

# CANNATalk<sup>®</sup>

MAGAZINE FOR SERIOUS GROWERS

ISSUE 22 2013

## COCO COIR

How to use



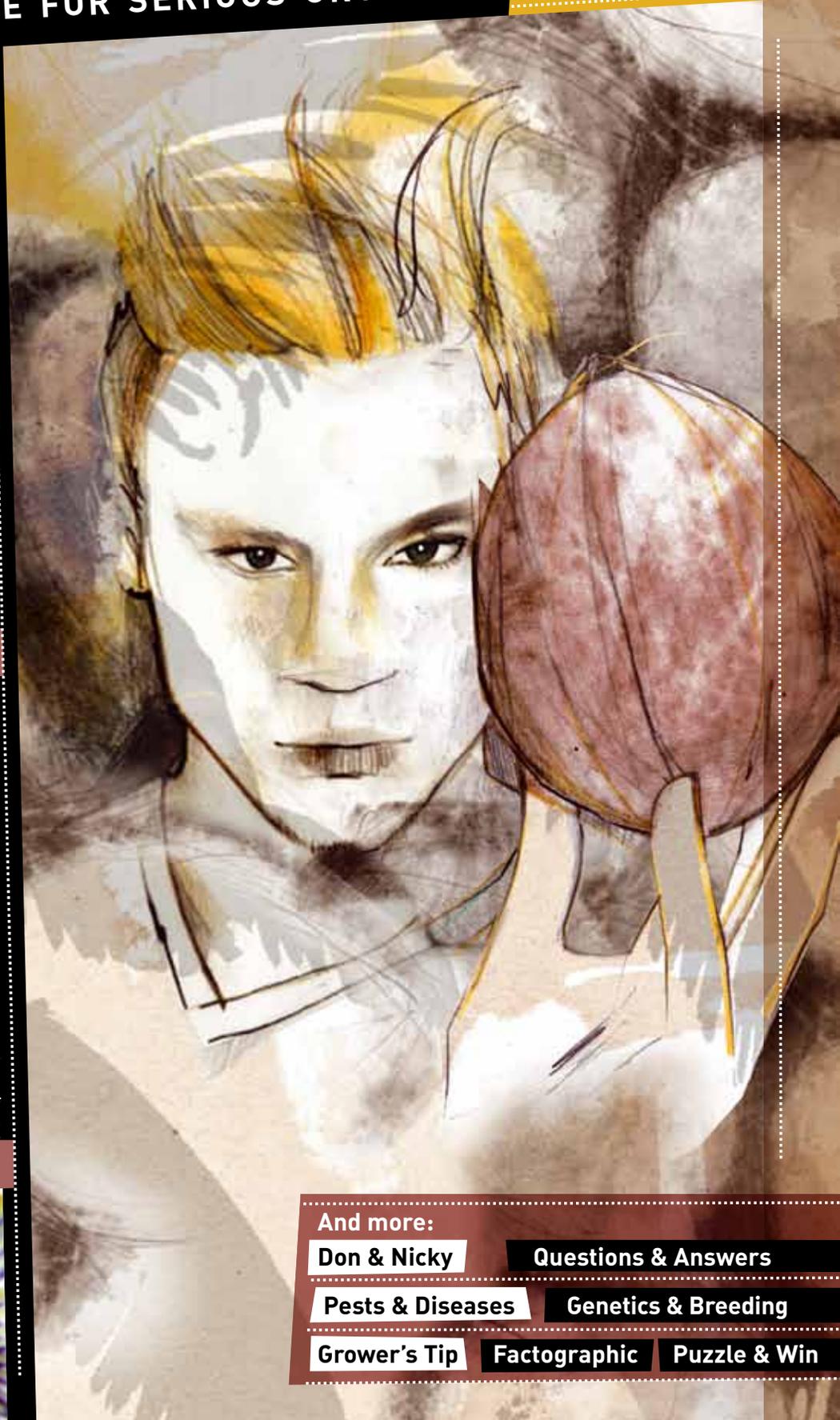
## IN LOVE WITH PAINTINGS

3D street painting



## PASSION FRUIT

Let's get passionate!



And more:

Don & Nicky

Questions & Answers

Pests & Diseases

Genetics & Breeding

Grower's Tip

Factographic

Puzzle & Win

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## HQTalk:

As I write, September is still a long way off! But as you can imagine, we have to work way ahead with this magazine to make all the deadlines and to make sure the magazine is available for all the readers 4 times a year. Anyway the September issue is now here, which means a new start of the growing season!

Back from holidays we are totally ready for the new season here at CANNA HQ! So we have produced a special edition about coco for you! Yes, we know how you guys in the UK love our CANNA COCO products! So in this issue we will be telling you about what coco substrate is exactly and what issues you may have while growing with coco. In the growing tip you can find even more tips for growing in coco. As well as our coco articles, we have the same old fantastic sections for you. We have a grow it yourself which tells you how you can grow the beautiful passion fruit vine. Don and Nicky are still living in France and are preparing for a summer full of home-grown fruit and vegetables and of course, we have an article about pests and diseases for you. And so much more which you can discover yourself by just turning this page!

But not before you have read this: we are always interested in your opinions, questions and comments, plus anything else you want to contact us about. In the back on the magazine you can use the answering card or go to [www.cannatalk.com](http://www.cannatalk.com) and leave a message!

And always remember: the more you read, the more you'll know!

Regards,  
Karin

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# HOW TO USE COCO COIR AS A CONCEPT



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**COCO COIR IS THE NAME GIVEN TO THE NATURAL FIBRE EXTRACTED FROM COCONUT HUSKS. IT HAS LONG BEEN USED IN THE MANUFACTURE OF BRUSHES, STUFFING FOR AUTOMOBILE SEATS AND MATTRESSES, DRAINAGE PIPE FILTERS, TWINE AND OTHER PRODUCTS. HOWEVER, THE VERY SHORT FIBRES (MEASURING 2MM OR LESS) AND DUST THAT WERE LEFT BEHIND WERE ONCE CONSIDERED A WASTE PRODUCT FOR WHICH NO INDUSTRIAL USE HAD BEEN DISCOVERED.**

.....

By CANNA Research



# COCO COIR



Fine Coco DUST



Coarse Coco COIR WITH HIGH FIBRE CONTENT



Coarse Coco COIR WITH HIGH CHIP CONTENT

The first reports of using coco coir and dust as a growing medium for various plants date from the late 1940s. But it was not until the early 1990s that coco really made a breakthrough as a growing medium, when it was introduced into Dutch horticulture. It was used to replace potting mix but it also served as an alternative to rock wool. It had the advantage of being a high-quality and environmentally friendly growing medium and the use of coco has really taken off since it was first introduced. What makes coco so special for growing? This article will focus on coco as a growing concept and explain some of its physical and chemical properties.

### What is coco coir?

At first glimpse, coco coir looks like soil, but it is actually a by-product of processing coconut husk fibre. Coco coir is the name given to the fibrous material that can be found in middle layer of the coconut fruit (*Cocos nucifera*). Three main horticultural coir products can be obtained from this husk; coir chips, coir fibre or coir pith/dust (see figure 1 left). The coir dust retains water well, while the fibres and chips help to create pockets of air and drainage. Coco coir consists primarily of particles in the size range 0.2-2.0 mm (75-90%), and unlike a medium like sphagnum peat, for example, it is free of extraneous organic matter like wood or leaves.

### Physical and chemical characteristics

Coco coir, mainly coco dust, is the major constituent of most coir products and it is made up of millions of capillary micro-sponges that absorb and retain up to nine times their own weight in water. As a substrate, it is well-aerated and compaction after drying is minimal. It has a natural pH of around 5.7 to 6.5, plus a high cation exchange capacity or 'CEC' which makes it good but challenging substrate for hydroponic cultivation. Now what exactly do we mean by 'CEC'? It all comes down to how easily the substrate releases nutrients that can then be taken up by the plant's roots. In order to understand this, we should think of the substrate as a storehouse for plant nutrients. Many nutrients, such as calcium and magnesium, may be supplied to plants from reserves held in the substrate. Others, like potassium, are added regularly to the substrate as fertiliser so that they can be taken up by the plants as they are needed. The relative ability of the substrate to store a particular group of nutrients – called cations – is called the cation exchange capacity or CEC of that substrate (see figure 2).



Figure 1: Example of different coco fractions.

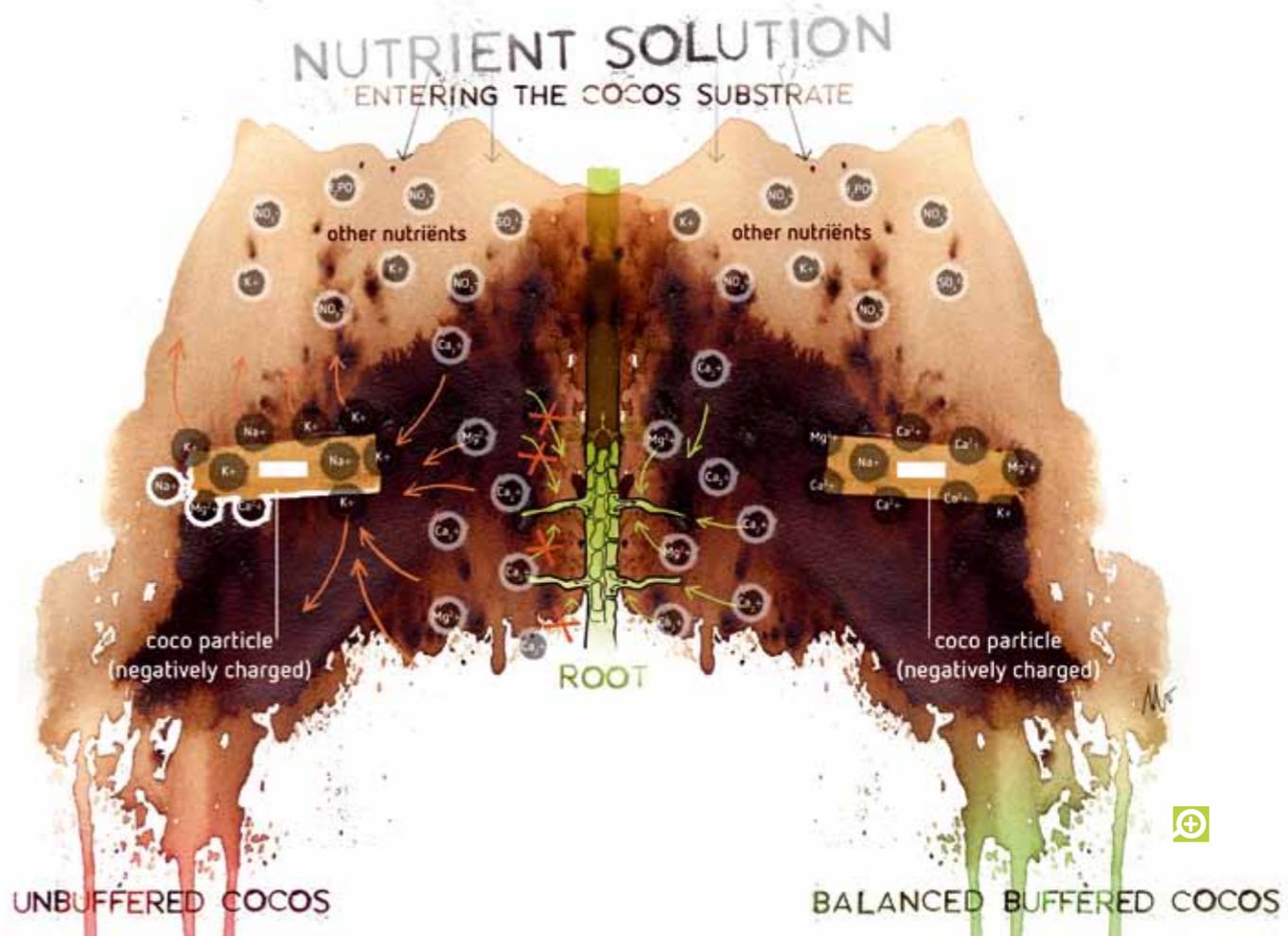


Figure 2: Schematic overview of the cation ion exchange in coco substrate. A coco substrate may consist of coir chips, coir fibre and coir pith. Chips are the biggest particles of coco used, and the dust is made up of the smallest. The coco substrate can be seen as a mix of microscopic particles which carry a negative charge. Each particle attracts positively charged ions. This is why natural, untreated coco particles have high amounts of sodium (Na+) and potassium (K+) ions. During cultivation, these ions are released making them available for the plants. Unfortunately, bivalent ions like calcium (Ca2+) and magnesium (Mg2+) bind to the coco substrate in their place. This means that these nutrients are less available for the plants, so there may be a shortage of calcium or magnesium. When we use a 'washed and buffered' coco substrate (right), the coco has been pre-treated with calcium fertiliser to enhance the potassium-calcium exchange. Coco substrate that has been pre-treated in this way is unlikely to release excess potassium or bind the calcium and magnesium that the plants need. The result: healthy plants with no symptoms of nutrient deficiency.

### Washing and Buffering

Coco coir, in its unprocessed form, tends to be high in both sodium and potassium compared to sphagnum peat. We know that the sodium can easily be leached from the material using irrigation. Potassium is also released and becomes available for the plants. Unfortunately, bivalent ions like calcium and magnesium then bind to the coco particles instead. This may result in excess levels of potassium, and a simultaneous deficiency of calcium or magnesium. Of course, this is something that growers need to avoid and to prevent it from happening the coco substrate is often washed thoroughly to leach excess sodium and chloride. It is then pre-treated with a calcium fertiliser such as calcium nitrate to enhance the potassium-calcium exchange. This process is called buffering and it produces a coco substrate that is not likely to release excess potassium or bind the calcium and magnesium required for plant growth.

### Properties of coco coir during cultivation

Plants grown in coir can develop large roots, stems and blooms. Unlike regular potting soil, which can easily become compacted, coco coir retains plenty of air pockets leaving room for the root system to grow. This gives rise to a healthy aerobic rhizosphere – essential for good uptake of nutrients and water. Some crops like tomato or sweet chili may tend to grow more vegetatively, meaning that the plants will look healthy and grow fast and strong but will actually produce relatively fewer flowers and fruits. For growers, this is something to be avoided, of course, because they will want to maximize their harvest. As you can read in our other article on coco, small adjustments in the fertilisation regime can resolve these problems.

Coco coir has a naturally high lignin content which encourages beneficial micro-organisms around the roots and discourages



# COCO COIR

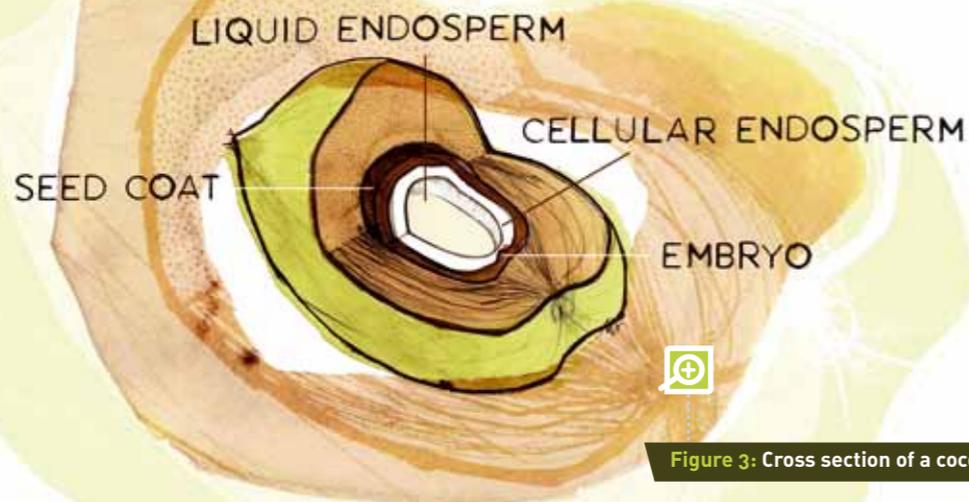


Figure 3: Cross section of a coconut including husk.

decomposition, making it an ideal growing media for reuse. It is also thought that the occurrence of favourable micro-organisms acts as 'protection' against plant pathogens. This was demonstrated in several experiments conducted in vitro which showed that coco coir suppressed the growth of soil-borne plant pathogens. One of these experiments showed that mycelia growth in the fungus of *Phytophthora capsici* was strongly inhibited when the growth medium was adjusted with an unsterilized coir suspension. On the other hand, the growth of *P. capsici* in the same medium was amended with a filter-sterilized coir suspension. Other experiments have demonstrated that the growth of *Fusarium solani* (figure 3) on water agar amended with non-sterile coir was completely inhibited. When the coco coir was completely sterilized, the growth of *F. solani* on water agar amended with autoclaved coir was no longer inhibited. Similar results were also obtained for *Aspergillus terreus*, a plant pathogenic fungus that produces toxins which inhibit pollen development.

The results from these studies suggest that coir can suppress soil-borne plant pathogens in vitro and this ability is largely due to micro-organisms associated with the substrate. We now know that the famous *Trichoderma* fungus plays a key role in the ability to suppress plant pathogens, but the benefits of these micro-organisms during crop cultivation are still largely unknown. Current studies are focusing on the resilience of coco coir during crop cultivation trials which aim to increase the plants' vitality and maximize harvests. Nowadays, the increased sustainability of coco coir is emphasized, and particularly the fact that the coco substrate can be safely re-used. But as promising as substrate re-use may sound, poor-quality coco coir can lead to some unexpected nutrient problems. A well-known issue that sometimes occurs is nitrogen-binding as the coco coir (or fibres) decompose. In some experiments it was found that a small amount of nitrogen draw-down occurred with coir dust.

Nitrogen draw-down is when nitrogen is retained in the substrate during decomposition of organic matter and is thus unavailable for crops. This is usually caused by the micro-organisms involved in the decomposition process, which compete for plant-available nitrogen.

### Coco coir as an alternative for peat

In this article we have focused on coco coir as a stand-alone substrate. However, coco coir is also used as a replacement for sphagnum peat in peat-based substrates. For almost a quarter of a century, coco coir has also been tested as a candidate to replace sphagnum peat, sedge peat and to a large extent rock wool plugs as a germination and nursery medium for broccoli, tomato and lettuce seedlings. It was found that germination occurred earlier in coir and tomato seedlings grew bigger and more uniformly. It is actually very probable that some countries will ban the use of peat as a substrate within the next few decades, because our supplies of peat are not endless and extracting it is not an environmentally friendly process.

### The coco substrate as a growing concept

The whole concept of coco substrate, both its benefits and its disadvantages, will require adjustments to the nutrient composition and regime. CANNA was among the first manufacturers of specialized coco nutrients to come up with solutions for the release and binding of plant nutrients. These days, coco coir is a very promising substrate. It is sustainable, it can be re-used easily, and ample research has shown that coco coir has a natural ability to suppress plant diseases. The other side of the coin, however, is that coco coir requires specific nutrient adjustments to compensate for the natural binding of calcium and magnesium and the release of mainly potassium. Unfortunately, we still know little about the benefits of disease-suppressing properties during crop cultivation. As we will see in our second coco article, there are a number of problems that may occur during cultivation that can put your harvest at risk if left unnoticed or discovered too late. •

# GrowIT YOURSELF



# LET'S GET PASSIONATE!

THE 'PASSION' IN PASSION FRUIT ACTUALLY REFERS TO SUFFERING – AS IN 'THE PASSION OF CHRIST'.

BUT WE WOULD ONLY SUFFER IF WE COULDN'T GET HOLD OF ONE – DELICIOUS EATEN FRESH WITH

A SPOON ON A HOT SUMMER'S DAY, OR ADDED TO A ZINGY CAIPIRINHA INSTEAD OF LIME. GIVE US A

PASSION FRUIT AT ANY MOMENT. WE MULTI LIKE! By Marco Barneveld, [www.braindrain.nu](http://www.braindrain.nu)

When I was a boy, around that age that girls suddenly start to be interesting, there was this urban legend going around that if you fed a girl with passion fruit she would become overwhelmed with desire and start doing things with you that good girls normally don't do. We all believed it. Why would it be called passion fruit? Well, I tried it and it didn't work. Later on in life I figured out that the best form of seduction is genuine attention. But that, of course, is a completely different story.

Later still, I discovered that the passion in passion fruit actually stands for the passion of Christ - where 'passion' means suffering rather than pleasure. But you don't need to worry about suffering when you eat them. Stop taking things so literally. You see, the passion fruit originates from South America and when the Spanish missionaries first saw them, they thought their flowers portrayed 'Christ's passion on the cross' because





# LET'S GET PASSIONATE!

the flowers have 'Three Nails, Five Wounds, a Crown of Thorns and the Apostles'. Well, in the eyes of a devout Christian missionary they might. The flowers are certainly very unusual. Anyway, the name stuck.

### Calming passiflora

Passion fruit comes from a large family that includes several hundred species. Most of them are native to the tropics of South and Central America, Brazil, Mexico, and the West Indies, but there are also species that are native to Australia. The Spanish explorers loved the fruits that these vines produced, so they took them back to Europe and from there they spread around the world.

And while some things that taste good are pretty bad for you, like marshmallows or triple shots of vodka mixed with Coca Cola, these little babies are excellent for your health as well. Why? Well, passion fruit is high in vitamins A and C, as well as being rich in potassium, calcium, iron and other nutrients. But the plant is also popular for its medicinal value. The leaves of many species of passiflora, the plant that bears the passion fruit, have been used for centuries by the indigenous tribes of Latin America as a sedative or calming tonic. Brazilian tribes used the fruit as a heart tonic and medicine, and in a favourite drink called maracuja grande that is frequently used to treat asthma, whooping cough, bronchitis and other stubborn coughs. Passion fruit still has an important place in South American traditional medicine. In Peruvian traditional medicine, the juice is used for urinary infections and as a mild diuretic. In Madeira, passion fruit juice is given as a digestive stimulant and to treat gastric cancer. In some countries, you can buy

a tincture of passiflora which you use to keep calm before exams. Drinking the whole bottle would make you pretty groggy though. I tried this, of course, just to prove the medicinal benefits.

### Grow it yourself

But since you are reading this magazine, your green fingers might well be eager to try growing these for yourself. Well, why don't you give it a go? Passion fruit vines are evergreen climbers that love to ramble over fences, sheds and outhouses, or up a veranda, pergola or screen. They are self-clinging, due to their spidery tendrils. They prefer a north-facing position, and though they will grow in westerly or easterly position you may find them sneaking around to the north to find more sun. They can grow 5 to 7 metres per year, once established, and they will need strong support. A plant will live five to seven years, and although they grow best in tropical climes, they will survive temperatures low as -6 degrees. They will also do well indoors, for all you indoor urban farmers out there.

To get decent growth and plenty of fruit, plant the vines in a sunny, frost-free spot and lavish them with



TLC. Passion fruit vines develop extensive root systems to fuel all that growth and fruit production, so allow plenty of room for the roots to grow. Also, keep the surrounding area free of weeds and competing plants, including grass. Give the vine space to climb too. An ideal spot to grow a vine is along a wire fence, across a balcony, or over a pergola where they will provide year-round shade. If you want to grow a vine along a sunny wall or fence, install some wire, trellis or mesh for the tendrils to wind themselves around. Passion fruit dislike having 'wet feet' and are prone to root rot in wet soils, so select a well-drained garden bed or slope. Add organic matter, such as composted manures to the soil before planting, as well as a little lime. Fruit is produced from the current season's growth so it is important to prune back after the last frost or in early spring. We advise pruning back by about a third. Remove weak growth and dieback. Thin out the vine every few years to increase ventilation. It's easy to see why passion fruit are so hungry – they produce so many flowers and fruit!

### Flowering and fruiting

Feed the vines with a fruit tree fertiliser and a little extra potash. Side dressings are also beneficial. When choosing your fertiliser, keep in mind that fertiliser high in nitrogen will produce leaves at the expense of flowers and fruit. Water deeply once a week in the spring and summer and spread the fertiliser and mulch over the entire root system, not just around the base of the stem.

Passion fruit thrive on any fertiliser designed to encourage flowering and fruiting. Apply fertiliser in spring and then every four weeks during the summer months. Always water well when applying fertiliser. It can take 12-18 months for a newly planted vine to reach fruiting size.

We usually get one large crop during summer and autumn; gardeners in more tropical areas will get continual cropping. The fruits are ripe when the skin is wrinkled: pick the fruit before it drops.

### Possible problems

Passion fruit are susceptible to root rot (Phytophthora). The sign that this is occurring are large patches of straw-coloured foliage that look almost like they have been burned. Subsequently the whole vine will collapse. You can prevent this by planting on a well-drained site and watering monthly with Anti-rot phosacid.

Sometimes aphids can spread a virus which causes mottled leaves. This is incurable so if it occurs, pull the vine out and start again.

### Tips & Tricks:

- If it rains during the flowering period, you might consider pollinating the flowers by hand to boost the yield of fruit.
- Passion fruit vines live up to seven years, after which time they will need to be replaced.
- Grow passion fruit on a trellis, fence or support that faces west or northwest for the best growth and productivity.
- Suckering is common with black passion fruit. Be on the look-out for different shaped leaves which are a sign of suckers from the non-fruiting rootstock. Pull the suckers off as soon as you notice them. •



# PASSION FRUIT CAIPIRINHA

Passion fruit is easy to eat. Just cut them in half, scoop out the flesh with a spoon and enjoy. Or try this one out on one of those wonderful summer nights when the sweet smell of hay hangs in the air and you're sitting outside on your porch with some friends.

### Ingredients

- 1/2 medium passion fruit
- 2 tablespoons sugar
- Crushed ice
- 2 shots of cachaca
- Sugar, for garnish

### Directions

Scoop out the flesh and seeds of the passion fruit and transfer these to a mixing glass or cocktail shaker along with sugar, and cachaca. Shake this with the ice and pour into a tumbler. Garnish the edges of the glass with sugar before you pour the drink into the glass.

ENJOY WITH PASSION.

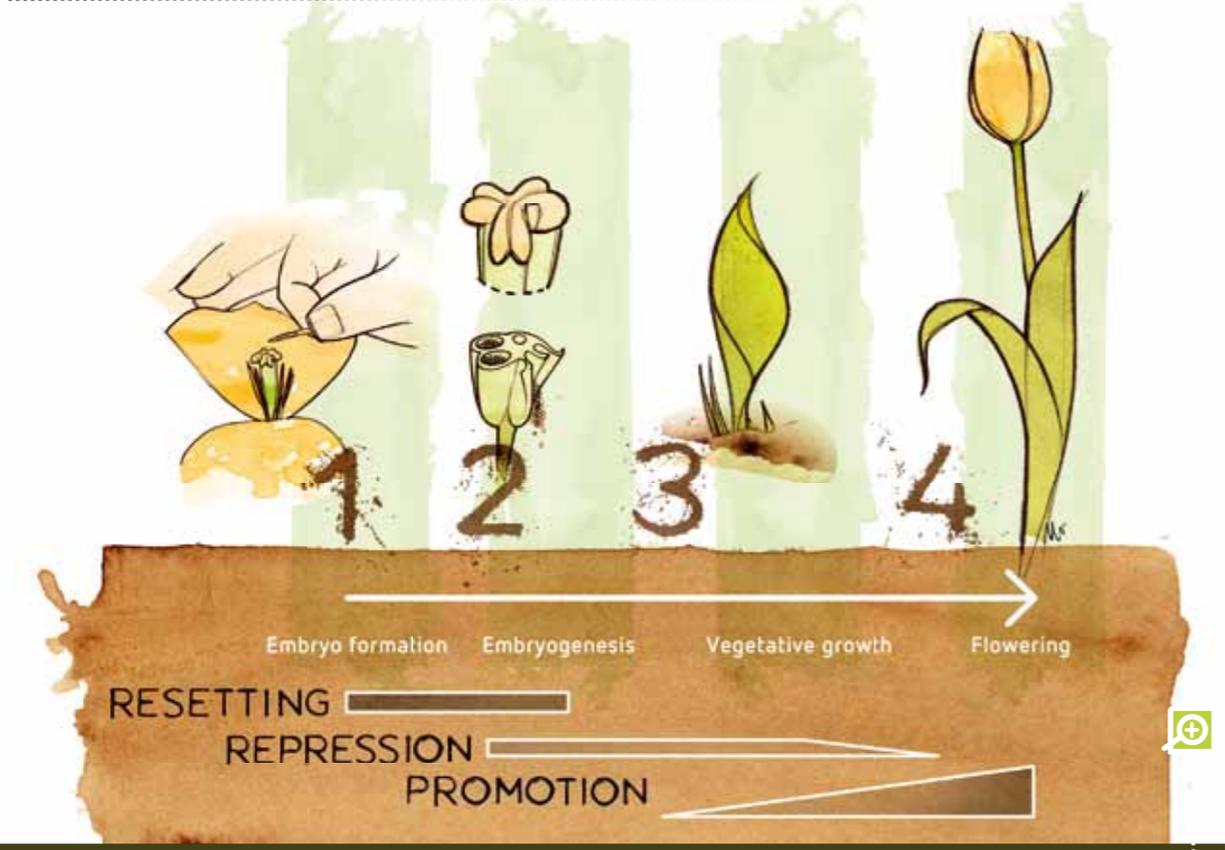
RECIPE

PASSION FRUIT

We could talk and write almost endlessly about the subject 'genetics and breeding'. We have come to part three and there is still a lot to tell you. In previous CANNAtalk editions we have introduced you to the rules of Mendel and explained what phenotypes and genotypes are. Don't miss the upcoming editions to stay on top of this interesting subject!

# PHOTOPERIODISM

FLOWERING, THE CULMINATION OF A LIFETIME FOR MANY PLANTS (ANNUALS), THE DRIVING FORCE IN EVERY PLANT'S LIFE (ANNUALS, PERENNIALS), IS THE END RESULT OF FORCES PUT INTO MOTION LONG BEFORE THE GRAND EVENT. By Geary Coogler, BSc Horticulture



**Figure 4:** Normally flowering plant tissue has to be reset after flowering to vegetative or juvenile to form gametes (meiosis), which then form seed (embryogenesis), which then grow and mature to the point floral expression is again promoted.

Plants are geared to flower from the beginning and, in fact, the only thing a plant wants to do is to flower. Evolution has imparted many mechanisms and pathways to this process, but the end result is the same, the appearance of a flower for sexual reproduction at the most appropriate time for the life cycle of the plant, or as a last ditch attempt to pass on its genes. To understand and appreciate the entirety of the miracle, the flower must be examined in two levels, the outward expression of the event (phenotype) and the master controller (genotype). First, you must understand that the default state of a plant

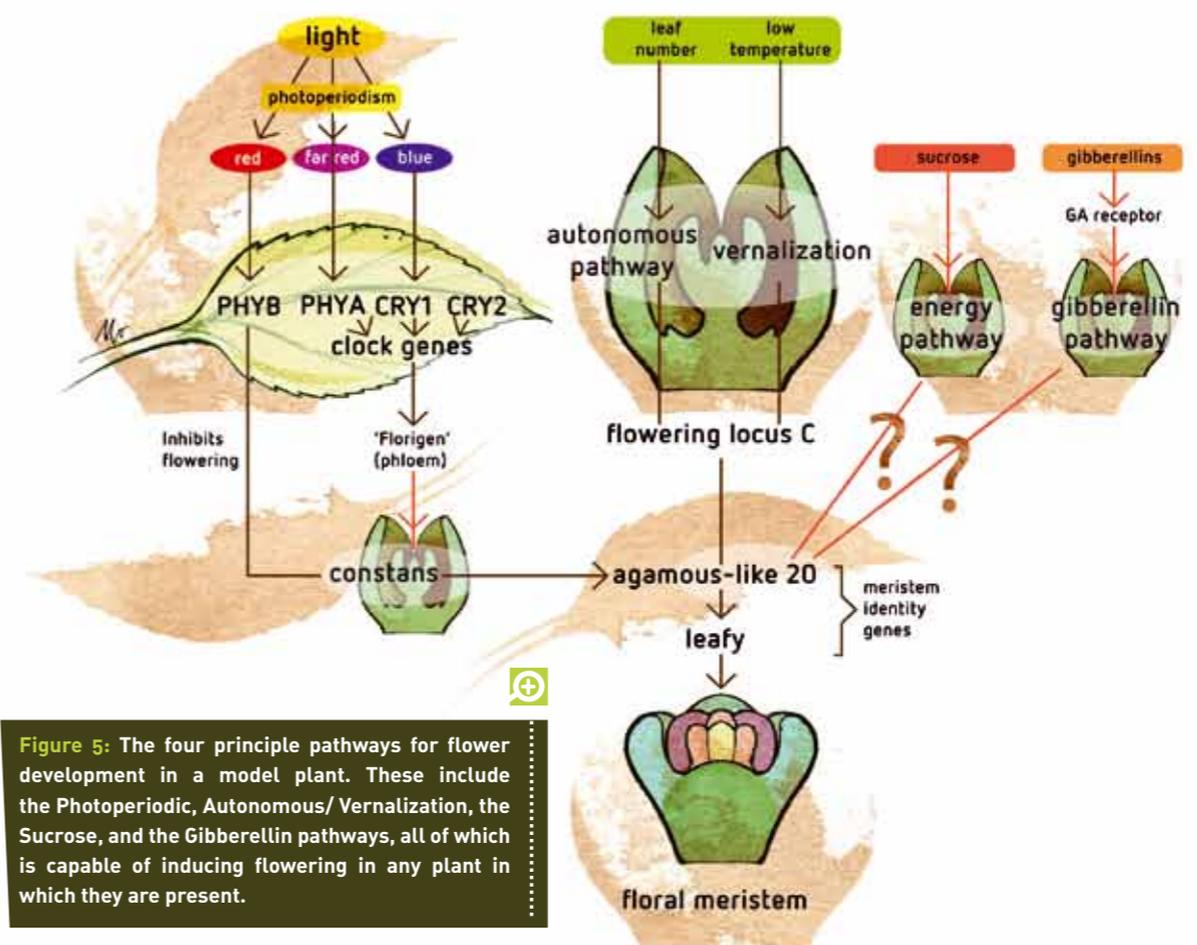
is floral, all plants annuals and perennials. Part of the developmental stages in both meiosis and embryogenesis (seed formation) stages of reproduction is resetting (of the suppression genes) the tissue to a harder vegetative state (expressed as juvenility after seed state). At this time, all tissue is and remains vegetative even when receiving floral signals. It is only later, after time, growth, hormonal activity or external stimuli that the apical meristems or buds become competent meaning that they can change to floral when signals are received, but something is holding them back from flowering or repressing them (with suppression

# ...OR NOT

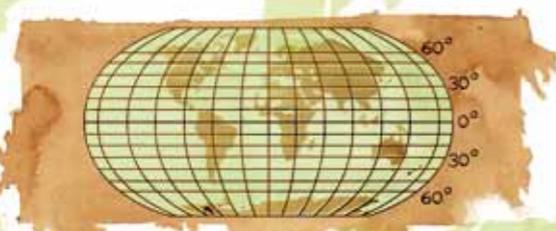
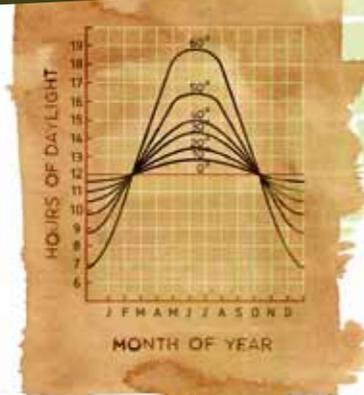
factors from suppression genes). This is sometimes known as the adult vegetative state. Once the appropriate signals have been received, the terminals and buds undergo a gradual change (promotion – removal of those suppression factors) to the floral state and become determined, adult

reproductive, at which time, even if the floral signals are shut off, the plant will still flower. It is possible for the bud to determine but not express right away as it awaits other signals to finish floral evocation by expressing. It might even be arrested (aborted) under unfavorable conditions. While time and development are all that may be needed for a meristem to become competent, the triggering of and completion of determination is a more involved process that utilizes one of four known pathways. When a vegetative bud is competent, it requires a change in the genetic expression to continue forward. For many reasons including survival and evolutionary advantage, and because there are many types and lineages of plants from simple to complex, there is more than one way to trigger the change of the plant back to the default state of flowering. There have now been identified 4 main, genetically controlled pathways to flowering in all plants:

- 1. The Light dependent pathway – Photoperiodism**, involves photoreceptors phytochrome and cryptochrome that are triggered by light quality and quantity to interact with the circadian clock that results in the expression of the CONSTANS floral promoter which works through other genes to increase the expression of the meristem identity gene LEAFY (LFY), thus promoting flowering.
- 2. The Temperature dependent pathway** – known as vernalization, usually records the amount of time the plant is inside a temperature range and represses the repressor gene FLOWERING LOCUS C (FLC), which increases expression of the meristem identity genes including LEAFY (LFY) gene, which then triggers the expression of the Floral homeotic genes. Usually more prevalent in Biennial and perennial plants.
- 3. The Gibberellin dependent pathway** – GA (and other hormones like Ethylene) induces flowering in many species of plants, although the exact mechanisms are not known. It is required in plants that flower early or non-inductive short days. Less understood and works with other paths.
- 4. The Autonomous pathway** – knows how to count and remembers. Usually based on developmental markers being achieved in the development of the plant. The plant can count nodes or leaves. It may have to do with hormonal expression and it functions in the same way as the Temperature pathway by suppressing the suppressor gene FLC.



**Figure 5:** The four principle pathways for flower development in a model plant. These include the Photoperiodic, Autonomous/ Vernalization, the Sucrose, and the Gibberellin pathways, all of which is capable of inducing flowering in any plant in which they are present.



**Figure 6:** Above: Chart showing the effect of latitude on day length and below a world map showing latitude.

LOCUS T (FT), which encodes the small protein florigen which then translocates to the meristem. Florigen then promotes the expression of the floral organ identity genes. Once the floral organ identity genes are turned on and the bud determines, the process is considered irreversible.

Under the temperature pathway, vernalization is the process by which the bud is rendered competent. There usually needs to be another signal received, such as photoperiod, to finish the determination and expression phases. Vernalization allows the plant to flower rapidly with the lengthening days of spring (Biennials and perennials). The plants also retain a memory of the cold and the genes must be 'reset' to vegetative in some plants (perennials) in order to repeat the process the following year. Vernalization is received in the terminal buds themselves and can both render a bud competent and determined.

The Autonomous pathway still requires all the floral signals from the leaves, however, light plays no real role in the event timing. This is the typical pathway of the DNP. Its main action is to decrease the expression of a suppressor gene which is keeping the buds vegetative, suppressing the suppressor. This is the same action as vernalization, and doing so allows the floral identity genes to continue expression. In practice, the plant tends to count nodes along the stem, and once it achieves the correct number it remembers it made it. Nutrition has to be correct but the plant will flower in any photoperiod simply through proper development. This is a common pathway among plants originating around the equator where day and night lengths are equal and constant year round, or with those special plants that complete their life cycles under extreme conditions; for example a desert plant that comes to life, flowers, seeds, then dies in a single summer thunderstorm.

Plants, particularly the Angiosperms, have developed many ways to trigger flowering in order to ensure reproduction under a wide range of conditions. Multiple pathways guarantee redundancy that affords the plant's reproductive function in spite of conditions and mutations, and seeks evolutionary advantage. Using these systems, a plant knows when it has been through winter and has, within a week or two, reached its normal flower time. All the plants in the same species and region "know" the same time so they can share a gene pool. That time when conditions are good, or that competition is reduced, to continue the species is dialed into the plant through the process of evolution: the genetic material at the base of all life.

It is possible through selective breeding to change some variables in the pathways that might be seen as desirable. Through these programs, the mutations that occur in one plant or one species can be transferred to the variety or to the Genus to become a hybrid with characteristics of both parental lines such as the fruiting characteristics of this species inside a genus with the day neutral characteristics of this species. These F1 or first generation lines are not stable genetically for sexual reproduction; they are hybrids having the better of the characteristics of both parents. Other breeding efforts may be able to carry these characteristics forward into future generations resulting in a new variety of a species. •

The complexity of the system of components that come together and interact is huge. It involves many other things such as carbohydrates and other hormones (cytokinins) that act on many sites and sometimes in many ways, but the transmissible signals required for determination of the apex, originate in the leaf in both photoperiodic and autonomous regulated plants. While some plants can rely on one pathway as the primary pathway, all 4 paths may be present and functioning. This is an advantage that will allow the plants to trigger flower in response to other variables when in a non-inductive state for the primary pathway. It also ensures that the plant not only knows it is in or headed into the correct season, but that the temperature is correct, or that other needs are met.

Probably the most important of the pathways or the most prevalent is the Photoperiodic pathway. Light controls many aspects of a plants life including flowering. Plants respond to the length and quality of the light signals it receives in the leaves, and under the correct conditions, it triggers changes of phase in the plant from juvenile to adult bud competency as well as causing determination of the meristem. There are 5 categories of Photoperiodism plants can be grouped in: Short Day Plants (SDP), Long Day Plants (LDP), Short - long Day Plants (SLDP), Long - short Day Plants (LSDP), and Day Neutral Plants (DNP). The SLDP and LSDP plants require a sequence of one photoperiod to be followed by the other to determine and express.

Light entrains the Circadian Rhythm system through the CLOCK genes, which regulates the CONSTANS (CO) floral promoter transcription, a protein that is stable in light and degrades in the dark. CO is expressed in the vasculature of the leaves that activates the expression of the gene FLOWER

# What's HAPPENING



## PAINTINGS YOU COULD FALL IN (LOVE WITH)

**Tracy Lee Stum lives and breathes street painting. She might well be the Van Gogh of 3D Street painting. Her temporary creations have stunned and amazed onlookers walking the streets all over the world. She is a wizard when it comes to depth and optical illusion. We were lucky enough to interview her.**

Interview with Tracy Lee Stum. By Marco Barneveld, [www.braindrain.nu](http://www.braindrain.nu) Images: Tracy Lee Stum

Tracy, you make amazing art. This kind of creativity... Where does it come from? What is your background?

"I had a lot of creativity as a child, so my parents supported those gifts and sent me to private art classes at an early age. I didn't come from an artistic family. My father's family were farmers in Pennsylvania, my father was an electrical engineer and my mother was a realtor."

Creativity goes where it wants?

"Indeed. I went on to college to study art and received a Bachelor's degree in Fine Art from Tyler School of Art, Temple University. I also studied naturalism at the Florence Academy of Art in Italy and various ateliers in California."

What did you do before you started street painting?

"I was a muralist / decorative painter and ran a successful



## PAINTINGS YOU COULD FALL IN (LOVE WITH)

mural painting studio in Los Angeles. My clients included The Venetian Casino and Resort in Las Vegas, The Forum Shops at Caesar's Palace and Disney Hong Kong. This provided the backdrop for a natural progression to street art as I have always worked on large format images. In my case, size does matter."

**How did you get into this kind of art?**

"Purely by accident. I stumbled on the Santa Barbara I Madonnari Festival in 1998 and fell in love with what I saw there: artists drawing large, beautiful images on the plaza. The following year I participated and kept going after that. It began as a weekend hobby and wound up as my full-time job in 2006."

**What or who inspires you?**

"My friends, colleagues, peers, forward thinkers, genius, self-less individuals, children and everyday saints; artists, scientists, poets, writers, philosophers, film makers, and adventurers. Too many to list, but here are a couple: Nikola Tesla, Jiddu Krishnamurti, Johann Wolfgang von Goethe, Johann Sebastian Bach, Visual puzzles, culture, art, people, history, music, travel, architecture, science. The list is too long. Life inspires me!"

**Where do you get your ideas?**

"I usually get my ideas from my active imagination. I am constantly 'downloading' thoughts, ideas and concepts into my sketchbooks, which leaves me with a ton of material to work from when coming up with a design for a painting. I take photos, draw and research when I travel, which also gives me more to work with. Usually a flash of inspiration comes to me, I see an image in my head and then proceed to put it down to paper or street. My creative processing methods are pretty fluid."

**How do you feel about your street art being so temporary?**

"I love that aspect of the art form - it's a performance-oriented process being primarily geared towards process. I think the fact that it's not permanent makes it all the more special. I compare it to hearing a musical performance. You experience it and are left altered somewhat, emotionally or mentally, from the exchange."

**Can you describe the process of how you make your art? e.g. do you start on the street or do you already have a master plan? What are the steps?**

"It all depends on the image. Sometimes I work from a master drawing, mostly in regards to larger works when I have other artists assisting me. I typically work from a sketch draft or I even make up the image on the spot, this happens more and more as I develop further. Even if I have a draft that I like, I may change it when I get to the site. I don't like being so rigid in my working methods. Certainly, location can affect the work, as local light source is an important consideration for effective illusions."

**Who are your favourite artists?**

"That is constantly changing! Currently, the painter Victor Rodriguez, and the street artists JR, Gerhard Richter and Gottfried Helnwein."

**Have you ever experimented with Augmented Reality (AR) in combination with your street art?**

"Yes, I completed a national campaign with US auto maker Cadillac in the fall of 2012 in which we used unique AR components in each piece of art. It was a very sophisticated use of the technology and highly effective. I learned quite a lot and am now pursuing further the development of this type of technology on the new images that I will be creating this year."

**What makes you the happiest, being the artist that you are?**

"Drawing all the time, you could say it's my first love, and travelling around the globe. I love discovering foreign cultures, meeting new people and seeing new places. Since I do both in my work as an artist, I am very satisfied. I love problem solving and I am constantly thrown into situations with this work that requires a tremendous amount of resolution. That keeps my approach sharp, because each situation is unique."

**What would you love to accomplish?**

"I'm now working towards providing training and education in street painting worldwide. I see a need in many places around the globe and hope to have a programme in place soon that addresses those needs. I also plan to work on larger group projects, bringing in other street artists and artists from other disciplines to collaborate on new approaches to working toward a common goal. Another goal is seeing the creation of designated street painting areas in public locations around the US. Europe has embraced this model but the US is slow on the up-take in regards to this. I think 42nd Street in New York could be a bit more interesting with a permanent street art designated area. I'd certainly like to work with more global non-profits



that support initiatives that I value; human rights, the environment, equality, education etc."

**What is your next project?**

"I'll be traveling to Taiwan for a corporate project and then after that to Panama City for the inaugural Bienal del Sur en Panama, a new international art exhibition featuring some of the best street - and other artists from around the world. I am very excited to have been invited and I'm looking forward to creating a unique interactive piece for the exhibition."

**So, you work all over the world?**

"Yes I do. I've painted in 25 countries thus far and have loved every minute of it. India is one of my favourite places on the planet and I've had the good fortune of travelling there numerous times to street paint. It's been a lot of fun."

**Did you ever make a painting that was sealed to make it permanent?**

"Yes, I have made some works with paint on surfaces

for more permanent installations; however, permanent is relative because they lasted for a month rather than a few days. I hope to make some more permanent works in the future."

**If I wanted to become a street artist, what should I do to get things started?**

"I'd say take a look at what other artists have done or are doing to get inspired. Flex those imaginative muscles and come up with your own unique vision. Find a decent piece of sidewalk or street to draw on, where people will see the work, and then get some 'hands-on' practice working with chalk pastels on the pavement. Practice is the best way to learn. This art form is very forgiving so you really have nothing to lose. I've got a free 'How To' video on my website for anyone interested in a basic 3D approach which I think would be helpful to a beginner."

*Want to see more of Tracy's work? Or do you want to get started as a 3D street artist yourself? Check Tracy's site: [www.tracyleestum.com](http://www.tracyleestum.com).*



## DEVIL'S WALL DID YOU KNOW THAT...?

- The rock formation shown in this picture is the Teufelsmauer (meaning Devil's Wall) in central Germany and it runs for about 20 km. This wall has been protected as a nature reserve since 1935 and is thus one of the oldest nature reserves in Germany.
- The soils formed from the sand of the various sandstones are loose and infertile regosols and gravelly leptosols which are poor in nutrients. Despite the shallow soil, regosols are still used for capital-intensive

irrigated farming but most common is low-volume grazing.

- The hard rock cannot support any plant life except for the crustose lichens that cover much of the rock formations. Lichens are in fact two types of different organisms that exist symbiotically – they are actually an astonishing partnership between a fungus and an algae. The two types of organism are so closely interconnected that they appear to be a single individual.

- Crustose lichens, such as those growing on the Devil's Wall are, as their name suggests, encrusting forms which spread over and into the surface of their habitat. They cannot be removed from the surface without it crumbling away.
- The Devil's Wall did not get its name by accident. There is a legend called: "The Devil and the cockerel!"  
"God and the devil were fighting for the possession of the earth and

*they agreed that God should keep the fertile plains, and the Devil would take the ore-bearing Harz Mountains, provided he completed a boundary wall by the time the first cock crowed. He built it all the way to the edge of the Harz Mountains. Meanwhile a woman came walking by on her way to market, carrying a cockerel in her basket. With one stone still missing from the wall, the cockerel crowed. All the Devil's work had been in vain and he destroyed his wall in a fit of rage."*



# Pests & DISEASES

Whitefly are Hemiptera insects belonging to the Aleyrodidae family. They are considered a major pest for many crops because they cause considerable damage and loss of production. They feed by sucking the sap from the host plant. They are polyphagous, meaning that they feed on many different plants, and so they represent a hazard for the majority of crops, as well as feeding off wild plants and weeds that act as a reservoir for the pest.

By Ignacio Garcia, CANNA Research



## WHITEFLY [DESCRIPTION]

The characteristic white colour of these insects is due to a layer of white powder that covers both their bodies and their two pairs of wings.

The two species of whitefly that affect many crops are *Bemisia tabaci* or tobacco whitefly and *Trialeurodes vaporariorum* or glasshouse whitefly. The main morphological difference that enables these to be distinguished from one another is the position of the wings. In *B. tabaci*, these are joined to the body and in *T. vaporariorum* they are parallel to the surface of the leaf. Furthermore, the adult and pupa of *T. vaporariorum* usually has a greater quantity of waxy powder than *B. tabaci*.

### Biological cycle

The full life cycle of the whitefly lasts between 15 to 40 days, depending on environmental conditions, particularly the temperature, as eggs will turn into adults more quickly when the temperature is higher.

The whitefly usually lays its eggs on the underside of the

leaves and the eggs stick to them by means of a pedicel. The larva or nymphs emerge from the eggs and in their first stage of development, they are mobile enough to move along the leaf until they find the right place to insert their stylus and begin to feed off the sap of the phloem, which is rich in sugars. The nymphs then pass through several more stages of development, during which they remain in the same place and continue to feed off the plant until the adult emerges from the last nymph stage. Non-fertilised eggs produce males while the fertilised eggs produce females.

### Damage

The direct damage is caused to the plant as the whitefly feed. The sucking of the sap leaves discoloured patches on the parts of the leaf when they have been feeding. Furthermore, as they suck out the sap, they release toxic substances into the phloem, which then spread throughout the plant. This leads to metabolic imbalances in the plant which leads to overall weakening, chlorosis and changes

to the flowers and fruit. In terms of indirect damage, the molasses excreted by the nymphs enables fungi such as sooty mould (*Capnodium* sp.) to form on the leaves. This mould acts as a screen and reduces the photosynthetic capacity of the plant.

However, the most serious damage that the whitefly can cause to crops is the transmission of viruses. These include the TYLCV (Tomato yellow leaf curl virus), the ToCV (Tomato chlorosis crinivirus) or the TYMV (Tomato Yellow Mosaic Virus).

### Cultural control measures

One of the main objectives when controlling whitefly is to avoid the crop being infected by a virus that the insect can carry.

Therefore, any weeds or remains of other plants that are near the crop should be removed as these can act as a habitat for the whitefly. Furthermore, if a whitefly feeds off a weed that contains a virus and then reaches your crop, the virus can easily be spread. The use of protective barriers such as nets and covers are also a good option for preventing infestations.



**Figure 7:** Whitefly (*Bemisia tabaci*) just emerged from its final nymphal stage, the fourth-instar nymph (pupa). Surface of hibiscus leaf. High magnification (5x) image showing the soft waxy appearance of this insect. This whitefly has a size of less than 1mm.



## DAMAGE AND CONTROL

### Biological Control

A range of entomophagous insects, parasites, and some entomopathogenic fungi are used to control whitefly. Most of the predators used feed on the eggs and nymphs of the whitefly. This category includes the *Delphastus catalinae* beetle. The chrysopidae larva and some bedbugs are also good biological controllers of this pest.

The small wasps of the Aphelinidae family are parasites of the whitefly larva, where the wasps lay their eggs and they develop by feeding off their host. They are the most commonly used parasite wasps and are specific to the pest that they live off. This results in a quicker control of the pest, even though their specific nature means that they are not useful against other phytophagous insects. Entomopathogenic fungi can also be used. This infects and grows inside the whitefly and eventually kills it. New spores emerge out from the corpse and infect other individuals. One example is the *Verticillium lecanii* fungus.

### Phytosanitary treatments

The aim is to provide the plant with maximum protection during the earliest stages of the crop, thus preventing any whitefly from getting established. It is in these earliest stages that a viral infection will cause the greatest damage as the virus will spread throughout the plant and will show all its symptoms as the plant begins to produce blossom and fruit. This is why insecticides are applied to the seeds in some crops. These act systematically as soon as the seedling starts to grow and continue to protect it for several weeks.

In later stages, insecticides like CANNACURE can be applied to the leaves to ensure the protection for the longest possible time. It should be noted that the use of non-systematic ingestion insecticides is not usually effective in combatting whitefly in its larval stage, since many of the larvae lack mobility. The use of insecticides that act by physical means, such as CANNACURE, are also a good choice to fight this larval stage. •



# 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.canna-uk.com](http://www.canna-uk.com), to submit your question.

## Question

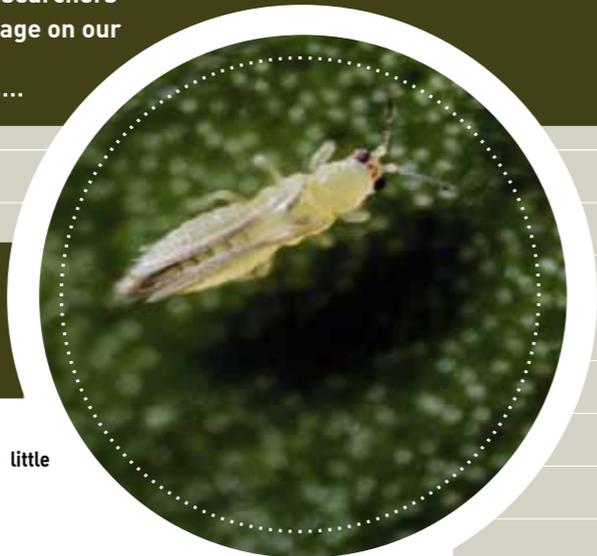
I have a few issues with some spider-mites and trips in my indoor garden. I tried using organic solutions as well as chemical. But I must be doing something wrong because they always take-over. Any ideas?

## Answer

Many people suffer from the same garden problem. Fighting these little buggers is hard. Only a multi-prong strategy is effective.

HERE ARE FEW THINGS YOU CAN TRY:

- Keep the garden cooler and more humid until you regain control. They don't reproduce as fast that way.
- A foliar spray works only if all surfaces of the plant are touched by the mixture. Don't spray in complete darkness. Impossible to do a good job. Turn off some lights and lift remaining ones. You'll see better and the product will work better.
- Prevent is better than cure. Plan your strategy by scouting your garden. Identify the onset of an infestation by turning over many leaves to spot the enemy early. Try to start from clean plant stock.
- Do not use the same product repeatedly. Rotate between at least three products. Keep them in a cool dark place, it's important for these products. Also shake well before adding to the tank.



## Question

When I add CANNA PK13/14 to my solution, I see a white cloud forming and white powder on the tank bottom. What's up with that?

## Answer

The white cloud you observe is a precipitate that results from the addition of the CANNA PK13/14 to the existing chemistry of your reservoir. Usually it is due to your water hardness (calcium carbonate content) being too strong. Try adjusting the pH before you add the CANNA PK13/14. Also, diluting CANNA PK13/14 to 3 or 4 litres of water and adding it slowly to your solution may help. In most cases, the precipitate will resolubilise. In the most extreme cases you may have to mix your solution water with half volume reverse-osmosis water (very low EC water).

Question: I am using CANNA Coco Slabs and I want to try to

Hi, can your coco soil-less medium go bad? I've had bag

The answer to your first question is yes, you can use your water with

Answer: Thank you for your question and we a

## Question

I want to set-up an indoor garden for my family to have access to fresh herbs and spices all year long. I have a hard time to decide which kind of grow system to commit to. Can you help me?

## Answer

If you want to grow many species of plants at the same time then a container style growing would give you much more flexibility than any kind of recirculation grow system. Plants of different species do not grow all at same speed and do not require all the same root conditions. Container growing would allow you to correct these preferences whilst growing in the same area in your garden. Hope this helps! Happy gardening!

## Question

I grow watermelons in CANNA COCO medium. For some reason I always run into some Ca and Mg deficiencies a few weeks after transplanting into final container. Is your fertiliser formula correctly balanced for watermelons?



## Answer

Normally the formula should contain all necessary nutrients for this fruiting plant. Since you are experiencing deficiencies only in Mg and Ca then maybe you are over-watering (watering too often) these containers. Mg and Ca would be the first deficiencies to rear up in such wet soil conditions. Without more information from yourself, this is the only thing that springs to mind. Try backing up the watering on a few subjects and monitor any change.

## Question

I followed my friends advice and switched to CANNA COCO and nutrients. I expect to reuse it many times as he does. I have gone through a few crops and although I am satisfied with the quality of the fruit I have been harvesting significantly less weight. Should I add something to your feeding program?



## Answer

The COCO nutrients contain all your plant needs to develop a heavy load of quality fruits. Maybe the problem is somewhere else. Here are a few hints that might help:

- Most fruiting plants prefer high oxygen root conditions to produce high yields. If your plants needs water only every two or three days, then you have chosen a slightly bigger than necessary pot. Try a few smaller containers on your next run or grow your plants a little bigger.
- Higher or lower than normal soil salt levels will affect yields. High soil salt levels negatively influences flower development. Low soil salts indicate your plants could use more nutrients or a slightly stronger feeding solution.
- Higher than normal plant or flower site density can induce the plants into producing smaller fruits. Choose your winners during the fruit setting stage and prune the rest. Research the internet for info on plant density for your plant specie.



# Don & Nicky

(PART 3)

Don and Nicky have moved back from Canada to their home country, the UK. Their search for the good life led them to France and they are now doing exactly what they wanted to do with their lives: growing. Don shares his experiences and will tell you everything about the good life in French Catalonia in this, and forthcoming editions.



# In Search of THE GOOD LIFE

## UNFOCUSSED, UNTRAINED AND UNPREPARED

It's probably best if we skim hurriedly over the catalogue of mistakes I committed during my first few months as a vegetable grower. In my defence, my first season was destined to be a somewhat rushed affair. From April (when I took charge of the plot) it was a mad dash to get it cleared of weeds and my plants settled in before the intense summer heat of southern France kicked in. My riverside soil looked great to my untrained eye but it was underprepared and undernourished. Still, I learnt a whole lot—and I happened upon an awesome book: "The Vegetable and Herb Expert" by Dr D G Hessayon. You probably know it already—if you don't, you should! Apart from the antiquated and downright dangerous

recommendations of using glyphosate-based herbicides to clear your garden plot of weeds, it's concise advice on growing the actual veggies has served me very well to date.

Next year, I vowed, I will not leave my green beans on the plants until they are leathery (this also signals to the plant to stop producing), I'd give my carrots more space—six to eight centimetres at least—and I'd dig in some much-needed nutrition in the form of well-composted animal manures. But hang on—what's all this "next year" business? Clearly I was still thinking like a British gardener—whereas I should've been thinking like a Catalan gardener—year round action! After all, my little town barely receives a single

1 These leeks got off to a flying start under T5 fluorescent lights back in March.

2 Carrots are so easy to grow—just make sure you thin them out so they are 6-8 cm apart.



frost in a decade! Distracted by the birth of my son in late August, I foolishly allowed my plot to become overgrown after the last of the tomatoes, carrots and potatoes were extracted when I should have focussed instead on getting some cool season crops started!

*However, when I regained my senses, I took the opportunity to dig in endless wheelbarrow loads of compost and goat manure—courtesy of a local cheese maker.*

My newborn certainly helped to bring my gardening efforts into a sharper focus. Gardening wasn't just about finding an escape from my computer screen—as nice as that was—it was about the very real task of feeding my family! I was determined to deliver the tastiest, most nutritious home-grown morsels I could muster to my little boy's plate, hopefully just in time for when he would start on solids. Still fuzzy from the excitement of being a new dad I went a little overboard buying seeds online—amassing far more than I needed. It felt good though. I kept digging in the compost and manure in readiness for the following spring. This may sound a bit corny but I started to feel like .... a real man! For the record, I'm not talking about the fledgling muscles that were just starting to

show on my arms! I mean realising the freedom afforded to us by the simple act of growing our own food—believing in good, old-fashioned hard work, not the normalised economic slavery of chasing dollars, euros, or pounds.

I can't tell you the satisfaction of feeding my baby boy his first taste of beetroot and peas—fresh from the garden—steamed and blended into a somewhat garish-looking pulp. He scoffed it down, staining his little chin with purple dribble, and quickly demanding more! Like I said, I felt like the man! But more than that, there was a tangible sense of dignity and pride. I was feeding my family at last! Nicky, seeing me well up a little, gave me a hug to fully squeeze out those tears of joy! I know, I know, I'm a bit of a softy.

Now it's early June—I have 91 tomato plants in the ground and the first, early varieties like Latah and Sub Arctic Plenty already have their first few trusses of green fruit. I'm about to harvest my first new potatoes and my carrots (well-spaced this year!) will be on my plate imminently. Next month I'll be propagating my winter veg seeds—Asian favourites like Pak Choi and Japanese onions. The goal is now clearer and simpler than ever: constant, year-round production! Something's really clicked in my head and I'm feeling more confident than ever. It's amazing what you learn in just one growing season. Get stuck in! •



COCO IS FAST BECOMING A FAVOURITE MEDIUM FOR CROP PRODUCTION WORLDWIDE, BUT IS STILL RELATIVELY NEW TO THE INDUSTRY. ALTHOUGH IT WAS FIRST BROUGHT TO THE ATTENTION OF THE ROYAL HORTICULTURAL SOCIETY IN THE NINETEENTH CENTURY, IT WAS NOT UNTIL THE LATE 1970S AND EARLY 1980S THAT IT BEGAN TO CARVE A NICHE FOR ITSELF. IT TOOK SOME TIME TO ESTABLISH ITSELF PRIMARILY DUE TO THE LACK OF UNDERSTANDING OF BOTH THE CHEMICAL AND PHYSICAL PROPERTIES OF THE PRODUCT.

By Ralph B. and Ronny D.G.

# PROBLEM SOLVING IN

# COCOCO

Once the properties of coco as a medium were understood and growers started to understand how to use it correctly, its popularity took off. So what are the potential pitfalls of using coco as a medium? What follows is a brief discussion of some of the issues that can arise, and possible solutions for those issues.

## Some basic properties that you should know about

We should never forget that coconut trees are capable of actually 'drinking' sea water. They have developed the ability to concentrate excess ions in the areas surrounding the cells, which allows osmosis to continue and water to move into the plant from the high-EC sea water. It is this ability that gives coco its characteristics, both positive and negative, when used as a plant growth medium. This attribute also allows the husk tissue to be very stiff and slow to decompose so that it is able to protect a developing embryo and future tree as it floats around the

ocean for a long period before germinating and landing on a new beach. In so doing, it allows the coco tissue to have both a known content and a known path for decomposition of acceptable duration, enabling the development of a system for usage. It also allows for a known structure to exist for a known amount of time giving the physical attributes necessary of a good medium.

These physical characteristics include fibres and a breakdown product known as coco peat. Once the edible part has been removed, the husk of the nut is softened and then the fibres are torn away. This produces long fibres that are very stiff and can be used to make items such as door mats and brooms, as well as shorter fibres that provide a ridged structure and give the coco its characteristic porosity. Dust or coco peat is also released; this is made up of smaller particles that act like tiny sponges. The coco peat component of coco growing medium not only improves its structure, it also provides a great deal of water retention. After the right amount of time being



GOOD

BAD

composted and processed by movement and regular rinsing, the consistency of the peat reaches its best and its chemistry is more stable and suited for growing. However, its chemistry is still not fully correct and needs to be adjusted.

Once the husks have been soaked and torn apart, the decomposition process accelerates. The concentrated ions (salts) begin to be released very rapidly. Careful processing and timing assist this process until the rate of release falls back into acceptable limits and the coco can be used for growing. In the process of this breakdown, the sites that release ions such as potassium, and sodium remain in place and function as Cation Exchange Sites (CEC) to which a useable plant nutrient can attach itself, as also occurs in good mineral soils. At this point, the medium needs to be processed by buffering with a product designed to control pH and protect the ratios required to maintain the availability of these elements for plants. This process was also mentioned in the previous article. These excess ions or salts are released for as long as the coco continues to decompose and the process must be managed continuously.

**THE MAIN THINGS TO WATCH OUT FOR WHEN USING COCO MEDIUM FOR USE IN GROWING INCLUDE:**

- 1] Choose coco that has been correctly treated and is of a consistent quality in both chemistry and physical structure.
- 2] Use coco that has been properly aged to maximize the efficiency and quality of the product.
- 3] Select coco that has been correctly balanced through a buffering process tailored to the characteristics of individual batches of product.
- 4] The availability of a nutrient designed to feed the plant and to manage and adjust the continuously decomposing coco medium.

While there are many other aspects to consider, these are important to bear in mind for the rest of this article.

**Figure 8:** Producing a good-quality coco substrate is an intensive process that takes months. To be able to use the product as a growing medium, the substance derived from the coco husks needs to be aged, washed, treated and rinsed. If this process is not carried out, or not carried out correctly, there is a risk of lacklustre growing results or potassium or calcium deficiencies. (see page 7, Figure 2)

Once this process has been completed, the coco has to be dried so that it can be pressed and made ready for shipping. The drying process is obviously dependent on the prevailing weather conditions, so good producers will ensure that they have enough coco product stocked up to see them through the rainy season or any shorter wet periods.

Producers also need to take precautions against the risk of impurities or inadvertent contamination. For example, the coco is susceptible to contamination with (tropical) weeds or human pathogens, or it could become mixed with coco that has not yet been aged or other substances such as sand. Any of these impurities could cause problems when the product is used for growing.

To prevent contamination, good coco producers will take steps to protect the coco as it dries, such as using protective screens, cleaning the drying area, checking samples of the product in a laboratory, using storage facilities and following appropriate procedures.

The two photographs above show examples of good and bad drying areas – on the right you can see a drying area where effective precautions have not been taken, meaning that the chance of impurities is much greater. On the left you can see a concreted drying area where the risk of contamination with impurities is being minimized.

**PROBLEM SOLVING IN COCO**

**Growing in coco – trouble-shooting**

When the right coco is used as a medium, it is possible to achieve some pretty exceptional results, and not all the mechanisms behind this are understood yet. Research into the properties of coco continues every day. Faster growth, healthier plants, lush foliage, and adaptability have all been used to describe successful trials with the product. It has long been known – and recently substantiated – that coco as a medium promotes plant health because of specific factors found in the product and by the micro-flora and fauna that develop in coco medium. In coco, the availability of the nutrients applied is unusually high because it does not bind or affect these nutrients. It also provides pH control without additional liming requirements between successive crops. However, none of these benefits will occur without correct buffering before use. After that, the buffering is best maintained over time by applying the right nutrients in the right way.

However, using bad coco is a recipe for disaster and much more hard work. Sterilising the coco incorrectly by harsh steaming or using toxic chemicals will destroy the beneficial characteristics of the product. If the product is not rinsed before it is packaged, or not rinsed correctly (too little or with bad water), high salt levels will be left behind. Failing to buffer properly leaves huge holes in the chemistry of the medium. Green or old coco is equally problematic and inconsistent in its composition and the consequences can vary from a wildly fluctuating EC and pH to an unstable and rapidly changing physical structure. Salts are given off constantly (such as sodium, potassium and chlorine) and they must be removed or their effects neutralized. A great deal of work and preparation goes into the successful use of coco as a growing medium.

One of the biggest issues with coco is watering. Coco acts like a sponge, absorbing and holding water. And just like a sponge, water comes out when it is squeezed, but not all the water. The sponge remains damp and coco may appear wet, and yet there may not be enough water available for the plants. On the other hand, constantly watering coco will result in over-



**Figure 9:** Installation of two tensiometers during a tomato cultivation trial on coco coir slabs. The pressure transducer is replaced by a digital recording system.

watering and in fact when you are using coco, you need to water at a minimum of 50% dry and 70% dry may be better especially during the first weeks of growing when most of the roots are formed. This is because roots need oxygen as well as water, and where there is water, there is no air. A sophisticated and reliable method of measuring the amount of water in the coco substrate that is available to the plants is using a tensiometer (figures 1 and 2). This is a device that determines the water potential in a substrate – effectively the force needed to release the water from the substrate. This takes the least force in substrate that is saturated with water and the most when the substrate is completely dry.



### PROBLEM SOLVING IN

# COCO

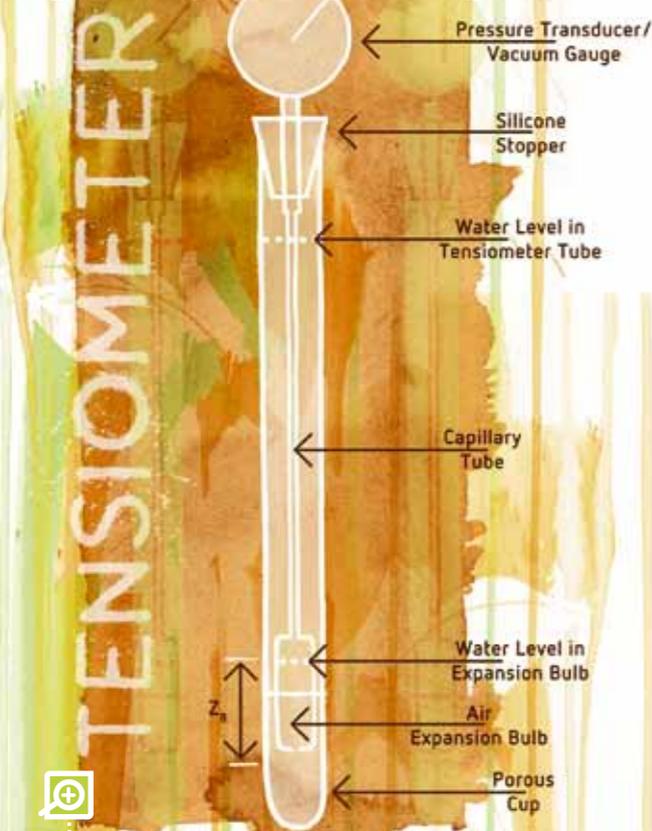


Figure 10: Schematic overview of a tensiometer

There is an easier and cheaper way to determine the amount of water available to your plants, however. You can determine the amount of water available to your plants by thoroughly watering a container of plants and coco medium and weighing it after the water has drained. Allow the plants to dry out until they reach wilt point and weigh the container again. The difference between the two weights is the water available to plants. When 50 - 70% of this amount has been used (you need to weigh the container), it is time to water again. It is never good to allow plants to wilt, but an experiment may make it worthwhile. If plain water is used on established coco, the buffer will be upset and the next issue will arise. The chemical balance in the coco is critical in three ways. First, the pH of the coco as a natural product is not ideal and needs to be adjusted. Second, the CECs that we mentioned earlier are not the real CECs in the classic sense, because while they will loosely hold monovalent cation elements (ions with a single positive charge) on a matching negative charge, they will bind a divalent ion such as calcium or magnesium more tightly, making them unavailable to the plant. They also come and go as decomposition moves forward. Third, the release of other ions by coco as it degrades upsets the ratio of elements to each other, causing many of them to become unavailable. The buffering that we have already mentioned fixes this issue temporarily by filling the sites with divalent

elements while stabilizing the pH within the range desired and fixing the correct ratio of elements to each other. If the water used to mix the nutrients is very soft, the concentration of nutrients will need to be higher or the coco will rob the nutrients and calcium deficiency will begin to occur. This is precisely because of these issues. With the popularity of reverse osmosis systems sky-rocketing, this issue is seen more and more often. Growers plan to use pure water, feed lightly to avoid burn and feed often to keep things pumping. This can be avoided, however, by adding back some of the original water to buffer the water once more. There is no other effective cure and throwing a calcium or magnesium product at the problem will just make it worse over time. Adding a higher concentration of nutrients is a better and safer option. Most importantly, the buffering process applies what we could think of as a coating on the coco which allows the coco to reach the correct pH but does not affect the availability of nutrients so much. The coco is constantly changing as it decomposes and this 'coating' must also change and adapt. Using nutrients that are designed specifically for coco growing is a critical part of this adaptation process and crucial to maintaining the buffer. Using some other ratio or combination of nutrients will not maintain the buffer. This includes using plain water, which causes the EC to drop and the buffer to disappear. Equally important is following the feed chart and testing the coco correctly.

Standards are not absolutes but markers by which things are measured. A foot is a foot because it is known as a meter is a meter. In order to get the true picture of the condition of coco in terms of its EC and pH, there is only one correct way and that is the correct extraction method with barium chloride in water. Barium, a bivalent metallic alkaline earth metal, binds strongly to the surface of the coco releasing virtually all the previously bound cations: sodium, potassium, calcium, magnesium and ammonium if present. The level of cations in a barium chloride extract is a good measure of the quality of the substrate at that point in time and enables us to make a prediction of which nutrients were about to be released by the coco substrate, making them available to the plants. Measuring drainage or run-off alone will never be accurate. It may give the grower an idea based on experience but that is all. Growing means knowing, and correctly measured coco should match the characteristics described. Some other issues or questions seen when using coco include nitrogen binding and ways to increase aeration. Many growers enjoy using coco more than once, but for successful growth, the coco needs to decompose a certain amount before being used for the next crop. If the first crop fails or is too fast, then nitrogen will tend to bind into the coco causing a week or so of nitrogen deficiency symptoms to appear. Finally, some growers insist on adding perlite to the media to 'loosen' it. Perlite is about identical to coco in physical characteristics and is not liable to do anything for porosity but it will affect the overall chemical profile. In the end, it is probably best to find a company that has decades of research into coco, that provides correct solutions, and that has introduced coco use into this market. Trust in their experience, use quality products that are well researched, and keep it simple. •

# Grower's

# TIP #22

By F.F.

## REUSING COCO

One of the most useful aspects of using CANNA COCO medium is its reusability. Providing it is used correctly, the COCO coir mix can be reused for up to twelve months of growing without any significant loss of performance. After such a time the individual COCO particle have shrunk and the mix becomes less porous. The advantage is not only in the savings related to the cost of the medium but also a lot less man hours invested in repotting and in waste disposal.

### It is as simple as follows:

Once the garden is harvested, using a serrated knife, cut into the soil around the stump. Remove the stump and make a hole a little bigger than the diameter of the potted plants to be replanted. Only very big roots and stomp need to be removed. No need to foray into the soil to remove all roots. They will decompose over the next few weeks and even faster if you are using CANNAZYM. The older root system helps to maintain soil structure and porosity through the next cycle.

Place the potted plants into the newly made hole. Fill in with new COCO medium making sure no air pocket remains by pushing in with your fingertips. Water the container with nutrient solution until run-off. It is wise to check the EC of this run-off water. If it is unusually high it might negatively affect your new plants. Make sure that the salt levels are not excessive before reusing COCO. If they are, run feeding solution through container until run-off is close to feeding EC.

If the medium dries out completely before you replant it rewet it a day before the operation. It is also recommended to keep the garden clean of damaging insects and disease when reusing COCO. Some of these garden enemies can use the medium as a shelter until new plants arrive.

Once used (9 to 12 months of usage) up, the medium can be added to garden plots or spread over your lawn. Even though it is not optimal for container growing it still serves as a great soil amendment. Doing so is more ecological than packing in garbage bags.



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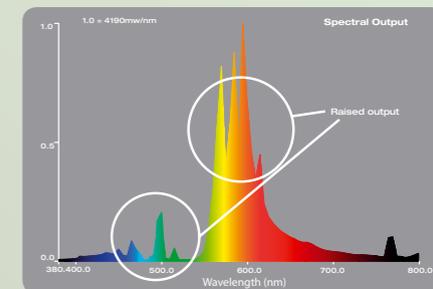
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