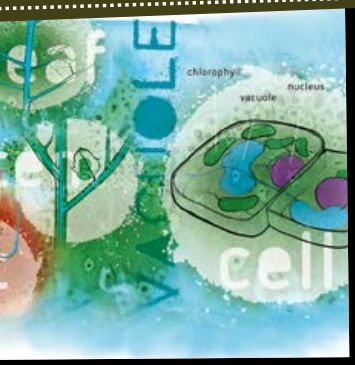
CANNAtalk®

MAGAZINE FOR SERIOUS GROWERS

ISSUE 38 2019

Impact of medium QUALITY

Building the foundation



BAD BOY BANKSY

Identity unknown

THE BIG misunderstood

Eggplant or aubergine?

And more:

R(evolution)²

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HQ Talk:

What is art? Wars have been fought over this question. Art is often defined as: the expression or application of human creative skill and imagination, typically in a visual form such as painting or sculpture, producing works to be appreciated primarily for their beauty or emotional power. In my humble opinion, art is something which moves you. The great Banksy understands the power of moving people. With his unconventional stencils, he has gained superstar heights. He is my favorite artist and if you are not familiar with his work, then we are happy to tell you more about it in this issue's *What's Happening.*

Geary Coogler takes us to the hotspot of growing in his article on the importance of finding the right temperature to create the perfect conditions in order to produce the perfect crop. And, along the way, he describes all the things that can go wrong when controlling or disregarding temperature. In his other article in this issue, he sheds light on the medium in which your plants grow. He states: "a strong foundation for anything in life is required for success, whether it is a building, an idea, or even a person's character. This is no less true for a plant." And right he is.

Talking about art, it is clear that a lot of art is misunderstood. And so is the eggplant. Once thought to be poisonous and the cause of insanity, it's now finally getting the respect it deserves for being just a delightful berry. Definitely try the recipe for Eggplant Jerky. The marinades create a flavor that is pure art.

Cheers,

Jeroen

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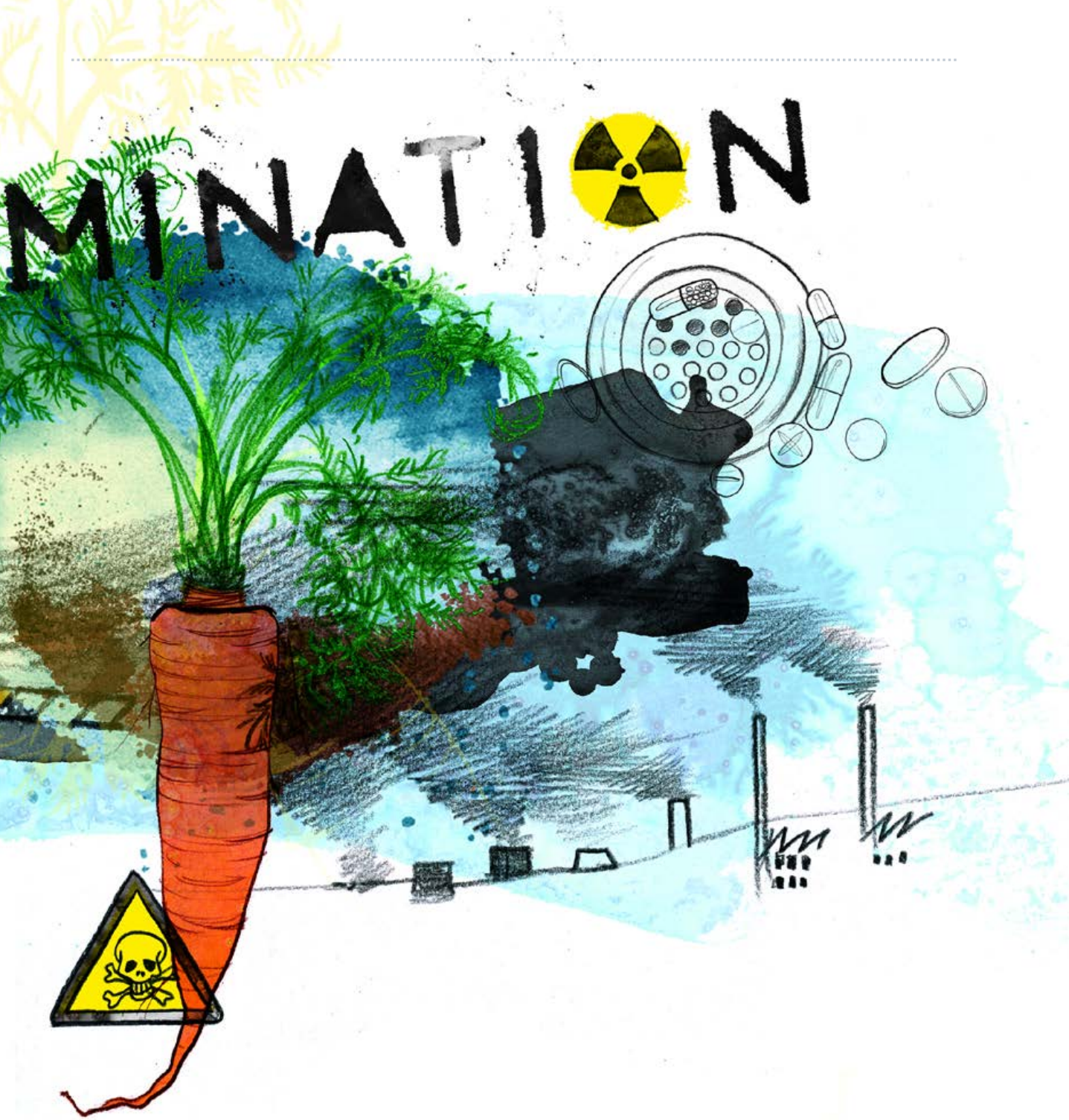
IMPACT OF MEDIUM QUALITY ON HARVESTED CROP CONTENT AND QUALITY

A STRONG FOUNDATION FOR ANYTHING IN LIFE IS REQUIRED FOR SUCCESS, WHETHER IT IS A BUILDING, AN IDEA, OR EVEN A PERSON'S CHARACTER. THIS IS NO LESS TRUE THAN IN A PLANT. THE MEDIUM IN WHICH A PLANTS GROWS HAS QUITE AN IMPACT ON THE QUALITY OF ITS CROP. THIS IS WHY.

By Geary Coogler BSc Ornamental Horticulture/ Floriculture



Half of a plant's mass is located in the medium, and the plant mimics the composition of the medium. Vintners are usually known for their abilities to discern a region from which a wine grape comes due to the qualities imparted by the native soils of those regions. These are the foundations of the crop and one that holds true across most plant species. Each medium contains different ratios of nutrients, microbes, and non-nutritive components that some plants are well adapted at pulling from the medium. These elements may not become incorporated in the plant structure or produced compounds, but they remain to the end and affect, negatively or positively, the end consumer of these products.

The idea of the foundation affecting the plant in this way is not confined to native soils but equally as affecting, if not more so, in the use of highly controlled or designed mediums such as peat mixes, sands, even where the foundation is the air itself. Plants are as direct a reflection of the medium in which they are grown, its composition, content, and structure, as it is the materials which might be applied. Plants are, in a way, surface based filters for the soil, and some plants are really good at it.

Good Quality Medium

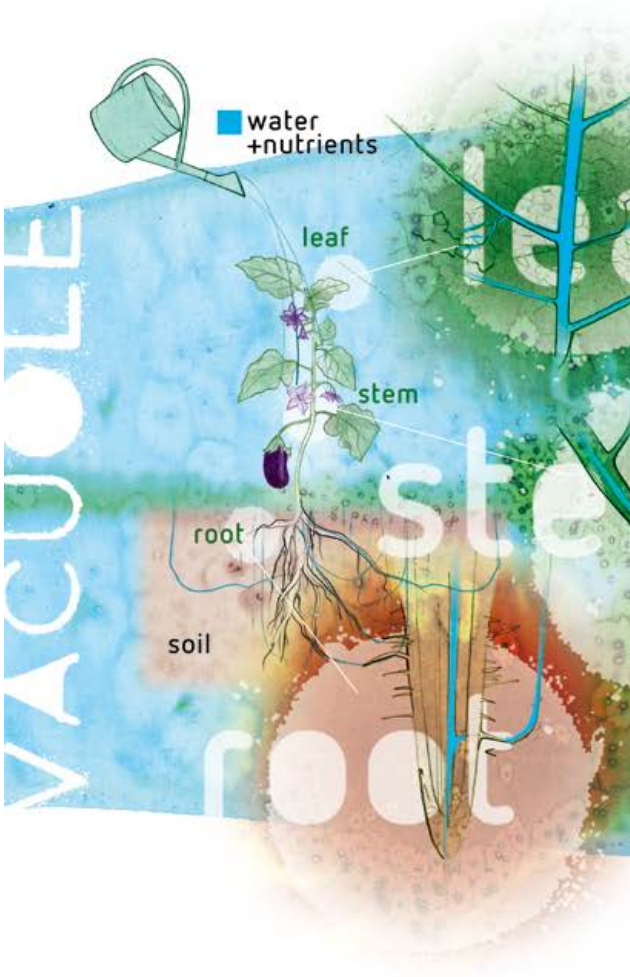
Whether the medium of choice is air, soil, water, or the myriad of components that are used to base a plant in, its characteristics must meet the needs of the plant. Good design starts here. All plants evolved

in a particular system of these characteristics, and by using the tools of porosity, chemistry, and consistency, a growth medium can be designed to fit the needs of a plant. This could range from low concentrations of nutrients in a warm highly aerated bath of water to adding organic materials for increasing nutrient storage sites and water holding capacity. Whatever a plant needs can usually be duplicated, but there is no substitute for cleanliness.

A medium must be free of disease and pests. It must also be free of any other contaminant that, while not always affecting the plant negatively (some even positively), will hurt the consumer or handler of the harvested product. These issues are never easy to fix or clean up, even if the problem was introduced in the making of the parent material, or additions to, that are used as grow medium. This includes simple less apparent things such as pH control (lime), pre-fertility charges, even the water used in production or packaging.

The problem: accumulation of toxins

Everything the plant sees, grows in, breathes, or drinks is suspect for contamination, something that if it exists in the plants environment, can cause harm. This is the gist of the problem: The plant accumulates anything that comes in that it cannot use. There are no waste disposal services for the plant's cells. It comes in and is either used or shuttled off to the cell's own On-Site trash dump, the vacuole. This is basically a bag of water in which some things can be stored, some to be forgotten for the life of the cell.



Ions (basically charged individual elements like Calcium or complexed groups like Nitrate), like heavy metals, float through the plants tissue, through each cell, on the cellular currents and, if not picked up for use in a compound or cellular function, are swept up into these bags as excess. Here they can remain as an element like Lead or they can meet up with other ions and form bad compounds such as Nitrosamines. In any case, unused heavy metals, compounds, and even unused fertilizer elements can be stored here, and added to, across time. Now the cell has become an accumulator and concentrator of these unused items since they never come out of the cell, being just bagged and stored in the cell. Lead, for instance, may come in as impurities in the lime or in many mineral fertilizers, even in organic fertilizers sourced from high lead containing organic materials, and may come in at a relatively small dose of say 1 part per million (PPM) daily, but over the course of a growing season of 180 days suddenly adds up to 180 PPM lead, which is an issue. Since the human body will also store this lead, every 180 PPM dosage adds to what is present until a big problem occurs. Cumulative effects are real and can be deadly.

Growing effort

These potential contaminants can occur in anything added to the growing effort. It goes without saying that fertilizers applied are the biggest source, either from contamination or very poor design, but just as critical is the base material of the medium. Peat can be contaminated in peat mixes, coco, rockwool, mineral soils, water, even the air, and can all carry and contribute to contamination. Even organic materials derived from organic inputs can be a source. A crop of hemp grown organically on an old industrial site and turned into compost will take with it high levels of many heavy metals and radioactive materials, which will be transferred to the new plants as the old decompose and releases these now high levels of contamination.

The key to avoiding this is in the quality

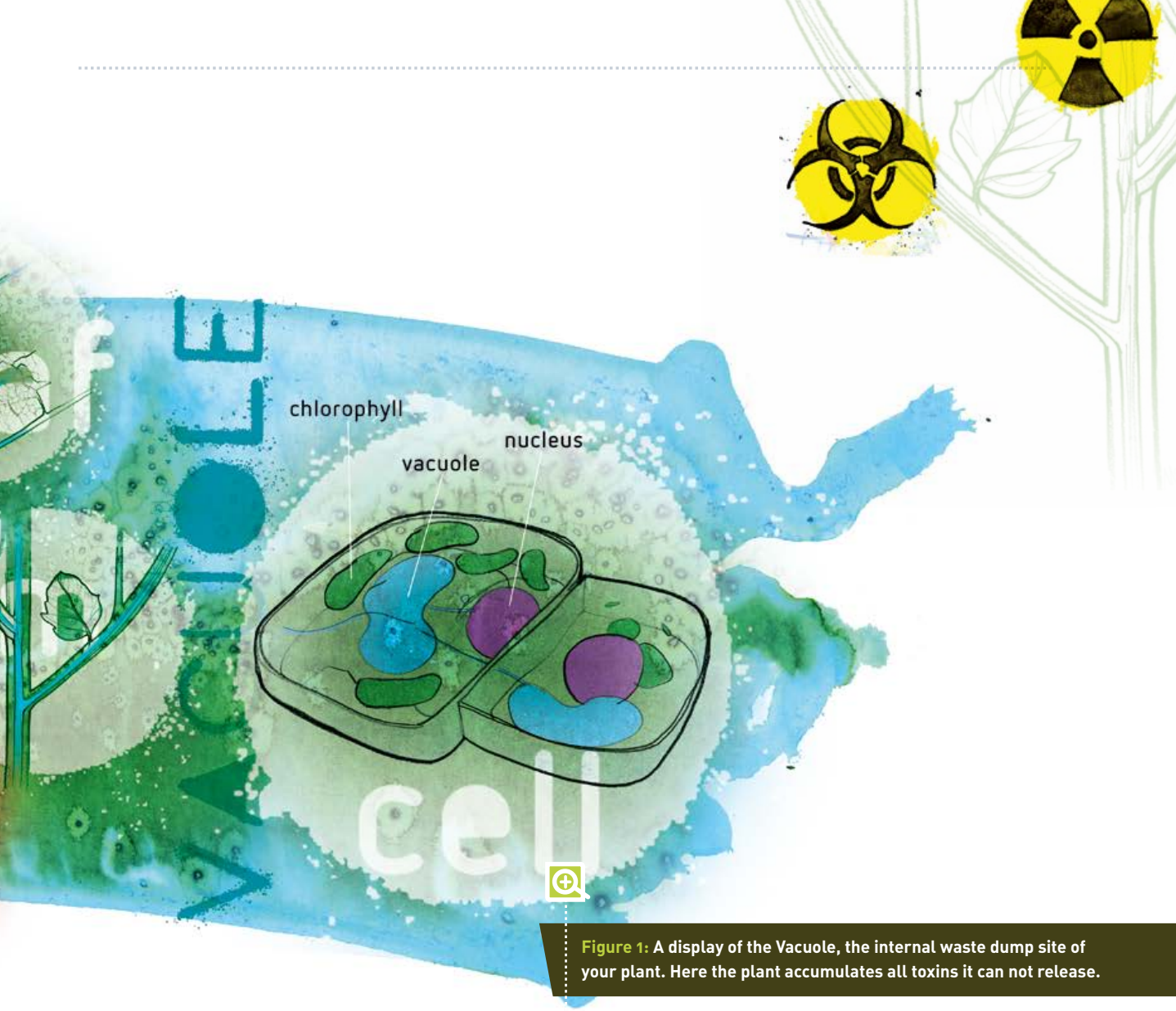


Figure 1: A display of the Vacuole, the internal waste dump site of your plant. Here the plant accumulates all toxins it can not release.

of the input materials. Use high quality medium, know what the water has in it removing contaminants if necessary, and use clean nutrients as inputs to keep the problem limited. Make sure the pH is always under control and correct to control and ensure proper nutrient availability. Have the inputs tested for the heavy metal ions so you know what the plant is exposed to. Most importantly, get the cultural conditions and growing techniques correct to limit root health issues, denial of oxygen, temperature stressing, and all the other issues that will affect plant health and ion uptake by the root system.

The discussion

Many plants, for untold reasons, have the ability, and sometimes affinity, for taking up elements which are non-nutritive. It has been known for decades that some materials can cross into the plant tissue with little change in the material that moves in. Even some complex organic molecules have this ability, or can be aided by other compounds to make the crossover. This is especially true with heavy metal elements, which will be taken up alongside the normal nutritive heavy metals such as Iron or Manganese. Over micro-nutrient fertilization is a primary cause of heavy metal toxicity even without the non-nutritive metals. Metals can be nutritive like Calcium, Magnesium and Copper, but non-nutrient based like Uranium, and Arsenic that the plant will also take up. Once inside the tissues and in the transport vessels of the plant, these move all over the plant to all the cells. They diffuse through the cell walls and, at some point, are swept into the vacuoles. Here they concentrate and remain after harvest, whether in a fresh green state or dried for use where the toxicity is further concentrated by the drying process.

Bioremediation

This ability varies to one degree or another across plant species, but some plants can be fairly aggressive in their take-up of these problem elements, the Hemp plant being one of the best. It is currently used in many parts of the world to do a variety of tasks in what has become the science of Bioremediation.

Mass plantings are being done along estuaries and river junctions to remove toxins from the water before they

Figure 2: Guidelines for maximum daily intake of chemical residues as described by the American Herbal Pharmacopoeia.

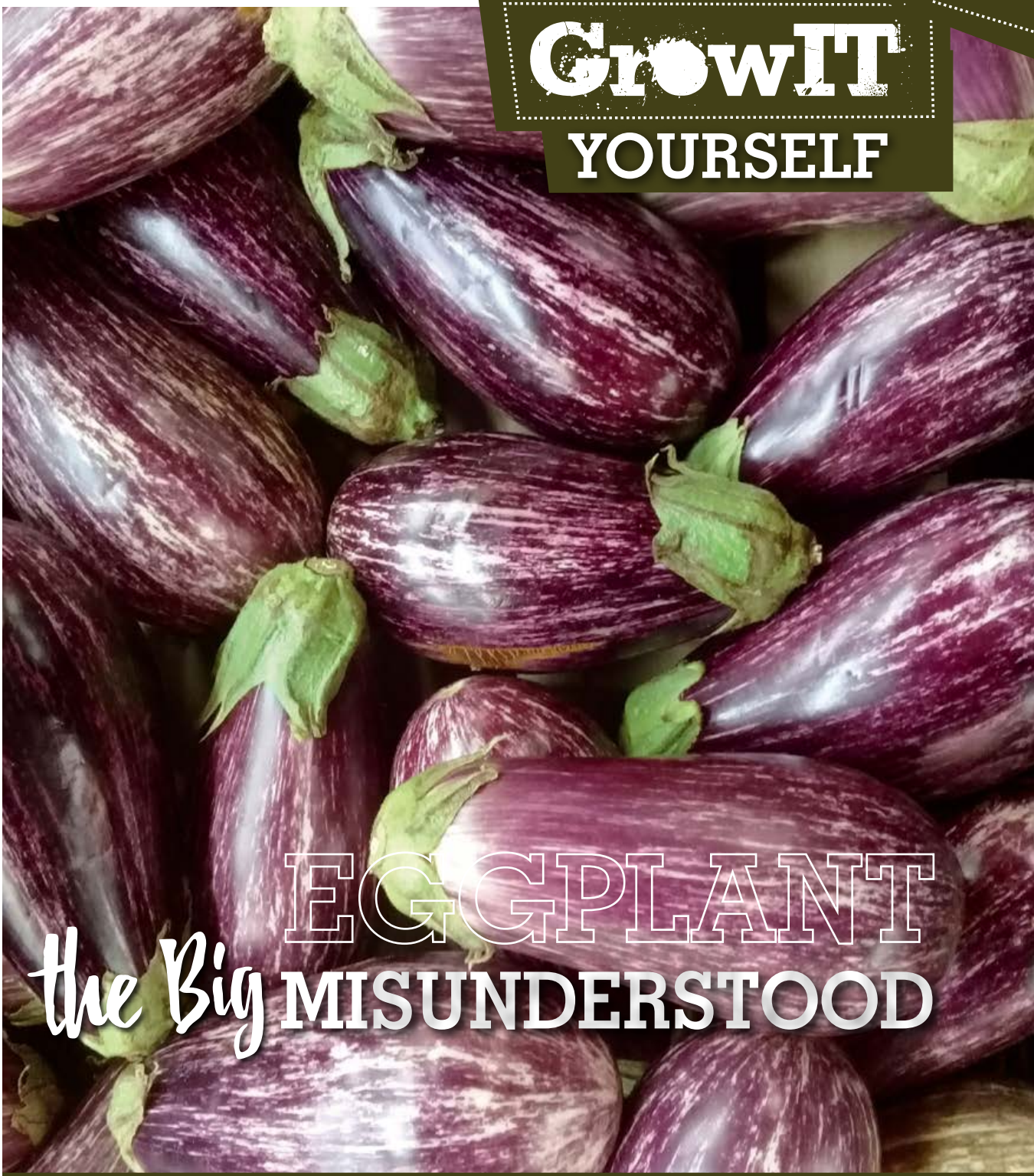
reach the sea. It is being used at old industrial sites and Hemp is especially good at taking up Uranium and Lead. When the crop finishes, the plant mass is removed and taken to be treated for these high level hazardous wastes, and another crop planted right behind it. In short, these plants will find these issues in the medium and capture it, but will not let it go until the plant is destroyed, which includes consuming or decomposing.

The American Herbal Pharmacopoeia guidelines for daily intake of chemical residues for example. (See: figure 2 Contaminant Tabel)

The conclusion

It is critical that the grower understands the information just laid down here, especially when a crop will be handled or consumed by others. Even in a situation where a crop does not have immediate toxic results but is high in the acceptable range, people and animals that cannot filter these problems, or have compromised health issues, will react stronger than the average person. The grower must remember that even very small amounts will be amplified in the final harvest many times over. The grower must closely monitor all sources of the medium, water, fertilizer, and air to which the plant is exposed and add up all the resulting numbers to understand the possible results.

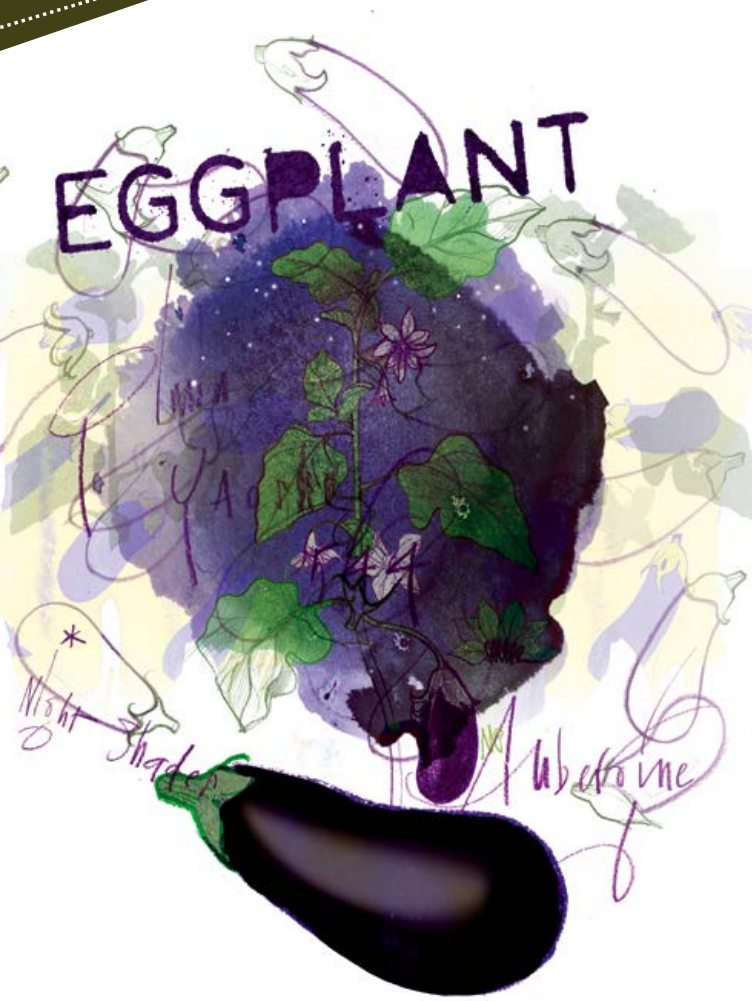
As a grower, it is their responsibility to use only the best sourced materials, not the cheapest. They must control the amounts of fertilizer applied and at the correct and necessary levels; a responsible choice. Selection of nutrients should be based not only on consistency and quality, but also on these heavy metal loads, which should be available from any producer on request. Whatever the grower does, they must never discount, or ignore the effect of the medium on releasing, storing, and contributing to the heavy metal load and the presence of other toxins. Even the composition of the water itself must be known. Look at the mediums activity across time as well. As material decomposes, it returns to its base state. Make sure the medium is tuned to the correct pH as too high or too low will cause a release of many of these locked up compounds and elements releasing a flood of problem on the plant, even for a single day. As the saying goes, Knowing is Growing, and Measuring is Knowing. Know what is in the medium and environment before it finds its way into the plant and into a consumer. •



the Big EGGPLANT MISUNDERSTOOD

YOU DON'T MESS WITH THIS FRUIT. YOU MAY TRY, BUT FROM THE SHADOWS OF THE NIGHT ITS ENTIRE FAMILY OF NIGHTSHADES WILL BE LURKING FOR REVENGE. SOMETIMES IT'LL TRY TO DISGUISE ITSELF AS AN EGG, JUST TO FOOL YOU INTO EATING IT. THERE ARE RUMORS THAT IT CAN EVEN DRIVE YOU INSANE AND THAT IT'S POISONOUS. MAKE WAY FOR EGGPLANT. OR SHOULD WE SAY AUBERGINE? By Marco Barneveld, www.braindrain.nu

I knew a man who invested his fortune in eggplant because he thought prices would rise.
Now, investing your entire fortune in a consumable product like the eggplant with a short expiration date is very foolish. Everything else regarding this bad-ass veggie, however, is pretty great.



A little background

As a member of the genus Solanum, the nightshade family, eggplant is related to the tomato and the potato. The birthplace of the aubergine is believed to be India, where it continues to grow in the wild. It has been cultivated in southern and eastern Asia since prehistory. The first known written record of the plant is found in Qimin Yaoshu, an ancient Chinese agricultural treatise completed in 544. The numerous Arabic and North African names for it, along with the lack of an ancient Greek or Roman name, indicate it was introduced throughout the Mediterranean area by the Arabs in the early Middle Ages.

The eggplant has been misunderstood its entire existence. From the dawn of its existence, it has battled terrible rumors. One of them is that the eggplant is rather bitter. Unfair. This is only true for the old ones. The longer an eggplant is left to grow or the longer it is left to sit after being picked, the more bitter it becomes. Look for small, young eggplants that have been freshly picked. Many believed that eating eggplant makes you insane. Nonsense. There is no scientific proof to back this up. Everybody says that the eggplant is a veggie. Wrong. Eggplant is very much a fruit and, botanically speaking, it's considered a berry.

Berry healthy

Some say that the aubergine offers no health benefits. Absurd. In fact, eggplants are a nutrient-dense food, meaning they contain a good amount of vitamins, minerals and fiber in few calories. They also contain niacin, magnesium and copper. Eggplants also boast a high number of antioxidants. Antioxidants are substances that help protect the body from damage caused by harmful substances known as free radicals. Some animal studies have found that eggplants may improve heart function. Eggplants are especially rich in anthocyanin, a type of pigment with antioxidant properties that's responsible for their vibrant color. Our aubergines are also high in fiber and polyphenols, both of which may help reduce blood sugar levels. And last but not least: eggplants contain solasodine rhamnosyl glycosides, which test-tube studies indicate may aid in cancer treatment.

Grow it yourself

Pretty awesome violet berry isn't it? Are you ready to grow your own? These stately plants grow well and look beautiful in containers, ornamental borders, raised beds, and traditional in-ground gardens. Small-fruited varieties tend to be especially heavy bearers, and you can expect to pick a dozen or more fruits from each plant over the summer in warm climates.

Eggplant loves warmth and grows best in very sunny, well-drained locations. Any fertile soil with a pH from 6.3 to 6.8 makes the eggplant happy. Although its coarse, leathery leaves withstand hot weather like champions, provide a generous mulch of hay, shredded leaves, or other biodegradable material beneath the plants to keep the soil relatively cool and to hold moisture and keep down weeds. Our berry nice friend likes warm soil. On a sunny day, soil temperatures inside black pots may be 10 degrees higher than in-ground soil temperatures. So, choose well depending on where you live. Row covers are also a good option in cool climates, or even to protect plants from cool spells in warm climates. Open the ends of the row covers on warm days to let the bees reach the flowers for help with pollination.

Aaarg, cold spells!

Eggplants grow into tall, angular plants, so they should be spaced 24 to 36 inches apart. Improve planting holes by mixing in 2 inches of compost to help hold moisture and fertilizer in the soil. Set plants at the same depth at which they are growing in their containers, and water well before spreading mulch. To help keep plants strong and well fed, fertilize them regularly.

In the case of a late cold spell, you may need to delay planting seedlings until the cool weather passes. Should this happen, keep the plants in a sheltered, sunny spot outdoors during the day, and bring them indoors at night. Be sure to keep plants watered or the fruit will be small and bitter. They need a nice, steady supply of moisture but not so much that the soil is soggy. Drip systems or a soaker hose are ideal.

Eggplants are prone to falling over when loaded with fruit, so you may want to tie plants to stakes to keep them upright. If you drive a stake into the ground just an inch or two from the plant at the time of planting, you won't

disturb the plant by trying to do it later. You can also use small tomato cages to support the plants.

Oh no, bugs!

The tiny, black flea beetle is by far the worst nemesis of eggplant. However, big, healthy plants usually produce well despite tiny leaf holes made by lots of flea beetles. In some areas, a common soil-borne fungus, verticillium wilt, can cause plants to wilt and die. Where verticillium is a common problem with non-resistant tomatoes (which are close cousins of eggplants), eggplants should be grown in containers filled with premium potting mix.

Ready? Steady? Pick!

Fruits can taste bitter if picked when under ripe or overripe, so harvesting is part of the eggplant grower's art. A perfect fruit will stop growing larger, have a glossy skin, and show a sprinkling of soft, well-formed yet immature seeds when you slice it open. Fruits with no visible seeds are immature, and hard, dark seeds are found in overripe eggplants. Use pruning shears to harvest fruit with a short stub of stem attached, because the fruits will not pull free by hand. Rinse clean, pat dry, and store in the refrigerator for several days. Eggplant discolors rapidly when cut open, so work quickly when preparing.

Eat your own: Eggplant Jerky

Oven-dried eggplant is very much like beef jerky. It's so delightfully chewy and dense that it seems only fitting to marinate the eggplant slices before drying and dubbing them eggplant jerky. This is an excellent snack for traveling. •

This is how you MAKE IT:

Use a sharp knife or a mandolin to thinly slice the eggplant into eighth-of-an-inch slices. Eggplant is incredibly absorbent, soaking up flavors with ease. Keep this jerky simple by marinating the slices in a combination of store-bought teriyaki sauce thinned with water and red pepper flakes. A combination of soy sauce, honey, and liquid smoke would also lend a meaty flavor to the jerky. Or create any marinade you like. Just be mindful of the salt content of your marinade; the flavor will concentrate in the oven as the jerky dries.

Dehydrators do a great job of zapping the moisture from fruits, vegetables, and meat for jerky with a combination of steady low heat and circulating air. But a very low oven (lowest oven settings vary from 118°F to 200°F) will do as well. Oven-drying does generally take a bit longer and isn't quite as efficient as an electric dehydrator, but it does get the job done. Check regularly if it is totally dried.

Bon appetite.

Questions & Answers

We receive a lot of questions about growing. Of course, our researchers are more than happy to answer them! Just go to the contact page on our website, www.cannagardening.com, to submit your question.

Question

Can you please explain PPM and PPM Total, as shown on your website feeding chart? I am familiar and have a pH/PPM meter. What does the name of the meter have to do with the amount of PPM in the mix?

Answer

First, the meters were chosen several years ago when the market had no understanding of true understanding of PPM and how it was derived. Most of the less expensive hand held meters used to measure dissolved ions in a solution were then fixed at 1 of the 3 conversion factors that changed EC, electrical conductivity, in mille-Siemens (mS/cm) and it was easier to understand just based on a type of meter. Truncheon is a model of meter popular in the industry for its quick dip meter. The way a meter works is based on an internal calculation and the type sensor it employs to read conductivity, it takes the initial reading in mS/cm (EC) and changes it to a ppm value based on 1 of 3 conversion factors: 0.5, 0.62, and 0.74. 15 years ago, these were not adjustable by the grower and the 3 meters shown were the ones that represented these values; Hanna for 0.5, Eutech for 0.62, and Truncheon for 0.74. Eutech is not available in the USA, and the other 2, especially Hanna, can now be adjusted by changing the conversion factor. This difference in conversion factors changes the reading seen. It does not change the actual EC of the material read. When using Truncheon, make sure your meter uses the 0.74 conversion. This will insure that the readings are accurate to the need and what is reported.

When we give what the conductivity should be, in EC, it is not an issue as these are the same across all meters, but we have to be correct for PPM and adjust it based on what the meter reports.

Now, in all this, when we recommend adding a certain amount of fertilizer to the water, we give that value, EC (or ppm), based on the water having a 0 value. This is what is to be added to the water EC (or PPM), and the final meter reading will be what is added to what EC the water had before adding. Online, this can be done for you by simply indicating what the EC of your source water is. The computer then gives back to the grower what the actual tank value should be after mixing. This is EC+. So EC is what is added based on 0 (zero) values for the water, and EC+ adds what you state the water conductivity is.

Question

Can the CANNA coco A&B solutions be used with a fertilizer injector?

Answer

Yes it can, the product is very conducive to using in an injection system. The best mix ratio you will get for the upper end of the dilution is shown on the label, such as 1:250 for Coco A and/or B. However, it is best, more efficient, and more accurate to use 2 injectors or an injector that has more than 1 input. Use one for A and one for B, set at a maximum of 1:250. This will give the highest concentration of use. Go up in ratio to get the lower dosages or mix the stock solution you use with enough water to get a lower level. The real problem comes in adding the additives such as Rhizotonic and PK 13/14, as those cannot be added directly to ether the A or B. The other CANNA additives can be.

Our research department is working to figure rates and dilutions to use for these but are a long way off as they also must test and allow for all the variables that a grower will see across all countries and situations.

I'm curious as to whether or not I need to mix perlite in with my CANN

There is no need to add perlite to the bagged coco from CANNA

I am trying out your Terra line and am wondering if I can reuse the med

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Question

I am trying out your Terra line and am wondering if I can reuse the medium, with some additional buffering? I am concerned about the extraction of peat from our earth and would like to leave the smallest footprint possible.

Answer

It is not recommended to reuse the Terra Professional Plus product. The structure will not remain correct as Terra Professional Plus depends on the structure of the peat fibers for porosity. Also, the chemical profile will now be skewed towards flower, and the pH will be off in a big way. These things would have to be addressed before reuse. The cost to modify will cost more, and be more uncertain in the end results then it is worth.
It can, however, be composted and/ or mixed into an outdoor garden to enrich that mineral soil. It has no perlite or anything else that would hurt the soil or look unsightly. Coco remains the best renewable medium that can be used up to 3 times.

Answe

Question

I'm curious as to whether or not I need to mix perlite in with my CANNA coco. What are the pros and cons of doing such?

In addition I frequently get nutrient burn after using your PK 13/14. What is the proper way to use 13/14? I have also heard that your formula stays in the coco for a long period, is that true?

Answer

There is no need to add perlite to the bagged coco from CANNA. The porosity is perfect and works really well with the nutrients especially the way it all works together.
Some growers find a need to use perlite in the mix due to a poor understanding of watering techniques and timing. It increases the air holding and decreases the water holding ability of the medium. While this might speed up water need early on, half way through a crop, or less, it will be near impossible to keep the crop watered especially as the root mass gets thick and water movement in the medium mass slows, ultimately creating dry space and what is known as root binding.
There is more than enough Phosphate in the A/B nutrients to supply the plant for all but a small window about half way through flowering. On an 8 week flower crop, that is about 5 weeks before harvest for about 7 days. I recommend you start about 5.5 weeks before harvest and go for 2.5 - 3 weeks. Then next crop shorten the time by a day on the front and several days on the back, repeating each crop till you notice a difference and then will know how long to use. Using PK at recommended rates, with your level of nutrient use will not burn the plant by itself. PK is mixed right into the same tank as the nutrients and applied at the same time. You are actually a little too low on feed especially if your plants are growing rapidly. Then the "burn" you see is actually a buffer issue in the medium brought on by the low feed regiment and high plant usage. You would also probably see some purpling of the main stem, perhaps, and even some leaf contortion.
Increase to no less than 12 ml/gal. Or you could use tap water as long as it is below 300 PPM and drop the Calmag. When you feed the plant in coco, you also have to 'feed' the coco. Certain ions bind naturally to the molecules in coco and then stay. Within a short time these wash out and have to be replaced through the nutrient addition. This is what the buffer does.

When the buffer is disturbed, the coco will out-compete the plant for certain ions like Calcium so the plant suffers. By designing the nutrient package and medium together, we are able to present a balanced product and a successful grow. So, in a way, yes some nutrient stays behind, but not much and it is bound up. Most of the elements seen in coco at irrigation and drainage is what is released through normal decomposition. As long as the medium is wet, there are nutrients for the plant.

Grower's interview Brent V.

Anyone familiar with construction knows that a well built foundation is the most important element to a sound structure. This principle is the same for plants. By examining the techniques and implementations of different media types, we can gain insights into maximizing plant productivity. CANNAtalk sat down with a local commercial consultant to discuss some of the finer points of medium used currently in this rapidly expanding industry.

Please tell me a little about yourself and your background in horticultural consultation.

My name is Brent V. and I have worked as Head Grower and Director of Cultivation at two separate vertically integrated facilities in Rhode Island and Massachusetts. During my time there, I ran into several issues while expanding these operations and learned many things by trial and error. Some of these problems have been input related, like nutrients or media. Others have been environment related, like incorrect VPD (vapor pressure deficit) or too much light.

Now I focus on two things: staffing commercial cultivators through my company Get A Grower and scaling up mid to large size facilities. I have worked with companies in Massachusetts, Michigan, Oklahoma, New Jersey, and Rhode Island. This has given me great insight into how growers all around the country operate.

Coco media has become the standard for commercial production these days. Why do you think producers have moved away from traditional mediums like rock wool and soil?

Coco combines the best characteristics of other traditional mediums. It gives you the ability to manipulate dry back, like you can with rock wool, by steering the plant into either vegetative or generative mode. Higher water content with more frequent irrigations, along with a lower EC (electrical conductivity), will steer the plant into stem and leaf growth. Lower water content and higher EC will steer the plant into flower or bloom growth.

Another great coco characteristic is that it can be treated and amended like soil, which can promote a rich biological root zone resulting in a higher quality end product than conventional hydroponics. At the same time, it tends to be a much cleaner product than traditional potting soil mixes. There is less worry about pest pressure coming in with

your media when using coco and, compared to rockwool, there is a larger buffer so if you have some sort of irrigation malfunction you have some time to correct the problem before experiencing critical wilting in your crop. It truly is the best of both worlds.

In your experience, how important is the quality and source of the coco being used and what characteristics are ideal for optimal plant growth?

The quality of your coco is crucial. You want a coco source that is not only correctly washed but also is properly treated. A lot of growers using untreated coco have experienced either calcium or magnesium deficiency in their early stages. A properly treated product can prevent these problems and ensure you get optimal results from your crop.

Another factor to consider is particle size. Having uniform size of the coco material helps even drainage and can prevent channeling. Knowing you have even runoff through the container lets the grower feel more confident by limiting unwanted salt build up and preventing nutrient burn. If you are getting channeling in your media, you may not be washing out the unwanted salts from the decomposition of the coco, causing poor plant growth.

What are some of the plants physical responses to the differences in various coco products?

When there are variances in how the coco is buffered, the plants will show it. Properly treated coco will result in lush, dark green leaves. This is in stark contrast to the interveinal chlorosis that will be seen from poorly treated or untreated coco. A well maintained coco container is a great visual example of this.

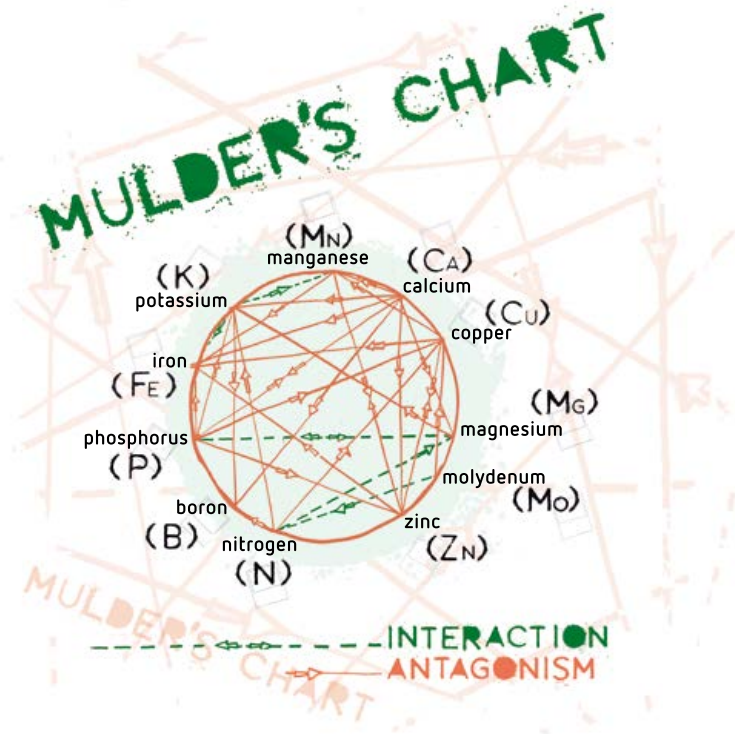
I have always had the best success with getting plants slightly root bound in coco, with a pot size that requires multiple feeds per day. This has a huge impact on your final harvest.

Other components to consider are the various amendments that some coco products contain. Perlite is common and can require more frequent irrigation to meet the plant's needs. If you have an automatic watering system, this can be desirable. But if you are hand watering, sticking with straight coco might be better for you.

What steps are taken to remedy a problem when a plant responds negatively to the coco medium being used?

The first step is to look at the nutrients you are using and make sure you are giving the system a balanced nutrient profile. Sometimes when using too many additives, or mixing things from various lines, you can overdo it with one element causing an antagonistic imbalance in the media. Mulder's chart shows these interactions very clearly. (See right above Mulder's Chart)

A common one is too much Potassium limiting the availability of Magnesium and especially Calcium in coco. If you happen to keep a feed log, now is a good time to give it a look and ensure that concentrations and pH were correctly fed to correspond to each stage of growth. This data can be



a helpful marker for what is occurring in the garden. Look at what the test shows during times of perfect health and compare it to what the results are when a plant is exhibiting issues.

When the buildup of nutrient salts is a potential issue a lot ofgrowers like to use runoff to measure the EC content of the media. Although this is a useful tool in most medium, coco presents challenges. It requires more than the traditional PourThru test that typically provides insight into the EC and PH of your media. In contrast, using a 1:1.5 dilution is the only correct way to determine what is happening inside a coco root mass. When measuring just runoff in coco, the readings in the drain water will always be higher than what will be found in the medium. This is due to the water moving through the container washing the bad salts from the surface of the coco particles. While in the root zone, these bad salts stay attached and are not always seen by the plant. Also adding plain water to the coco medium, will negatively affect the buffer that establishes.

As the imbalance of nutrients from overfertilization has become a common problem I encounter these days, I have had to define some best practices to remedy these situations. The first is do not use plain RO water to flush out the container. Instead, irrigate your plants to runoff with a 0.6 EC nutrient solution, wait 10 minutes, then water again until you achieve about 25% runoff. This form of "flushing" will ensure you dissolve all built up salts and exchange them with a nutrient solution that is balanced and will keep your plants thriving.

CANNAtalk would like to thank Brent for taking the time to discuss his experiences in the field and encourage readers to learn more about the functionality of coco. Do you want to learn more about this subject check the www.cannagardening.com website..•

FERNS

DID YOU **KNOW THAT...?**

- Ferns are a very old group of plants. They first appeared on Earth in the middle Devonian Era about 360 million years ago, just before the Carboniferous Era. Most of the modern fern families we see today first appeared in the Late Cretaceous about 45 or 50 million years ago during the age of the dinosaurs.
- Ferns appeared long before the first flowering plants evolved. The early fossil record shows that giant tree ferns and cycad palms were the only plants for millions or tens of millions of years. The organic matter of these ferns and cycads accumulated to such a thickness that they were deposited in deep layers. When these were combined with the Earth's heat they were compressed and converted to create the coal, gas and oil deposits that we use as our main sources of energy today.
- Ferns exist on all continents except Antarctica.
- Ferns belong to the botanical group known as Pteridophyta.
- Ferns reproduce via spores and have neither seeds nor flowers.

Fact GRAPHIC

- Over 12,000 fern species have been identified.
- Around 441 fern species are native to North America, while Europe has about 175 native species..
- China alone contains an estimated 2000 fern species, and the island of New Guinea has a similar number.
- Mexico has one of the most diverse fern floras in the world, with approximately 1000 species, about 18% of which are found nowhere else.
- Ferns were so popular in England that from 1880 to 1900 there was a so-called "fern craze" (pteridomania). English city dwellers took excursions to the woodlands to collect ferns to take back to their homes and estates, nearly stripping some areas of ferns.
- In addition to absorbing carbon dioxide and releasing oxygen as all plants do, Boston-type ferns also eliminate significant amounts of formaldehyde, xylene, and toluene. This was confirmed by a NASA study designed to understand how to remove irritants and cancer-causing air pollutants that are emitted by everyday objects in our indoor environments.

BAD BOY BANKSY

Pretty impressive. Keeping your identity absolutely unknown whilst being one of the world's greatest artists. That is almost an art form in itself. Meet Banksy, an international icon and subversive and secretive street artist who keeps turning the art world upside-down.

By Marco Barneveld, www.braindrain.nu

Banksy, whose real identity is unknown, recently carried out what could well be one of the most audacious stunts in art history, arranging for one of his best known works to self-destruct after being sold at auction for just over £1m. Girl With Balloon was the final item in an auction at Sotheby's in London last October, and its sale price equaled the artist's previous auction record of £1.04m. When the hammer came down on the item at over 1 million

British pounds, the canvas began to pass through a shredder installed in the frame. The mysterious Banksy posted an image on Instagram of the shredded work dangling from the bottom of the frame with the title: Going, going, gone.

Great return

Not that the destruction will do any harm to the artwork's value. Oh no. Just the opposite. Banksy is so popular and given the media attention (including this article) this stunt has received, the lucky buyer will likely see a great return. "This is now part of art history in its shredded state," says an insider. "We'd estimate Banksy has added at a minimum 50% to its value, possibly as high as being worth £2m plus."

Love it or hate it. Call it art or call it whatever you like, but what do we know about this enfant terrible of the art world? Time magazine named him one of the world's 100 most influential people back in 2010. On that list were other big names such as Barack Obama, Steve Jobs and Lady Gaga. He supplied a picture of himself with a paper bag over his head. And his star has just been rising ever since. One of the biggest signs of Banksy's growing iconic status came in 2014, when young adults named the artist as one of the people they most associated with UK culture, alongside William Shakespeare, The Beatles and Queen Elizabeth II.

Bombing with stencils

That's not bad for a pundit who started out spray-painting walls in Bristol, England in the 1990s. He has left his mark on cities from Vienna to San Francisco, Barcelona to Paris and Detroit.

Over the past few decades, his stencils – with their recognizable style and often bearing searing political statements – have unexpectedly appeared in various cities across the globe. When he was 18, he once wrote that he was painting a train with a gang of mates when the British Transport Police showed up and everyone ran. "The rest of my mates made it to the car," Banksy recalled, "and disappeared so I spent over an hour hidden under a dumper truck with engine oil leaking all over me. As I lay there listening to the cops on the tracks, I realized I had to cut my painting time in half or give it up altogether. I was staring straight up at the stenciled plate on the bottom of the fuel tank when I realized I could just copy that style and make each letter three feet high. As soon as I cut my first stencil I could feel the power there. I also like the political edge. All graffiti is low-level dissent, but stencils have an extra history. They've been used to start revolutions and to stop wars."

Laugh now

The people, apes and rats that he drew in most of the stencils in these early days have a strange, primitive feel to them. My personal favorite is the painting of the monkey that sullenly looks down. "Laugh now, but one day we'll be in charge" it says. For me Banksy had a visionary view with this statement – a vision that has become a reality in recent years, with a monkey now leading the Land of the Free.

Banksy has moved from graffiti on gritty urban walls to painting on canvas, conceptual sculpture and even film, with the guileful documentary Exit Through the Gift Shop, which was nominated for an Academy Award.

While he may shelter behind a concealed identity, he advocates a direct connection between an artist and his constituency. "You don't have to go to college, drag around a portfolio, mail off transparencies to snooty galleries or sleep with someone powerful; all you need now is a few ideas and a broadband connection," Banksy said in an interview. "This is the first time the essentially bourgeois world of art has belonged to the people. We need to make it count." •

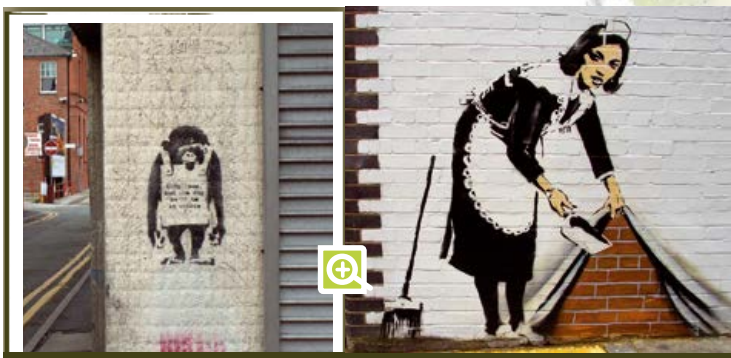
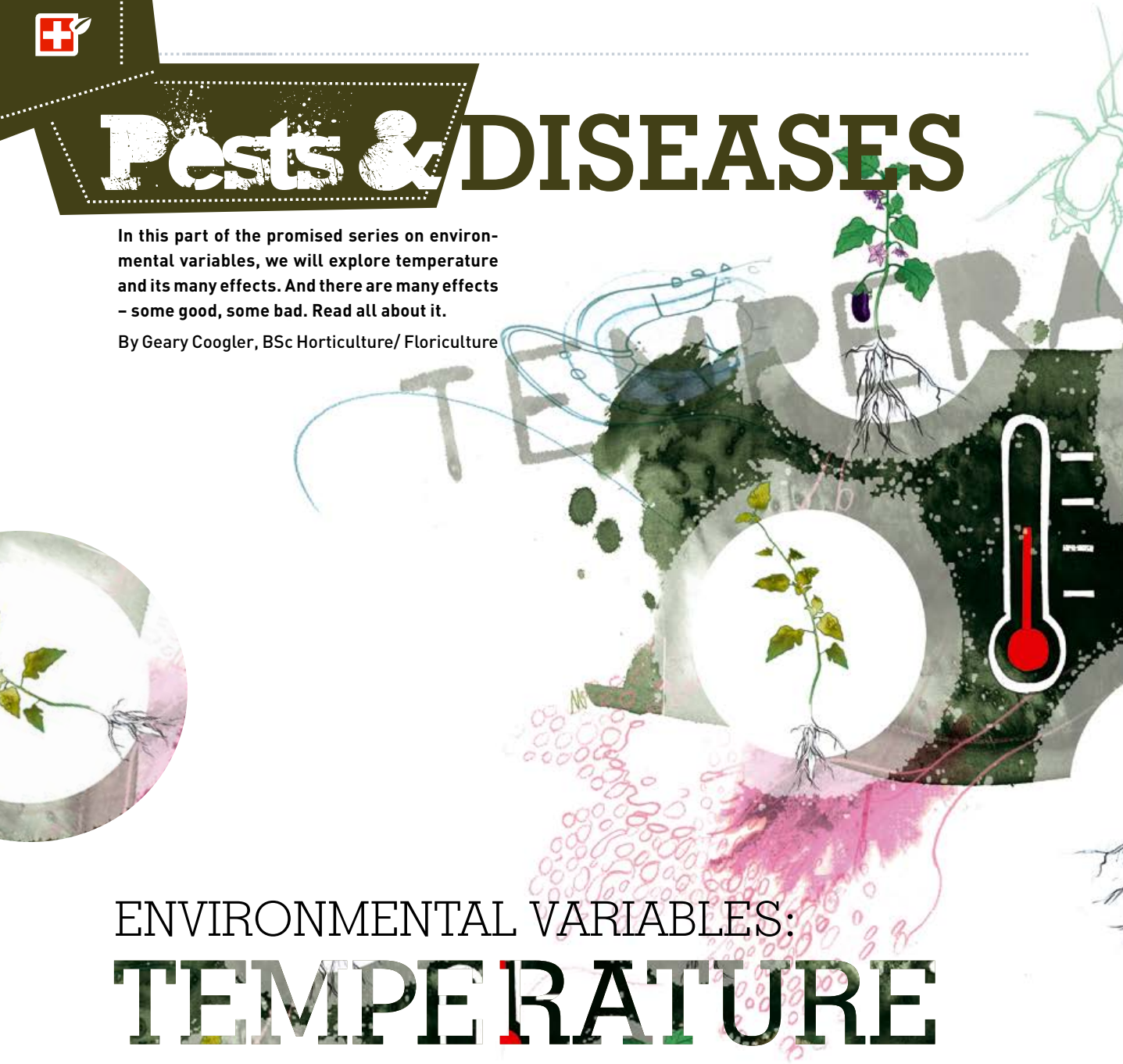


Figure 3: Three examples of famous Banksy work that can be seen in England and the historic city of Bethlehem.

In this part of the promised series on environmental variables, we will explore temperature and its many effects. And there are many effects – some good, some bad. Read all about it.

By Geary Coogler, BSc Horticulture/ Floriculture



ENVIRONMENTAL VARIABLES: TEMPERATURE

Disease: *"any abnormal condition in a plant that interferes with its vital physiological processes, caused by pathogenic micro-organisms, parasites, unfavourable environmental, genetic or nutritional factors, etc."*

Temperature is a part of the whole environment in which a plant grows and develops. It is only one part but it is what speeds up and slows down all the chemical reactions. Mostly, temperature works within an ideal range. While some processes occur below or above a limit, they work really slow or so fast that the results are unreliable. Proteins are temperature critical, and the structures they make, such as enzymes, denature or change shape, which is critical to the way they work, below and above a certain temperature range they lose all function. And cycles used by the plant to manufacture the basic carbohydrates for the building blocks of the cells slow till they stop at a lower temperature or begin running faster and faster until they reach a point that they begin to short circuit and fail.

Roots and top

Plants have two major parts, roots and top. The roots are designed to work efficiently at cooler temperatures then the top since the ground has a more stable temperature range always cooler than the air. Plants can adjust themselves, based on evolution, to have better function at cooler temperatures to gain an advantage over other plants where life cycles are completed in the spring or fall. Other plants gain this advantage by protecting this chemistry from hot conditions. Plants are even categorized by the way they perform the photosynthetic process into C3, C4, and CAM plants based on how they protect that part of the photosynthesis process that combines the energy generated from sunlight into carbohydrates (the Calvin Cycle) from heat and the affects. C3 plants (typical of broadleaf trees, shrubs and flowers) work better at cooler more humid environments as they do not protect the CO_2/ O_2 interface. C4 plants (typical of monocots like grasses) work better in warmer drier conditions as it separates the interface by distance and by finishing the cycle in different specialized cells. CAM plants,

Figure 4: Temperature can be your friend or foe. Roots will need a lower temperature to thrive and develop than their tops, keep an eye out for the environmental variables!

succulents and cacti, that only open their pores (stomata) after dark to conserve water so the original products of photosynthesis are stored in the daytime and used in the cycle after dark when CO_2 can be brought in.

Carbohydrates

Plants take in Carbon dioxide (CO_2) and uses energy from the sun, as energized chemical compounds such as ATP, and converts these into Carbohydrates which can be changed to fit a function, burned in normal respiration with Oxygen to release the energy, or used as a building block of sorts to add mass. The problem is that Oxygen can and will take the place of the CO_2, a process known as photorespiration, which shuts down the cycle, short circuiting it, and nothing is built. This happens with regularity at normal temperatures and the plant can deal with it. However, as temperature increases, so does photorespiration to a point the plant processes shut down. It is not just air temperature that should be a concern. Root temperature is also critical. Roots work at cooler temperatures. In a container exposed to the air, as most indoor and greenhouse production uses, the temperatures will be closer to air temperature. This can be an issue if to warm, and equally a problem at low temperatures. Roots need the correct range to work efficiently for maximum uptake and transport of nutrients and water.

Extremes

The structure of the plant cell is also highly dependent. Plants all react to temperature extremes; some plants have different ranges of temperatures. Exceeding these high and low ranges will cause a structural change in the cell walls, usually causing them to leak. This results in permanent wilting of the tissue. In some plants this happens about freezing, other plants will see this occur 10 degrees higher or lower, and the same with high temps. Plants have specific ranges in which they need to work.

Then there is the way chemical reactions occur, both speed and quality. While limiting elements used in these processes, such as Carbon dioxide in the photosynthetic process, will slow, inhibit, or stop the process overall, temperature will control the speed of these reactions or combinations. Cooler temps will slow down how rapid these occur, warming things up will speed these up, and really warm will have them going so fast they begin to combine incorrectly until they stop in total.

Capturing device

It is also very important to realize that the leaf is a very efficient light focusing and capturing device, and this means higher temperatures that the surrounding air. Sometimes this can be considerable. So, even while the air temperature might be slightly cooler than optimal, under bright light, the internal leaf temps, where these processes occur, can easily be 10 degrees higher or more. Water movement and by definition humidity, must work hand-in-hand with temperature.

The results of temperature issues can be marked or subtle, narrow or wide. Being 10 degrees either side of the average may only make only small differences, but shoot for the optimal. If temperature control can be held tight then do so, but do not neglect other considerations such as humidity and light levels. It is more likely that only the rate of growth will change. Temperature can also influence quality, vigor, and timing of harvest or the various photoperiodic activities a plant uses.

Perfect conditions

Finally, temperature affects greatly the development and growth of all pests and pathogens. Even these life forms have temperature ranges they work in. Root disease and insects prefer cooler temps, leaf insects and pathogens usually prefer warmer ones, however, even pests and pathogens have adapted with competition profiles to work better at lower or higher temperatures then the competition. If the plant has warm air temps and cool root temps, then uptake and movement of anything, including, for example, water will be affected. In this case, holding the roots wet and causing perfect conditions for a water mold invasion, or just killing, outright, root tips and resulting in loss of the needed infrastructure to move that water.

Be aware of temperature, it can be one of the most important elements in a successful crop program. Get it wrong, and the results seen are as important a disease as any other disease that might be caused by a biologic. •

THE ROUTES TO BROKEN DR

Figure 5: Keeping a close eye on your plants can make you detect issues early on, so you can make the right decision on how to move forward. In need of a fast and effective way to address a nutrient deficiency, have a look at foliar spraying.

WHETHER GROWING FOR YOURSELF, FRIENDS, OR COMMERCIALLY, THERE IS NO FEELING LIKE PRODUCING A PRODUCT THAT STANDS TALL IN QUALITY, SOMETHING THAT IS A PLEASURE TO SHOW OFF, OR WATCH FLY OFF THE SHELVES. TAKING PRIDE IN WHAT YOU PRODUCE, NOT JUST THE AMOUNT, BOTH A HIGH QUALITY, SAFE PRODUCT FRIENDS CAN STAND IN AWE OF, AND CUSTOMERS WILL COME BACK FOR TIME AND AGAIN. YET TIME AND AGAIN, SOMETHING HAPPENS THAT EITHER ENDANGERS THE DREAM OR OUTRIGHT DESTROYS IT, AND ALL THE WORK THAT WENT INTO IT.

By Geary Coogler, BSc Ornamental Horticulture/ Floriculture

EAMS

Many things and events can come together in so many different ways to leave a grower wondering what hit them. Issues can arise from the very beginning of the crop, or at the very end. The better issues happen as early as possible enabling the grower to hit the reset button and start again, maybe a little cost involved but not the cost involved with growing a crop to harvest and finding it cannot be sold or distributed. Decisions the grower will make affect the crop until it is distributed, and maybe after. Use the wrong product and the crop becomes dangerous to consume through many things from heavy metal contamination to persistent pesticides. Harvest wrong, and the crop does not store well or rots. Ignore a symptom and right at harvest the entire crop collapses. Worse, a regulatory body finds residual pesticides,

BROKEN DREAMS

molds, metals, or many other issues and not only the crop must be destroyed but there goes the reputation as well, lose friends and lose customers.

The Trap

It is impossible to lay down here all the varied and multi-faceted ways that life can dump on the grower in an amazingly short period of time. Varied because so many things can affect the outcome of the crop, multi-faceted because these things can overlap and become separate concerns as the feed off of each other.

As a grower, it is important to understand every aspect of the crop. This understanding includes the plant, the source of the plant, the plant's genome, the way it is propagated, the cultural techniques it will need to prosper, and a hundred other things. The grower will also need to know and understand the environment the plant will grow in; the buildings, the structures, fields, regions, temperatures, humidity, lighting, traffic patterns, demographics of the surrounding area, the climate, the seasons, and a bunch more. There is the whole question of the inputs next. Inputs are used to produce the crop and include the container, the water, the medium, the fertilizer, the pest control, even the air itself. Then there are the combination of these issues that create a logarithmic increase in the number of ways things can go wrong. The grower must understand that what he or she does to or for the crop will be written in the plant until the plant is used up, consumed, or destroyed.

The trap is failing to understand every possible variable, ignoring it, or passing it off as unimportant. The grower breaks the rules, or allows the rules to be broken, at his/her own risk. It is not about having all of these issues perfect, but it is about knowing them, understanding how they can affect, and having a plan for dealing with these.

Losing sight

Given the repetitive nature that growing can become when a rhythm is established, it is very easy to lose sight of the issues and make allowances. Experience growers are just as likely to do this as any, but are quick to understand and adjust to the issue, and are much less likely to make that mistake again. Still they are more likely to make the mistake on 1 or 2 items, not the entire thousands of issues facing the crop. This makes for an easier fix for the crop when only a couple of variables must be dealt with. It becomes a disaster when the problems come day after day.

How many questions are out there, how much does a grower have to verify and get correct to succeed? This varies with the crop and the desired outcome. It starts with growing environment design and control and ends with the post-harvest and storage periods. If it can go wrong or be affected, it will. In really it starts with the grower and their abilities. A sloppy grower that does not understand science, has no discipline, no experience, and is not tuned into the details and numbers should grow simple crops that require little effort. By the same token, a smart grower that is hung into the numbers and cannot see the forest for the trees, should also avoid anything but simple crops. A grower must be disciplined, precise where it is needed, attentive, knows the crop before starting the first plant, and never afraid to explore every reason there is an issue. Of course, Head Growers need extensive experience in growing the numbers of plants and crops to succeed, otherwise it is nothing but a crap shoot and success becomes purely luck.

Climate

Every aspect of the environment is also a point of concern. This not only includes big ticket items like light/lighting, temperature, ventilation, but also extends to a hundred other items such as the floor, is it accessible, maintainable, cleanable, does it hold debris and possible insects, will it off gas toxins, and a hundred more? What about any plastics used in the growing area, and what about the materials used for construction, do any of these pose a problem for the crop and environment? Are vent intakes isolated from possible disease and insect sources from lawns to corn fields? What is the climate and how does the facility interact with the climate.

The system used to grow with must be built to the plant's needs not the grower's...period. Anything less adds stress to the plant and increases the opportunity for issues to arise. Some are hard to maintain, some require reaching parameters that are impossible such as growing non-aquatic plants in water. While these systems that go off the path can be successfully employed, they add additional sets of potential problems. Grow using the KISS principle, Keep It Simple and Safe, to avoid many issues.

Knowing the plant

Know the plant and how it crops. Some plants will never dry down the same and must be individually monitored, others crop work well on automatic systems. Some plants produce fine roots that stay shallow, others produce thicker roots that go deep, than there is every configuration between. This determines container specifications. Wrong size or design, then the plant will stress or have other issues. What kind of medium does it need, aeration, density, pH, fertility, composition, or a thousand other concerns. Get this correct then a hundred problems go away. Get it wrong and a hundred possibilities line up to make the growers day not so enjoyable.

Is the medium acceptable or is it contaminated. Are heavy metals weighing it down? The nutrient package is it correct. Different plants different nutrient ratio needs, is the plant being starved by too much of what it

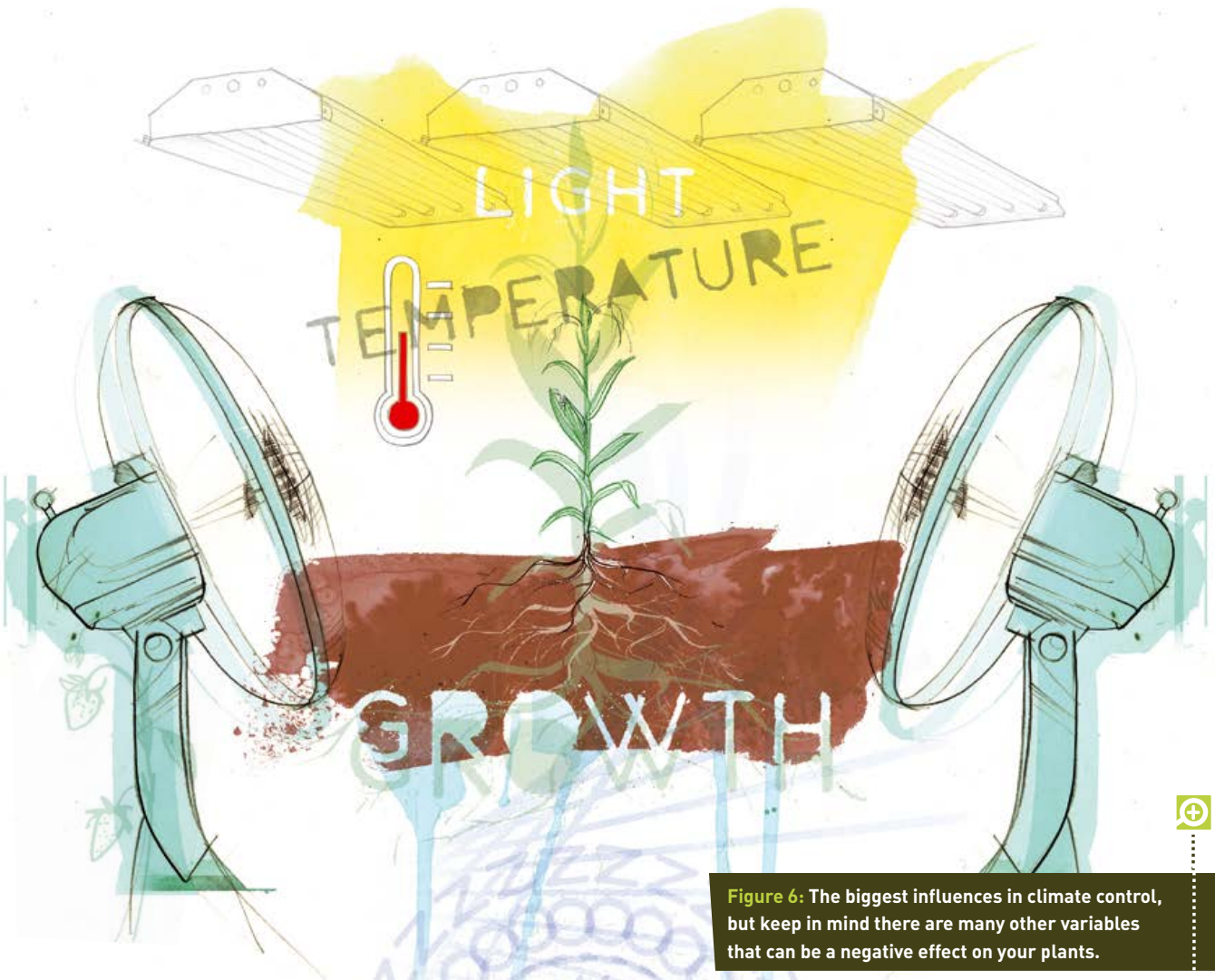


Figure 6: The biggest influences in climate control, but keep in mind there are many other variables that can be a negative effect on your plants.

needs less of, and not enough of what it needs more of? Are the materials in the fertilizer sourced from the cleanest sources for those crops that will be consumed? Are they functional in the very physical environment of the root zone when affected by conditions and elements in the medium? Is the aeration, large pore spaces, enough or too much allowing for difficulties maintaining proper moisture levels?

Questions, questions

Going to use chemicals, then the grower better know if they are registered for that crop, what the residuals are, how long they stay, does it vaporize, will it saturate the plastic container and show up every time another plant is produced in that container? Where do the targets live and what are the life cycles. No sense treating walls for spider mites, they do not live on walls (but a good cleaning on a very regular bases will insure they do not use it as a resting point in a journey). How does the chemical work, contact or consumed, and how does the pest feed and infect? These questions a grower must know or risk bad results, legal issues, or a crop that cannot be sold.

The plants themselves are a huge issue. Getting starts from an uncertified source is risky at best. Even certified sources have issues time-to-time. Know how it is best to produce the plants from sexual propagated (seed) to vegetative propagation (cuttings and tissue culture starts). Are they clean, are they correct genetically, are they healthy, are they sized correctly, are they mature, are they infected, just what are they? A good grower never assumes that just because things were correct 25 times, the 26th will also be correct. They check each and every time. Maybe they accept something a bit less and adjust for it in the crop cycle, but they are very aware of the issue and they never lose sight of the potential problems it brings.

BROKEN DREAMS

Checking the Waypoints

Waypoints are the different identifiable stages a plant reaches. This might be indicated by size, physiological change, leaf count, or many other things. Growers learn these as guideposts to the development and action they might need to take to insure success. All crops have these.

In any route taken, for success, a grower must know what the waypoints to development are. Cropping is no different than any other journey. A grower should know where at in the cycle for the crop they are. Plants give many clues as to how they are progressing or at what point they are in timing. Has the seedling changed from a juvenile to an adult and is now capable of flowering? Poinsettias can tell a grower when and how to pinch to develop the number of flowers the grower needs. Easter Lily can tell the grower how many blooms to expect weeks before the flowering begins. When a crop does not meet these waypoints, the grower must adjust. Schedules might need changing, orders may need delay, temperatures might need raising, or fertilizers changed. Know the plant, the crop cycle, and what to look for and a grower will never be surprised by life.

Key to success, the grower

At any and all times, the Grower has the success or failure of a crop in their own hands. They can blame whatever and whoever they want when things crap out, but they are ultimately responsible. A grower must understand, accept, and plan for every eventuality, must know the inner workings of every single factor affecting the crop. Anything less will not work. The general rule that anything that can go wrong, will go wrong, does not have to apply. A grower must have an option A, B, and C for everything that can be an issue.

The sooner a grower understands that every single thing that intersects the plant and crop can and will affect the plant and crop, the sooner they will become a good grower or a great grower. Seemingly trivial things can become open sores. Knowing every aspect of these relationships serve as a guide to the grower for what can and may be faced throughout the crop cycle. This guide shows the grower the best route to take from a start to the desired finish. Understanding and planning for these issues, without depending on magic charms and potions, but by depending on data, knowledge, and proven science, will insure that the grower's route does not lead to a broken dream. •

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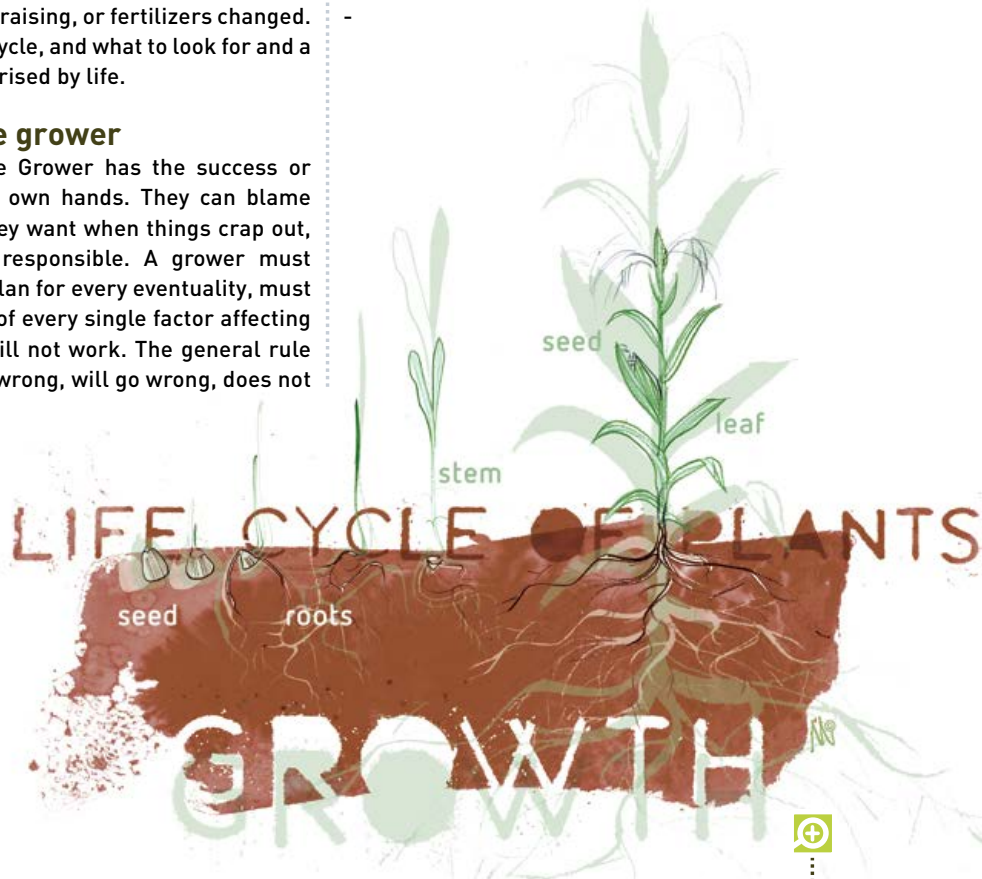

Figure 7: Knowing these waypoints in your plants life cycle will help you grow the best crops. Plants give many clues how they are processing.

Grower's TIP #38

By your friend SEZ

FLUSHING: A MIRACLE CURE OR MERELY WISHFUL THINKING?

Nowadays, information on growing and plant-related problems comes in all sizes and colors, thanks to the Internet and its panoply of forums where gurus generously offer their wisdom to help troubled souls.

Of the many cures instantly offered by those online shamans is the famous "flush it well!" By that, gurus mean that the growers should "wash" their growing medium with copious amounts of water, with the goal being to restore balance, magically sweep all poisons out and with the help of faith make everything great again.

How good is it?
Is it really something useful? Does it really set everything right again and solve problems? In reality, this one-size-fits-all cure relies on a crystal ball approach, which assumes that most growers over-fertilize and thus every issue is in fact related to salt building up out of control.

What if the grower's problem is not related to a "nutrient lock out" (another famous term used by the gurus) or a heavy salt build-up and the grower flushes everything out of the medium? Would it really help the plant to be nutrient deprived for an extra few days? How would you feel if you were sick from starvation and the doctor said "I don't need to check anything, drink plenty of water, avoid food for the next few days and you'll be fine!"? Of course, this doesn't make any sense for plants either.

Reasons
On the other hand, it may be necessary to fix a salt build-up issue because they do tend to happen. This issue can be the result of numerous causes, the main ones being high temperatures, excessively dry air, too much wind and lights that are too close to the canopy.

First, the grower needs to assess if a high salt level is really the problem, and for this a growing medium test is essential. You can find out how to do this here: http://www.cannagardening.com/measuring_coco. While the article is about coco, the same method also works for a peat-based medium. Rockwool growers do have an easier time, as all they need to do is extract the solution with a big syringe and measure the salt levels.

If the salts levels are off the chart, is a copious shower of water through the medium a good idea? Yes! But how efficient is a shower without soap?

Efficient
A flush is always more efficient when it is done with some nutrients; they act a bit like soap, grabbing salts as they go through. Use half of the usual nutrient dose, water through the containers, repeating several times, making sure there is plenty of runoff. Measuring runoff at the end could help you assess if the amount of solution you poured in is sufficient. Not only will it "clean" the medium in a more efficient way, it will also leave behind some fresh nutrients to prevent your plant from starving until the next feed.

Another problem that comes with plain water flushes is that they affect the medium's chemistry and content. If we look at coco, plain water will leach the nutrient buffer out, possibly leading to calcium and magnesium deficiency and the release of excess potassium. In the case of peat-based mix, the lime that keeps the pH where it needs to be might get pushed out. This would bring the medium closer to peat's natural pH of 4.4-5.0, a level that many plants aren't too happy with.

Take your time
Keep in mind that plants do not like drastic changes in anything. If the plants have been used to very high salt levels and suddenly these levels drop quickly, you might see some other problems show up later. Always take care to prevent the salt build-up by watering properly, with plenty of runoff at each feed. Take your time, measure your parameters and enjoy a much easier, healthier growth. This will also ensure that you never have to consult the clairvoyance of the online 'master growers'. Good luck and happy gardening!

Puzzle&WIN

CANNAtalk wouldn't be complete without a good old Sudoku puzzle. Sit down, relax and train your brain for a moment. It's not too difficult and you could win an awesome prize! Are you new to this kind of puzzle? Here's what to do: each row, column and 3x3 grid must contain all the numbers between one and nine, once only.

WIN A 1 LITER BOTTLE OF CANNAZYM

	9		2		3			
1	3					4		5
8		7			6		2	
3		1					9	
			1	9	5			
	6					5		1
	7		6			1		2
4		5					8	9
			9		2		5	

GREAT PRIZES

You might be lucky this time! Another great prize is waiting for one of you. You just have to send us the correct solution (sending the middle part of the puzzle to editor@cannatalk.com and mention CANNAtalk 38.

If we pick your name, a bottle of CANNAZYM could be coming your way.

Winner puzzle#36

The winner of last Sudoku is **Mr. Coleman.**
Congrats on your 1 liter bottle of CANNA Rhizotonic!
We will contact you as soon as possible to make sure you receive your prize. Enjoy!

Facts

RESEARCHERS DISCOVER GENES THAT GIVE VEGETABLES THEIR SHAPE

From elongated oblongs to near-perfect spheres, vegetables come in almost every size and shape. But what differentiates a fingerling potato from a russet or a Roma tomato from a beefsteak? Researchers at the University of Georgia College of Agricultural and Environmental Sciences have recently found the genetic mechanism that controls the shape of our favorite fruits, vegetables and grains.

In article published in the journal Nature Communications, Esther van der Knaap, professor of horticulture, and her team at UGA detail the genetic traits, shared by multiple plants, that have been shown to control fruit, leaf and seed shape. "We may be able to explain the shapes of many fruits and vegetables through a similar mechanism to the one we described in tomatoes," van der Knaap said. "We found that in tomatoes, plant cells in the fruit divide in a column or in a row and that will determine their shape. We also found that this mechanism is likely the same in several other plant species: melons, cucumbers, potatoes."

The discovery of the genetic pathways that control shape are important for plant breeders but the information is also crucial for a better understanding of plant evolution and development.

LIVERWORT PLANTS CONTAIN A PAINKILLER SIMILAR TO THE ONE IN MARIJUANA

Some species of liverwort have surprising similarities to marijuana. A chemical compound found in liverworts may provide the pain and inflammation relief of pot's THC but without the same kind of high.

Both the molecule, called perrottetinene, and tetrahydrocannabinol, or THC — the mind-altering substance found in marijuana — have similar molecular structures. Lab tests with human brain cells and in mice have revealed that, like THC, perrottetinene easily attaches to the brain's cannabinoid receptors, or molecular docking stations, dampening the effects of pain signals, researchers report in Science Advances.

"Nobody really notices liverworts because they're so small," says Douglas Kinghorn, a phytochemist at Ohio State University in Columbus. "Sometimes you find important medicinal compounds in plants from unexpected sources."

A group of Japanese scientists in 1994 discovered perrottetinene in liverworts, but the new study is the strongest evidence yet that the compound is a psychoactive cannabinoid. Previously, cannabis was the only plant known to produce such cannabinoids.

SMART PLANTS CAN TEACH US A THING OR TWO

The Revolutionary Genius of Plants challenges the brain-centered view of intelligence. For example, the Mimosa pudica, a plant that closes its leaves when touched, can learn that certain experiences are harmless.

More than 200 years ago, French botanist René Desfontaines instructed a student to monitor the behaviour of Mimosa pudica plants as he drove them around Paris in a carriage. Mimosa pudica quickly closes its leaves when touched — presumably as a defense mechanism. Desfontaines was interested in the plants' response to the continuous vibrations of the ride. Initially, the leaves closed, but after a time, they reopened, despite the shaking. "The plants are getting used to it," the student wrote in his notebook.

Stefano Mancuso recounts this tale in The Revolutionary Genius of Plants and reports on a modern follow-up: a repeat of the experiment (without the carriage) demonstrating that plants can indeed learn that an external provocation is harmless and remember what they've learned for weeks.

Learning is impossible without memory, and both are hallmarks of intelligence, argues Mancuso, who leads the International Laboratory of Plant Neurobiology at the University of Florence in Italy. But our animal-centric view of neuroscience makes us loathe to employ terms like "memory" and "intelligence" when talking about organisms without a brain. With infectious passion, Mancuso sets out to convince us that the plant way of doing things not only deserves our respect, but also may help us solve greater societal woes.

The Revolutionary Genius of Plants, Stefano Mancuso, Atria Books, $30

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