stacking the deck — a bit more in their favour. After all, it is your plants we're talking about.

Enhancing Your Plants' Defenses

The market abounds with amendments designed to fix whatever ails your plant. Products meant to specifically bolster natural plant defenses and immunities, however, are relatively hard to come by. "The main scientific challenge is the complexity of the physiological effects of biostimulants," explains an article in the November 2015 issue of *Scientia Horticulturae*. "In general terms, the primary effects of biostimulants are to induce physiological responses in the plant. Many of these responses bear on primary metabolism, growth, and development. These processes are subject to tight homeostatic regulations which originate from millions of years of biological evolution and explain why plants occupy specific ecological niches and display characteristic phenotypic responses to fluctuating environments. Acting on such biological processes is challenging and attention should be paid to the many cross talks between processes and pathways in plant organisms in their response to their environment."

So, what can you use specifically to improve your plants' natural defenses? The Rodale Institute, a non-profit dedicated to supporting organic farming research, states the addition of organic matter, specifically properly crafted compost, will boost your plants' pathogen-fighting microbial populations by up to 1,000-fold. You can also use certain commercially produced plant hormones on your plants. Salicylic acid is available as an amendment to help your plants fight off pathogens and methyl jasmonate is available to help plants cope with stressors. There are also aloe vera-derived solutions sold as plant immune system boosters.

More to Learn

Plant natural defenses are extremely complex, and we only fully understand a sliver of what there is to know about these responses and processes. However, we do know enough to understand how to enhance your plants' natural defenses. The best thing you can do for your plants to help them realise optimal health is make sure they have all the nutrition and moisture they need and an ideal environment in which to grow. When they are healthy, your plants can develop and maintain their own defenses and be fully equipped to handle whatever nature throws at them.

check out our app for info on-the-go...

... and pick up a copy of Maximum Yield for your garden adventures!

MAXIMUM YIELD

growing with you since 1998

maximumyield.com

The dream

of the perfect hydroponic nutrient

CANNA
Thé solution for growth and bloom

CANNA is the solution for growth and bloom. It is a leading producer of nutrients and growing mediums for the cultivation of fast-growing plants. Ever since founding the company in the early 1990s, all our plant products are scientifically tested, honed, and improved prior to releasing them onto the market. Long before the CANNA marque that we know and love today began, the founders were scientifically pioneering with plants.

The Founding Years

Back in the 80s, CANNA's founding fathers were dissatisfied with the existing and very limited range of hydroponic fertilisers, so they set about researching and developing a new nutrient line. It was a Dutch coffeeshop proprietor who noticed that the quality of medicinal crops grown on mineral wool with the new formulas were dramatically improved. The results were so well received that CANNA's first-born twins, CANNA VEGA and CANNA FLORES, were quickly in production. This marked the start of a business that within just a few years never stopped developing the most innovative and reliable constants for use in growland. This innovative approach was to prove itself not only in the production of dependable products, but also the fact that CANNA fulfils a pioneering function. One result is the standard mixture ratio of 1:250 for nutrients that is in general use today, which was originally introduced by CANNA.

Innovation and Tradition – 25 Years in Australasia

In 2019, CANNA Australasia celebrates an extraordinary 25 years in Australia and New Zealand. Our diverse range of products have been enjoyed by thousands of Aussies and Kiwis in cities and rural towns across the lands. The joy of helping you grow continues to inspire our people to create innovative products that make your life that little bit easier. So, to each and every customer who has supported us since 1994, we'd like to say something simple. Thank you.

In 1994, Australians and New Zealanders took a set of humble Dutch hydroponic nutrients into their hearts and they've been loved ever since through successive generations of growers.

CANNA Vega and CANNA Flores nutrients arrived a few years after their domestic debut as pioneers of the global basic hydroponic nutrient system – a highly nutritious grow and bloom formula combining macro and micro elements in an A and B system (rather than the three-part system common to American hydroponic nutrients at the time).

Central to the instant appeal of CANNA Vega and Flores – a name that represented a nutrient created for indoor gardens grown under HID lighting – was a list of impressive values not typical of hydroponic nutrients in the early 1990s including crop specific formulation, environmentally friendliness, high quality, and repeated reliability.

CANNA's timing couldn't have been more opportune. Although it had been a response to the commercial struggles of a Dutch coffeeshop grower, its introduction to growland coincided with the new cultivation methods using stonewool and the subsequent grower rush towards growing smaller plants taken from cuttings. The popularity of Vega and Flores in overseas markets was boosted when it became the first nutrient to meet the demands of Dutch growers for fast-growing medicinal and culinary herbs, courtesy of its ground-breaking balanced nutrient formulation.

Quality Proves Itself

Since 1979, CANNA's founders have searched the planet for active plants and minerals for plant health and well-being. Years of experience, indigenous inspiration, and the latest high-tech plant research have culminated in effective formulas that guarantee everyone, including inexperienced growers, can achieve amazing results!

The use of our cutting-edge, nutritional plant products is clean, simple, easy to use, and does not harm the environment. From the beginning, CANNA, a Dutch company, has been synonymous with the highest quality nutritional products and growing media available thanks to our relentless scientific research-driven philosophy. Therefore, it's not surprising CANNA is recognised by its peers worldwide as the undisputed market leader in plant technologies for fast-growing plants.

CANNA holds the complete production chain in its own hands. Right from development through to research, including marketing, sales, and our unique environmentally friendly production line. CANNA also has its own logistics department and, of course, a laboratory. Here, passionate scientists unravel the secrets of nature. The passion for plants is shown in CANNA's quality products. Years of intensive research precede the market launch of each product.

CANNA produces all its global products for sale in a state-of-the-art facility in Made, The Netherlands, to meet the needs of plants cultivated on different substrates. In this way the best results can be achieved regardless of the cultivation system or level of production used. Plants require that the same nutritional elements be available regardless of the growing medium used. Cultivation systems have a considerable influence on the availability of these nutritional elements. Stonewool, for example, does not contain any nutritional elements or the ability to store them, whereas coco both absorbs and supplies nutritional elements to the nutrient solution. It is for these and many more reasons plants need different compositions of nutrients under different growing conditions.

CANNA's products are well known for high yields, purity of the raw materials, user friendliness, and our unrivalled concern for the health of the grower and consumer. Our cornerstones are VEGA and FLORES. These terms indicate in which developmental phase of the plant to use the nutrients. VEGA is for the plant's vegetative or growing phase.

CANNA
Thé solution for growth and bloom

During this phase, the plant develops its roots, stems, and foliage. A fast start, healthy root structure, and powerful shoots are essential for optimum results. FLORES is for the blooming phase. During this phase, the plant's nutritional requirements change, for example from needing high nitrogen to a demand for more phosphorus. FLORES products will generate the highest yield possible because the specially formulated nutritional elements are specially designed for this phase.

Each CANNA product has been lovingly created to offer you the greatest yields possible when using a specific growing medium or method. The secret behind CANNA's intelligent products is found in a carefully balanced and integrated blend of the finest main and trace elements for each growing medium and fertiliser combination.

Be Modest

"Be modest" is a phrase that just seems to be made for CANNA. Although whipped up marketing hype seems to be the norm at present, patting ourselves on the back is not our scene. We prefer to let our products speak for themselves.

The fact that countless professional growers in more than twenty countries rate us the No.1 brand in plant technologies, and that our products are offered in more than 95 per cent of all grow shops around the globe, seems to us as an adequate proof that our philosophy bears fruit.

The Pioneer of Tomorrow… On the Proving Field of Today

Team spirit and love for the plant are just a few keywords that characterise CANNA's business philosophy. It must be obvious that CANNA is much more than just a producer of fertilisers. Unique in growland is that we keep the whole production process in our own hands. From development and research to the unique environmentally friendly production line and our extremely rapid delivery department. As the only producer of nutrients, CANNA has its own laboratory and research areas where specialised scientists daily unravel nature's secrets. We think that by keeping as many factors as possible in our own hands, will we be able to offer a product of a consistently high quality.

Closer to the Future with Every Step

Based on decades of experience with growing and intense collaboration with other pioneers, CANNA has assembled an enormous reservoir of knowledge that cannot be matched

in growland or even beyond. This rare combination of professional knowledge and enthusiasm has, for years, led to a series of very high-quality products. No single CANNA product is simply placed on the market. Only when we are 100 per cent certain that a product will have an optimum performance do we bring it onto the market.

But for us that is still not enough. To be sure that there will be no unpleasant surprises, we also need to be certain why something works. In addition, we first undertake an extended investigation with people in various countries who are in the growing business, to list all the possible conditions. Therefore, we shall never launch a product into the market too hastily. However, tempting as that may sometimes be in a market where the issues of the day all too often lead to short-term hype.

The Essence of CANNA

We believe that the serious expert knows how to estimate the value of our professional approach. We believe he who takes the grower seriously treats the development of a new product with equal seriousness. And that is not a process that you can complete within a few weeks.

For CANNA, research is also of essential importance. After all, this has extensive consequences for the end user. Therefore, we take as long as is necessary for the development of a new product – two years on average. A period in which a team of highly trained specialists tirelessly sifts all aspects of a new product. That we place so much emphasis on this means we can stand four-square behind our products. And that does not end when a product has passed over the counter.

After-sales service is for us an indispensable part of the business. We keep in close contact with end users via our dealer network and take their problems extremely seriously. Feedback from the field is not only a welcome addition to our research. The greatest satisfaction derived from our work is still always a client who is satisfied with their result.

At Home All Over the World

It's not only in the growrooms and greenhouses of the world that CANNA is at home. In addition to its original headquarters in Breda, Holland, CANNA found a second home in Made back in 2012. Since then, it has been one of the most technologically advanced nutrient factories in the world. All the formulas are now manufactured here, each one translating the founders' dream into the perfect solution for each different hydroponic substrate.

Yet, CANNA Made is more than a production facility. It is also one of our CANNA research centres. What are these? Locations around the globe where growers and researchers can come to discover the fascinating appeal of the nutrients conceived in Breda – on test benches and experiment cells, with grower training courses and yield improvement programs. A chance to explore the CANNA brand with all the senses – offered by the CANNA research centres all over the world.

As you can see, CANNA's founders dream of the perfect hydroponic nutrient has always driven us – throughout our history. And we get closer to achieving it every day. With every concept, every development, and every formula. Along the way, we follow a plan, an ideal that unites us all. Many people would call it a principle.

We refer to it simply as the CANNA Philosophy.

AU: canna.com.au 1-800-4-CANNA (422-662)
NZ: canna.co.nz 0-800-4-CANNA (422-662)

#GROWBIGGEST

WITH ATLAS PLANT TRAINER!

901 Pleasant St., Ste. 694, Attleboro, MA 02703 • 1+ years in business
1-207-228-2055 • *atlasplanttrainer.com*

Atlas Plant Trainer is a customisable, modular plant training and support solution – growers can think about it like a click-together tomato cage. Their product allows growers to grow their plants wide, not tall, or into any shape at all. Atlas Plant Trainer replaces stakes, cages, and ties giving cultivators everything they need for training and supporting their heavy plants inside their plant pot. Co-founder Rob Smith tells us more about the company.

WHAT DID YOU AND YOUR PARTNERS DO BEFORE STARTING ATLAS PLANT TRAINER?

Prior to starting Atlas Plant Trainer, I was a full-service medical cannabis caregiver in Maine managing a 20-light grow and supplying a full range of medicine for our patients. My partner and wife, Danielle, has worked in human resources for over 15 years and chose to leave that career path to help others experience the benefits of the cannabis plant and then learning how to grow it themselves. We also own a trimming machine rental and sales company in New England called Green Harvest Solutions.

HOW DID YOU GET INTO THIS INDUSTRY?

Before growing, we had both been long-time cannabis consumers, so when there was an "industry" and the opportunity presented itself to make a living growing the plant, we jumped at it. We started out slowly when I left my job in January 2016 to focus on the businesses, but then quickly got Danielle out of the corporate grind when we were able.

> “I spent a lot of time learning how to get bigger yields out of my plants and knew that plant training methods such as **TOPPING AND LOW-STRESS TRAINING WERE THE SOLUTION.** ”

WHEN AND WHERE DID ATLAS PLANT TRAINER BEGIN?

When I first started growing, I was concerned with two things: how much I would get off of my six plants, and what they would smell and taste like when I was done. I spent a lot of time learning how to get bigger yields out of my plants and knew that plant training methods such as topping and low-stress training were the solution. Also, just like any home grower, we were limited by the number of plants we could grow. We were also limited by how tall those plants could get, like a lot of other people. As time went on, I tried many commercial solutions and a few DIY ones as well, but nothing grew with the plant as it grew. So I drew up my idea. I showed it to a couple of friends who encouraged me to move it along, and Danielle made the first contact to a product designer and we've worked together to bring APT to market ever since.

HOW DOES YOUR COMPANY PHILOSOPHY TRANSLATE TO OPPORTUNITIES?

Besides just helping people grow bigger plants and replacing their mold-ridden bamboo stakes, we do a lot of education on home growing. We've done side-by-side grows comparing products, live educational sessions on home growing, and lots of blog posts about the same subject. We believe the opportunity lies in growing your own plants at home, because you know what goes into and onto your plant — keeping you safe and healthy.

WHAT DID YOU FIRST PRODUCE?

Our first prototypes left a lot to be desired. Considering we're like an erector set or K'nex, we have a lot of the same types of pieces, so we didn't prototype a full set until the very end. When we did, there were many improvements that needed to be made and another four rounds of iterations on the prototypes. Finally, we got the pieces to fit together snuggly and be firm as the system grew around, over, and through the plants.

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

Atlas Plant Trainer is a very unique product that is creating a new category in a very unique market. While our competition has been around for a long time (and are cheap), they're all very basic and limiting in functionality and they are not a long-term, sustainable solution.

HOW DID YOU GAIN MARKET SHARE AND RECOGNITION?

Honestly, any progress we've made can be attributed to our educational features, social media, and boots on the ground at tradeshows and in hydroponic shops. Atlas Plant Trainer needs a bit more explanation, so the hands-on approach has been key to our early successes.

HAS ATLAS PLANT TRAINER MOVED OR EXPANDED SINCE THE BEGINNING?

Since we've only been on the market since April 2018, everything has been expansion since! We've now shipped product to six different countries and more than half of the states in the US. Atlas Plant Trainer is also being used on many kinds of plants that have heavy flowers or fruits that need supporting.

WHAT IS YOUR CURRENT PRODUCT LINE?

We currently offer Atlas Plant Trainer in two different size kits: the Autoflower Set that grows a 2x2-foot plant and the Large Plant Set that has enough pieces to easily grow a 4x4-foot structure or multiple smaller ones. We also offer discounts for multiple sets and bulk discounts for your larger gardens. We're prototyping an attachment that will attach to the side of any hydro bucket or flood table acting as the medium for the stakes.

WHERE DO YOU DISTRIBUTE?

Currently we're in about 20 grow stores across New England and are working on a few distribution deals in Canada, Australia, South Africa, and the UK. We'll ship from our website anywhere in the world, just please reach out about international shipping costs first!

HOW MANY PEOPLE NOW WORK FOR ATLAS PLANT TRAINER?

There are still just three of us: myself and Danielle, and our sales director, Chris.

WHAT ARE YOUR COMPANY'S STRENGTHS?

Our passion for helping people learn how to grow their own, at home. Atlas Plant Trainer is the product that helps them save time and effort while providing them with an easy way to yield more, but ultimately, we have to educate people how to get started and keep growing in order for Atlas Plant Trainer to make sense for them, and then for them to get the most out of the product. We also didn't want to put out another product into the world that wasn't going to last, so being a creative, sustainable solution in an otherwise replaceable world is another strength we like to boast.

WHAT ARE SOME OF YOUR PROUDEST MOMENTS?

The first as a company was our first sale, and then the first time that a grower shared with us how easy Atlas Plant Trainer was to use and how much more he enjoyed plant training now that he had the product. Final results have just started flowing in, and we've also been really impressed with how much more people are able to yield just by using our product and proper training techniques. Another moment happened more recently, when a fellow inventor saw the product in a grow shop and reached out to ask questions about the product creation, marketing, and go-to-market process. I always love to help other people, and this was the first time that someone reached out for advice on the product side, so I thought that was pretty cool.

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

That there's still so much opportunity for creative entrepreneurs to start something awesome. Every day we either see a really cool new business or think of one that doesn't exist but really should for the industry. Also, 99 per cent of people are really nice and helpful, and I haven't found that in any other industry I've been a part of.

> "**ATLAS PLANT TRAINER IS ALSO BEING USED ON MANY KINDS OF PLANTS** that have heavy flowers or fruits that need supporting."

“WE’VE BEEN REALLY IMPRESSED with how much more people are able to yield just by using our product and proper training techniques.”

WHAT HAVE YOU LEARNED ABOUT STARTING AND GROWING A COMPANY?

It’s not easy, and the more that you can do to create a market for your product before you actually have a product, the better. You can also never market or sell enough.

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

That there still is so much opportunity. I’ve heard lots of people that think they’ve missed out on the “green rush” and I tell them all they are crazy! There are still so many places to legalise. Also, with as small as the industry still is, it’s important to be the best business person you can be. There are only a few degrees of separation between most people, so word travels fast if you aren’t a stand-up type of individual.

SHARE YOUR FAVOURITE STORY FROM A DAY ON THE JOB.

We had a booth at MJ Biz Con in 2017, and it was the first time the whole set had been assembled in public. Remember, the pieces didn’t fit together perfectly, and the assembly appeared a bit weaker than I would’ve liked. Also, this was our first time out of New England with it, so we had a lot of nerves. Within the first 10 minutes, a couple of guys walked by, made it half way past the next booth, and slowly walked backwards until they were standing in front of our booth and Atlas Plant Trainer again. One of them asked if this was my product, which I confirmed, and he went on to say “I’ve been growing weed for 20 plus years, and you know how many times I’ve thought of this exact idea and didn’t do anything with it? This is a great idea, and needs to exist for growers, keep up the good work.” The rest of the week were filled with similar messages, but the exact wording of that will always stand out to me.

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

We always have fun at tradeshows, and with how busy a startup can be, it’s one of the few times that we are all together doing the same thing. We always make sure to get an Airbnb- to ensure we get good bonding time off of the floor as well. Nothing like cooking a meal together to get to know each other better.

PLEASE FEEL FREE TO INCLUDE ANYTHING FURTHER YOU’D LIKE TO SHARE.

We encourage everyone to try to grow at home. It used to be way harder than it is now, so don’t be discouraged. There are lots of products, like Atlas Plant Trainer, that make it easy to get started growing and then get better at growing as you stick with it. As much as you’ve enjoyed consuming the plant, I assure you that you will enjoy growing it just as much, if not more. This plant is one of the few things in this world that I’ve found that returns exactly what you invest into it. Make sure you give it love, so it provides that love back to you.

distribution **LIST**

retail stores are listed alphabetically in each state

ACT

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

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

NEW SOUTH WALES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Hyalite 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
(07) 3335 3556

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

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

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

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

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

Hyalite Varsity
1/11 John Duncan Crt.
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 2B/20-22 Fleming St.
Townsville QLD 4810
(07) 4728 3957

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

NQ Hydroponics
1/31 Casey St.
Aitkenvale, Townsville QLD 4810
(07) 4728 3957

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

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

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

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

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

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

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

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

SOUTH AUSTRALIA

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Hush Hydroponic Wholesalers
25 Charlotte St.
Smithfield, SA 5114
(08) 8254 1585

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Seaton Hydroponics
129 Tapleys Hill Rd.
Seaton SA 5023
(08) 8268 2636

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

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

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

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

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

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

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

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

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

TASMANIA

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

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

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

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

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

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

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

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

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

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

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

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

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

VICTORIA

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WESTERN AUSTRALIA

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

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

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

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

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

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

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

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

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

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

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

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

Hydro Nation
41A Rockingham Rd.
Hamilton Hill WA 6163
(08) 9336 7368

Hydroponic Xpress
295 Warton Rd.
Canning Vale WA 6155
1 800 640 222

Hydroponic Solutions
1/1928 Beach Rd.
Malaga WA 6090
(08) 9248 1901
hydroponicsolutions.com.au

Hydroponic Warehouse
Unit 7/627 Wanneroo Rd.
Wanneroo WA 6065
(08) 9206 0188

Hydroponica
317 Guildford Rd.
Maylands WA 6051
(08) 9371 5757

Hydroponics Guru
Unit 6, 8 Lindsay Rd.
Wangara WA 6065
(04) 3052 7575

Isabella's Hydroponics
66 Jambanis Rd.
Wanneroo WA 6065
(08) 9306 3028

Johnson's Nursery Garden Centre
30 Blencowe Rd.
Geralton WA 6530
(08) 9921 6016

Neerabup Organic & Hydroponic Supplies
Unit 1, 21 Warman St.
Neerabup WA 6031
(08) 9404 7155

One Stop Hydroponics
11 B Beechboro Rd. S.
Bayswater WA 6053
(08) 9471 7000

Perth Hydroponic Centre
Shop 4, 171-175 Abernathy Rd.
Belmont WA 6104
(08) 9478 1211

Reptile and Grow Store
Unit 7 - 117-119 Dixon Rd.
Rockingham WA 6168
(08) 9527 2245
reptileandgrow.com

Richo's 4 Hydro
Unit 7/22 Franklin Ln.
Joondalup WA 6027
(08) 9301 4462

Southwest Hydroponics
Lot 29, Pinjarra Rd.
Mandurah WA 6210
(08) 9534 8544

The Grow Room
1/1451 Albany Hwy.
Cannington WA 6107
(08) 9356 7044

The Great Indoors
Unit 1/25 Gillam Dr.
Kelmscott WA 6111
(08) 9495 2815

The Watershed Water Systems
150 Russell St.
Morley WA 6062
(08) 9473 1473

The Watershed Water Systems
2874 Albany Hwy.
Kelmscott WA 6111
(08) 9495 1495

The Watershed Water Systems
1/146 Great Eastern Hwy.
Midland WA 6210
(08) 9274 3232

Tolesas
No. 6 Abbey Rd.
Armandale WA 6112
(08) 9497 3527
tolesasgrowsmart.com.au

Tru Bloomin Hydroponics
7/36 Port Kembla Dr.
Bibra Lake WA 6163
(08) 9434 5118

Water Garden Warehouse
14 Drake St.
Osborne Park WA 6017
(08) 9443 7993

NEW ZEALAND

Easy Grow New Lynn
3018 Gt North Rd.
New Lynn, Auckland
(09) 827 0883

Easy Grow Manukau
15/69 Wiri Station Rd.
Manukau, Auckland
(09) 263 7560

Guru Gardener
14 Molesworth St.
New Plymouth
(06) 758 6661

Otaki Hydroponics
1083 S.H. 1 South Otaki
(06) 364 2206

House of Hydro
221 Waiwhetu Rd.
Lower Hutt, Wellington

Pet and Garden
10 Fitzgerald Ave.
Christ church
(03) 377 2507

Grow and Brew
14a Flexman Pl.
Silverdale, Auckland
(09) 426 2095

Hyalite Christchurch
240 Annex Rd.
Middleton, 8024
(03) 338 3762

Hyalite Dunedin
313 King Edward St.
Dunedin, 9012
(03) 456 1980

Hyalite Hamilton
1C Sunshine Ave. Te Tapa
Hamilton
(07) 850 8351

Hyalite Hastings
406 Eastbourne St.
Hastings, 4122
(06) 876 7885

Hyalite Henderson
Unit 159 Central Park Dr.
Henderson
(09) 837 1210

Hyalite Linwood
9 Buckleys Rd.
Linwood
(03) 381 0937

Hyalite Manukau
57 Cavendish Dr.
Manukau
(09) 263 4336

Hyalite Nelson
3 Pascoe St.
Nelson
(03) 546 4769

Hyalite Tauranga
64 Ninth Ave.
Tauranga, 3100
(07) 579 9840

Hyalite Upper Hutt
1060 Fergusson Dr.
Upper Hutt
(04) 526 3913

Hyalite Wellington
62 Kaiwharawhara Rd.
Wellington
(04) 472 5265

Hyalite Whangarei
189 (Lower) Dent St.
Whangarei
(09) 438 022

INTERESTED IN CARRYING *MAXIMUM YIELD* IN YOUR STORE?
Distribution is available by contacting:

- Dome Garden Supplies
- Holland Forge
- House & Garden
- Hydroponic Generations
- GrowLush
- Way to Grow
- Nutrifield
- Stealth Garden Supplies

Already a distributor?
Call to update your listing. 1-250-729-2677

check out our app for info on-the-go...

... and pick up a copy of Maximum Yield for your garden adventures!

MAXIMUM YIELD

growing with you since 1998

maximumyield.com

ten
FACTS ON
PEPPERS

by Philip McIntosh

Whether you like them yellow, green, or red, hot, or mild, there is a pepper for every taste.

1. **Like their tomato relatives,** pepper plants are members of the nightshade family, the Solanaceae.
2. **Peppers are included** in the genus Capsicum and are not closely related to the plants that produce the spice known as black pepper.
3. **The hot varieties** are often called chilies, but the more-round and mildly zesty varieties are usually known as bell peppers.
4. **Although the genus contains** about five cultivated species, most peppers found in grocery stores are *Capsicum annuum*. This includes bell peppers, and the hot peppers such as jalapeño, serrano, bird pepper, Anaheim, habanero, cayenne, and others.
5. **The "heat" in a hot pepper** comes from the capsaicin molecule, an alkylamide ($C_{18}H_{27}NO_3$), which is a pungent, colourless, waxy, or crystalline solid in its pure form.
6. **Most of the capsaicin in a pepper** is located within the white pith and ribs of the pepper fruit, not in the skin or seeds.
7. **All chilies are not created equal** when it comes to their heat, which is why Wilbur Scoville invented the Scoville Organoleptic Test in 1924, to classify peppers by something of a "heat unit index."
8. **The Scoville scale ranges** from 0 (for sweet bell peppers — which can go up to about 100), into the millions with the Carolina reaper coming in at around 2.2 million.
9. **Pure capsaicin has** a Scoville index of about 16,000,000 — really, really, hot.
10. **Think pure capsaicin is hot?** Resiniferatoxin, from an African euphorbia plant, tips the scale at 16 billion Scoville heat units, 1,000 times greater than capsaicin itself.

GrowLush Lamps

Recommend to use with high output ballast

TURN THE

MAGIC ON

20% MORE LIGHT!

Melbourne Australia

info@growlush.com 61 - 3 - 9546 9688 www.growlush.com

GreenPlanet

Grow MASSIVE

Contact us for your nearest re-seller:
(03) 9335 3310
sales@whg.net.au

QUALITY FOCUSED, RESULTS BASED.

WHY?

MASSIVE is more than just a mineral PK Booster (Potassium & Phosphorous). MASSIVE contains large quantities of organic plant stimulants including triacontanol, a natural plant growth regulator found in bee's waste. Triacontanol enhances the physiological efficiency of plant cells and exploits the genetic potential of your plants. Triacontanol (TRIA) is proven to increase and enhance terpene and flavonoid production, flowering sites, flower size and most importantly flower MASS.

HOW?

Green Planet nutrients were developed and thoroughly trialed in thousands of North American licensed cannabis cultivation facilities. These real world trials form the basis of our unrivaled nutrient feeding programs.

See the results of our products first hand on youtube:

GROWINGEXPOSED
www.growingexposed.com