

CANNATalk[®]

MAGAZINE FOR SERIOUS GROWERS

ISSUE 34 2016

ALL ABOUT ENZYMES

All there is to know



MISS GHOST PEPPER

More than hot?



MINI VEGETABLES

Big in a small way



And more:

Don & Nicky

Factographic

Pests & Diseases

Puzzle & Win

Grower's Tip

Questions & Answers



create your own environment

HOTalk:

That's right folks. CANNAtalk is all up in your grill this issue with a bunch of jive about everyone's favourite additive: enzymes. Not sure exactly what enzymes are doing in your pot? Not sure how they can actually be beneficial to plant growth? Not sure how they even fundamentally work? Not sure if you even care? Well my friend, you need wonder no more. All of that stuff explained plus a whole bunch more like a feature on Dwarf veggies (someone phone the political correctness police quick – we have a live one here) or a disastrous installment from Don and Nicky's Garden. If only Don had thoroughly read CANNAtalk like you loyal readers he could have easily saved his garden from himself, but hey, nobody's perfect. Especially Don.

We hope you've all had a great few months enjoying the weather this summer. We sure as hell have. We've been dancing the nights through at NASS and Boardmasters festivals in the UK as well as the Route to CANNA tour that's worked its way up and down the country. Then on top of the usual day-to-day drudgery there is the epic shenanigans of the Autopot festival to get over. Some-one get a cold one ready for us: we need it!

Let us know your feedback on the magazine too once you have given it a once over. We honestly do appreciate your guys feedback. Even if it's just to say you found the sudoku a bit of a struggle this month, we really do love to hear from you. It warms the deepest cockles of our hearts.

Much love and happy growing!

Nico

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Foto courtesy of Trinh nữ, Mác cỏ, Xấu hổ Mimosa Pudica L., họ đậu Fabaceae

IN THE WORLD OF PLANT NUTRIENTS AND SUPPLEMENTS, YOU CAN FIND ALL SORTS OF WEIRD AND WONDERFUL LIQUIDS AND POWDERS SCATTERED ACROSS THE SHELVES OF YOUR LOCAL SHOP. IT IS MOST COMMON FOR A GROWER TO SELECT NUTRIENTS AND FLOWERING SUPPLEMENTS BASED ON THEIR NUTRITIONAL CONTENT. WHETHER IT IS THE BASE NUTRIENTS CHOSEN DIRECTLY ON NPK VALUES OR ADDITIVES SUPPLEMENTING P/K OR CAL/MAG, THESE INPUTS EASILY TRANSLATE TO A GROWER IN TERMS OF WHAT BENEFIT THEY ARE DIRECTLY GOING TO SEE IN THEIR CHERISHED PLANT. YOU'D BE CRAZY NOT TO BUY THESE THINGS RIGHT? YOU KNOW YOUR PLANT PHYSICALLY NEEDS THEM.

By NICO HILL, BSc Floriculture / Horticulture

ENZYMES

PART 1

Not such an obvious choice for a modern grower are products that have less direct and maybe not quite as obvious results, but still offer a wide range of key plant benefits that you would be wise not to dismiss. Enzymes are one of the best examples of this. It's not the sort of product where a grower can easily visualise what benefit they are actually going to get. Well, let's break that shadowy veil of mystery shall we? Follow us down the path of enlightenment as we look at exactly what enzymes are, and just how you can make the most of them.

What are they?

You can consider them to be little bio-chemical helpers. Tiny little protein based missionaries going around in life with the sole purpose of helping out other molecules to perform their various tasks. We can all relate to that surely? We all need a bit of help now and again don't we? For example: If you didn't have help filling out your government benefit forms then you wouldn't get any extra money to go down the pub with. Obviously these proteins aren't going around filling out forms though, they have a lot more complex tasks ahead of them.

What do they do?

Enzymes play the role of a catalyst in almost every bio chemical reaction that occurs. They speed up these reactions by lowering the activation energy required by the substrate to react. As an example: Your body's ability to digest and break down food into a source of nutrient your body can actually uptake, relies on enzymes. Without their presence this process would happen so slowly you would very quickly be dead from malnutrition, regardless of how much food you swallow; No amount of protein shakes or energy drinks would be able to save you.

Yeh ok, but what actually are they?

Generally speaking, enzymes are made up of proteins and then if required, a partner group of molecules. The proteins are made up from chains of amino acids. Although strictly speaking, in the formation of these chains they become amino acid residues as they lose a water molecule each time a bond occurs. The partner group will be either: Co-factors. Molecules (like Iron or Zinc ions) that increase the rate of reactions.



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Co-Enzymes. Organic molecules (commonly derived from vitamins) that bind loosely to enzymes and help them function. Prosthetic Group Organic molecules or metal ions that are bound extremely tightly to the enzyme, often by a covalent bond.

How do they actually work?

The protein chains and cofactors described earlier can be combined in all sorts of weird and wonderful shapes. It is this shape and its unique three dimensional structure that plays a major part in the role of the resultant enzyme. Each different enzyme has its own unique active site. It is these active sites that provide the base for the enzymes function.

This is what is known as the 'Lock and Key' principle. As each enzyme has a unique three dimensional structure it

also has its own unique active site (the lock) and will only react with a correspondingly shaped substrate (the key). Just as important as the physical shape of this active site, is the amount and type of available bonding sites it has along its surface. As you know, the active site is composed from long chains of amino acid residues. Well, the amino acids that form these chains in turn have their own side groups of amino acids sticking out them, referred to as 'R' Groups. It is not only the amount (commonly between 3 and 12) but also the type of 'R' Groups that an active site has that dictates how it will react with a substrate.

So, once the substrate is positioned perfectly in the Active Site (and formed the necessary bonds with the required 'R' groups) the enzyme gives a slight chemical based nudge on the substrate. For example a slight change in pH may be all that is needed. What this little biochemical poke does is lower the activation energy for the reaction and allow the substrate to break apart into its products.

A classic example that most hydroponic enthusiasts will be familiar with is Hydrogen Peroxide (H₂O₂). H₂O₂ breaks down into Water (H₂O) and Oxygen (O₂) thanks to the enzyme called Catalase.

It's almost like a jigsaw puzzle but with a major plot twist at the end: You've spent ages with the final few pieces, but for the life of you can't get them to fit. Finally you give up and go on Youtube to see how to do it. With this catalytic information you are able to quickly complete it and bask in all its magnificent glory. However, as you place the last piece the whole board shatters back into its separate pieces, ready to be used all over again.

You can probably guess that you need to be very selective when producing an enzyme intended for a particular purpose. Each specific enzyme is only capable of providing the catalyst for one specific reaction. It needs to have precisely the right shaped active site, correct amounts of 'R' bonds and have the right partner group or it will catalyse nothing. If any of these are not correct, then you have a useless enzyme and might as well not bother applying it. As a pertinent example for plant cultivation: they need to break down not only the dead cells walls, but also the pectin that binds these cells together.

Practical benefits in cultivation with enzymes

You're probably thinking: "All that sciencey stuff is all well and good, but what does it actually mean for me and my garden? I don't care about Active sites and 'R' Groups, I want to know what benefits my prize winning Begonias actually going to see from using them" Well, the answer to this centres on certain enzymes abilities to increase the rate at which organic matter is decomposed. On the face of it, this sounds like quite a trivial process but is one that can have significant knock on effects to the overall performance of your crop in a variety of ways.

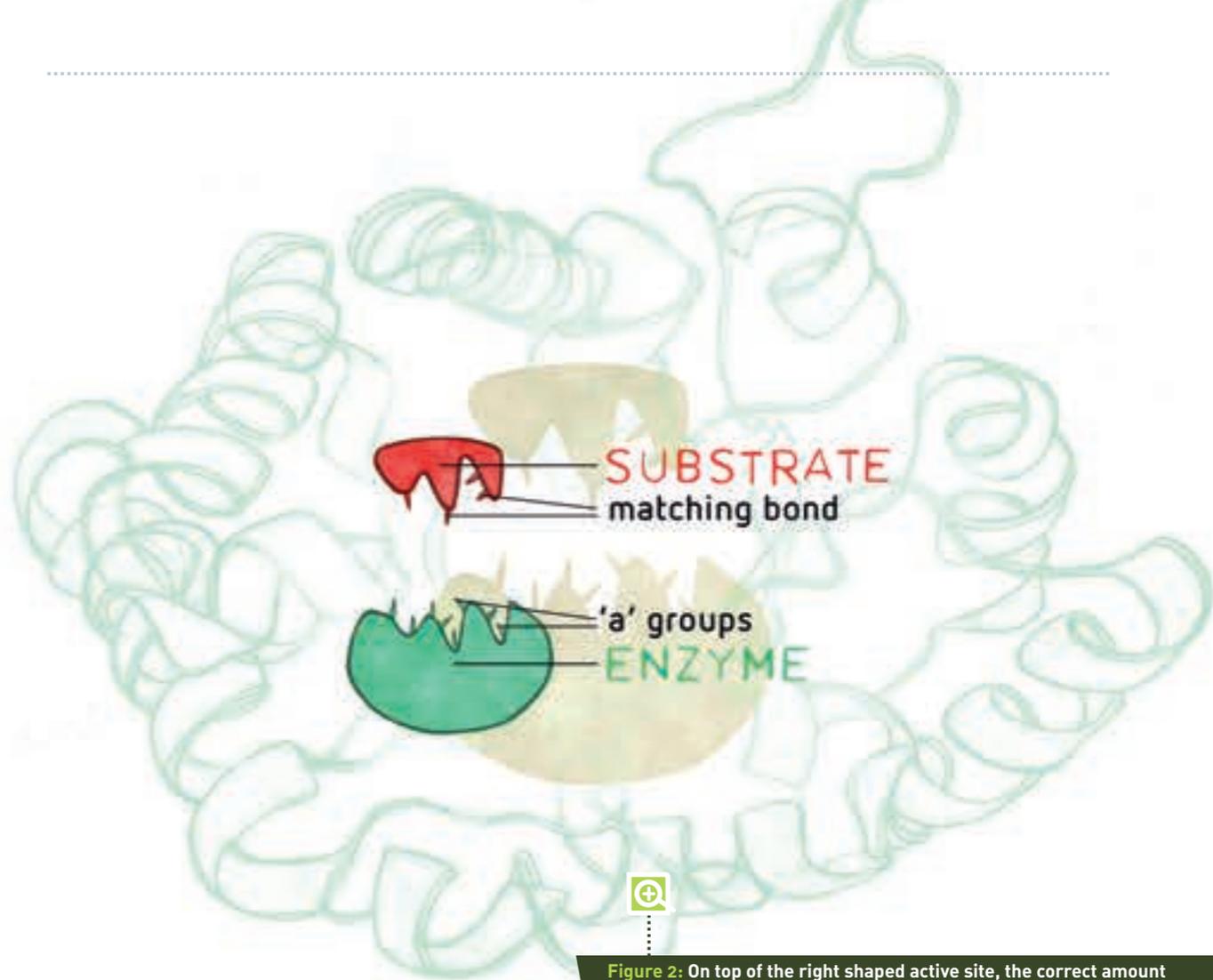


Figure 2: On top of the right shaped active site, the correct amount of R bonds must be in place for the reaction to be possible.

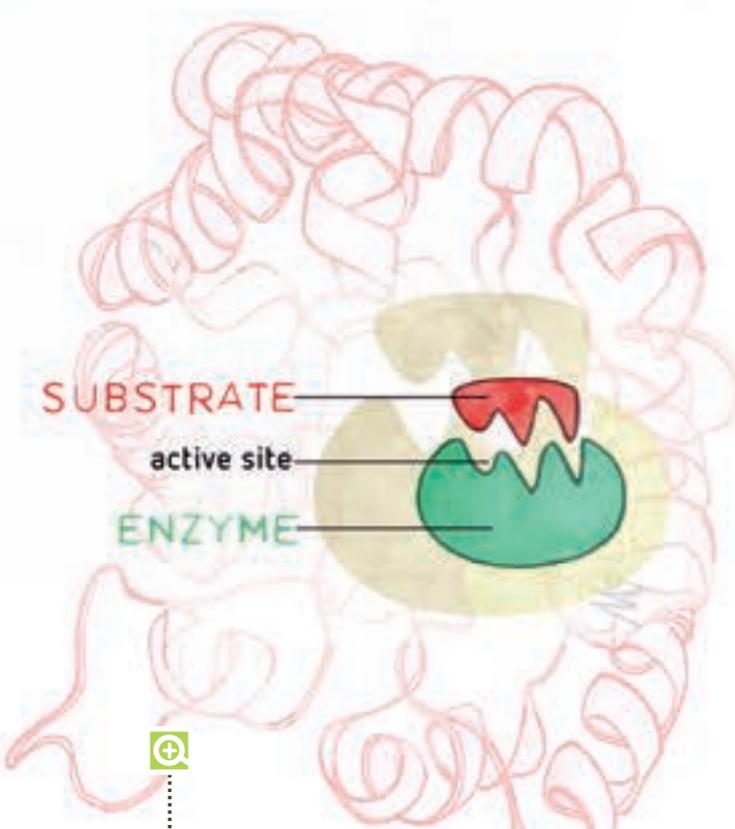


Figure 1: The physical shape of the active site, perfectly matches the substrate. Each unique enzyme has its own unique purpose.

Improved nutrient cycling

This is possibly the most obvious and advantageous benefit enzymes can provide to your plants. Your plants need nutrients. That much you can be certain of! You wouldn't spend hundreds of pounds on bottles of liquids to pour over them if they didn't. It isn't just that bottle of liquid that can be a source of food for your plant though. Locked away inside your growing media is a wealth of nutrition that just needs a particular nudge in the right direction for it all to be made accessible to your plants again.

Organic matter, decaying plant material and mineral salt deposits can all broken down by enzymes and converted back into a plant available format.

Promotes the growth of beneficial bacteria/fungi

On top of producing nutrients from the breakdown of dead roots, natural sugars are also released back into the growing media. These sugars mostly come from the decomposition of the pectin between the dead roots cell walls and require very particular enzymes to do this. The resultant natural sugars provide beneficial biology with the ideal food source to continue their proliferation and help you maintain a happy, healthy root zone.

Prevents against deadly pathogens

A rapid breakdown and subsequent conversion of dead and rotting organic matter in a root zone will significantly reduce your plants risk to contracting a disease. Dead roots and decomposing organic matter are the food sources on which many pathogens will use to gain a foothold in your pot. They will usually begin with this dead material in order to build up the energy to then go on to attack an otherwise healthy plant. By removing this initial food source, they will not be able to take hold so easily, thus leaving your plant in a nice and healthy state.

Promotes healthy root growth

With the increased proliferation of beneficial bacteria in your growing media, you will also reap the rewards of the associated increase in root growth and development. However, it is not just the greater microbe population that will increase root growth: The inclusion of certain vitamins that make up the co-enzymes promote the production of particular hormones in the rhizosphere, and help to push root growth to the limits.

Maintains soil structure and integrity

The rapid breakdown and removal of decomposing material keeps everything nice and clean in your pot. Not



ENZYMES

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only that but it means no space is being unnecessarily taken up with dead and decomposing organic matter. With less physical matter in the pot a proportionally higher level of aeration can be expected, once again encouraging a healthy and productive root zone. This is particularly important for growers who choose to re-use their growing media for successive crops: transforming a spent root ball back to a useable state is effortlessly achieved with the use of enzymes.

Break it all down for me

Besides creating opportunities for outrageously hilarious puns like the title of this paragraph, there are all sorts of positive affects the use of enzymes can have

on your crop. We have highlighted a few of them here but this is by no means where the list ends. The sort of advantages you can have from using an exceptional enzyme product aren't quite as tangible as say a bloom booster may be, but that does not necessarily mean that they are any less important.

Hopefully now the question on the tip of your tongue will not be whether you should use an enzyme product: It should now be beyond doubt that your plants will thank you for using one. The question you should now be asking yourself is what enzyme product you should be using. No doubt you have seen a lot on the shelves of your local store and choosing which one to invest both money and time in can be a spurious task.

Above all, you need to be certain of its effectiveness. Fortunately, there is a very simple way in which you can test this for yourself. For the full method you can head over to our website and watch one of our top scientists show you how (we do let them out occasionally). All you need are some cups, paper, apple sauce, water and your chosen enzymes. In no time at all you will be grading your enzymes like a connoisseur and only allowing the finest of them to grace your grow room. •

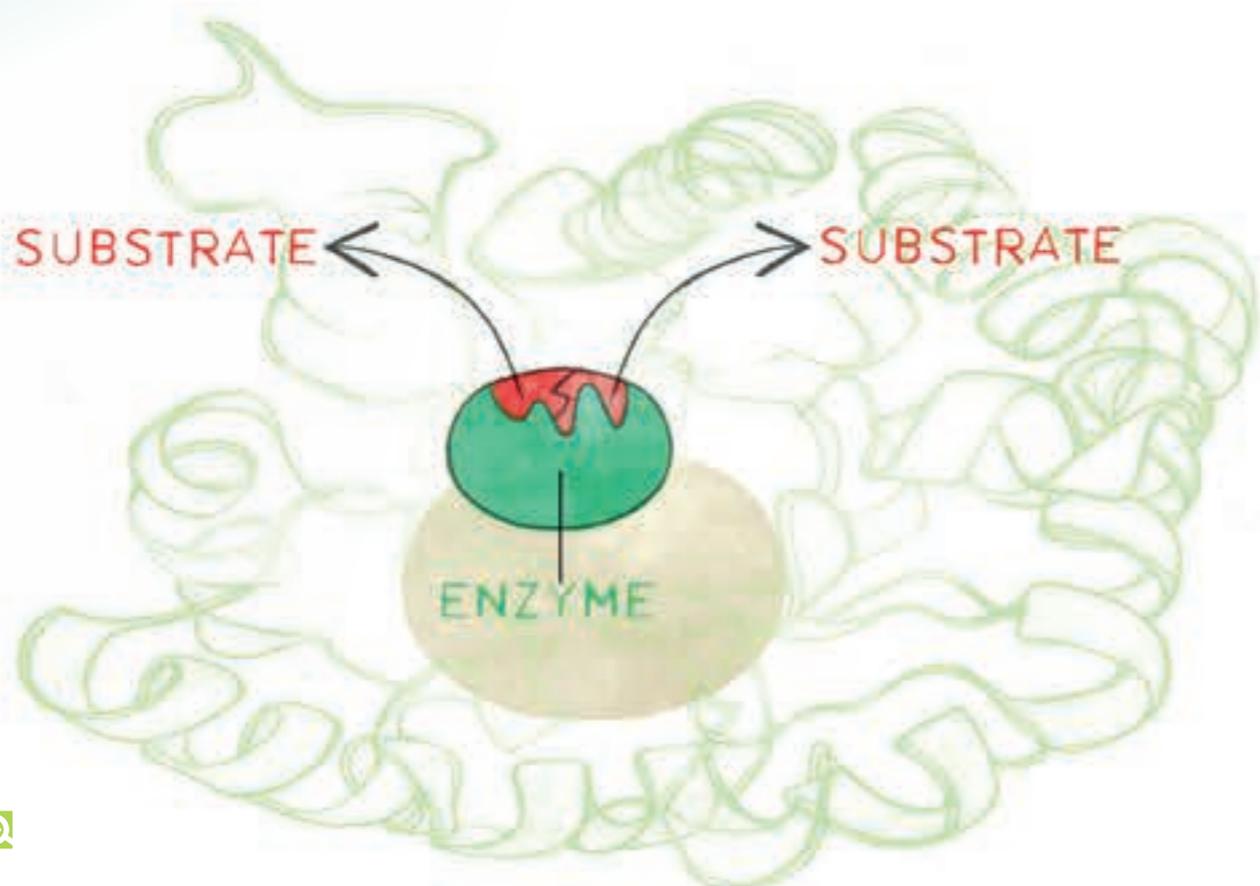


Figure 3: The substrate combines with the enzyme, which lowers the activation energy of the reaction and the substrate is split into the resultant products.



YOURSELF

BEWARE OF MISS GHOST PEPPER



SO YOU LIKE IT MORE THAN HOT? YOU WANT THE HEAT OF THE SUN TO ENTER THE SANCTUARY OF YOUR VEGETABLE PLATE? YOU LIKE IT HOTTER THAN MAGMA? MEET MISS GHOST PEPPER AND HER FIERY FRIENDS. SHE'S NOT HOT, SHE'S INCINERATING. JUST THE WAY YOU LIKE IT.

By Marco Barneveld, www.braindrain.nu

Peppers are the belles of the ball at any buffet table. Pure veggie eye candies, these ladies in their bright coloured dresses are an easy sell. Some of these ladies are hotter than then the others though, and some are almost too hot

to handle. Like lovely little Miss Ghost Pepper. Peppers, whether sweet or hot are, members of the plant genus capsicum, a term that derives from the Greek word kapto, which means 'to gulp'. They are members



of the nightshade family, which also includes potatoes, tomatoes and eggplant. They are not related to that other pepper, *Piper nigrum*, you grind on your food. When Columbus tasted the small, hot red “berries” he found on his Caribbean voyages, he believed he had reached India, where Europeans obtained black pepper, and called them red pepper. He was a bit off that Columbus as the world figured out soon, but the names has stuck although the native peoples of the Americas had been growing and enjoying sweet and hot peppers for an estimated 7,000 years. When Columbus’s ships brought them back to Spain, traders spread them around the world and the pepper became an instant hit everywhere she showed up in kitchens, wrapping cuisines around her delicious little finger from Morocco to Hungary, and India to China.

Like dying

In some places people liked their food hotter than elsewhere. And since the pepper is easy to grow and to cross many varieties of these ladies popped up around the world with the ghost pepper being one of the hottest varieties on this little blue planet. In fact from 2007 until 2010 Guinness World Records stated that the ghost pepper was the hottest. The orange and red little lady rated over 1 million Scoville heat units, a range that identifies how spicy a pepper is. In comparison: that is four hundred (400!) times hotter than Tabasco. Eating a ghost pepper is tricky because when you first put it in your mouth, it has a sweet flavour. But, about 45 seconds after putting in your mouth, the fiery sensation starts and continues to intensify for 10 to 15 more minutes. At the very least, you’ll experience a painful, stinging sensation on your tongue when you eat a ghost

pepper. Your lips, gums and inside of your mouth will likely sting quite painfully as well. Eating just a small piece can also make your eyes water. Your upper body might break into a sweat and your heart might beat faster when you eat a ghost pepper. The heat begins to cool down about a half hour after starting to eat. Digonta Saikia, an Indian farmer who grows ghost peppers, told NBC News that eating one of these peppers is ‘like dying’ because they are so intensely spicy. Great fun, right? Yeah, you know you want them.

Hot ‘n healthy

So, I’ve got you thinking about growing them yourself? Let me add a little more spice to this plant. Peppers are very healthy. When ripe and thus red they contain more vitamin C than citrus fruits, massive amount of vitamin E and a lot of carotene. But the stuff that makes ghost pepper hot is called capsaicin: the hotter the pepper, the more capsaicin. This phytochemical exists, most likely, to deter animals from eating peppers, and is also the active component of pepper sprays used for self-defence. Yet for humans it offers a myriad of health benefits. If you don’t rub it in your eye, that is.

A study published in Cancer Research found that capsaicin caused cancer cells to commit suicide. The substance caused almost 80% of prostate cancer cells to die in mice, and prostate tumours treated with capsaicin were about one-fifth the size of those in untreated mice. Capsaicin is also known as a painkiller. Studies have found that capsaicin both relieves and prevents cluster headaches, migraine headaches and sinus headaches. Capsaicin has potent antibacterial properties that fight and prevent sinus infections, or sinusitis. Because it is so hot, it also helps to stimulate secretions that help clear mucus from your nose, thereby relieving nasal congestion. This phytochemical may also help relieve sinus-related allergy symptoms.

Anti-inflammatory agent

Capsaicin is also a potent anti-inflammatory agent. Capsaicin is being looked at as a potential treatment for arthritis, psoriasis and diabetic neuropathy. A Duke University study (US) found that capsaicin might lead to a cure for inflammatory bowel disease (IBD). The substance can also help to kill bacteria such as *H. pylori*, which can help prevent stomach ulcers. Last but not least capsaicin may help to protect the heart by reducing cholesterol, triglycerides and platelet aggregation. It may also help the body dissolve fibrin, which is necessary for blood clots to form. Further, cultures around the world that use hot peppers liberally in their meals have significantly lower rates of heart attack and stroke than cultures that do not. And the list of health benefits doesn’t stop. It also helps losing weight. Capsaicin increases metabolic activity. This, in turn, helps to burn calories and fat. You like it a bit less chilli and bit more chill? Well, about 80% of the capsaicin in a chilli pepper is in its ribs and seeds, which is why much of the heat is removed when these items are taken out.

Grow it yourself

The fun thing about growing rare species like ghost pepper is that they are very hard to get by since almost no grocery store sells them.

So, order your seeds online.

Growing ghost peppers is difficult compared to other peppers due to their requirements for a certain amount of humidity and heat, which is in direct relation to their heat index. In order to best grow these peppers, your climate should most closely match that of their native India, which has five months of intensely high humidity and temperatures. If your growing season is short, the ghost pepper plants can be moved indoors in the evening; however, these plants are sensitive to shifts in their environments and a lot of moving around may damage the plants irreparably.

Best indoor

The surest way of growing ghost peppers is indoors or in a greenhouse where temperatures can be maintained at 24 degrees Celsius. Seeds for ghost peppers take around 35 days to germinate in very warm soil between 27-32 degrees Celsius while keeping the soil moist consistently.

Use full sun fluorescent light bulbs to maintain temperature and humidity. Fertilise the newly planted ghost pepper plants, and then two or three more times during the growing season. Alternatively, use a controlled release fertiliser to feed during the whole growing season. And lastly in the care of ghost chilli peppers, maintain a regular watering regime to avoid shocking the delicate peppers.

Pinch off first flowers

As difficult as it might be for you, pinch off any early blossoms that appear on your pepper plants. This won’t harm the plants. In fact, it helps them direct their energy into growing, so you get lots of large fruits later in the season (and a higher overall yield) instead of just a few small fruits early on.

Reap the bounty

You can harvest the peppers at their immature green stage, but the heat will grow more intense if you wait for them to turn their mature colour orange slash red. To be on the safe side when harvesting ghost peppers, you might want to wear gloves to prevent any burns from the peppers. You can save them for a long time while frozen in your freezer.

Eat it yourself

Big fat warning: when you’re handling ghost peppers, wear gloves to protect your hands, and be careful not to touch your face or eyes. Wash your hands frequently and thoroughly, and clean your cooking equipment carefully. If you’re grinding the peppers in a food processor or blender, be careful to avoid inhaling any dust that may arise; it may be a good idea to wear goggles. Ready? Hit it, ghost peppers!•



R E C I P E



GHOST SALT

This recipe will give you the most of the taste of Miss Ghost pepper. It will also preserve it. The salt absorbs all of the heat from the peppers. This is especially fantastic because the salt will dissolve into whatever you cook and spread the heat through the dish without dramatically changing the flavour.

You need:

500 gram of ghost peppers or 120-gram ghost pepper puree.
500 gram of sea salt.

Do it like this:

Rinse peppers and remove stems. Place peppers in blender and blend fine
In a clean jar, mix peppers and salt. Shake. Over the next few days, shake once per day (it’s ok if you forget). This helps distribute the salt. You will likely find that a liquid forms in the salt. You can continue to add salt if you wish until the liquid eventually is absorbed into the salt. Sprinkle it on anything you crazy heat lover.

ENJOY.



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, to submit your question.

Question

Hi! I just bought a lot of CANNAZYM for my hydroponic systems. I'm confused with the dosage guide on the bottle. The total amount of water per system is 200 litres. Do I add 250ml to the system or do I add 25ml to 10 litres and then add the solution to my system? I am afraid to overdose :-)

Thanks! Martin

Answer

Hi Martin!
CANNAZYM has to be mixed with all nutrients and additives in the water. Your system is 200 litres, which means you have to add $200 \times 2.5 (25 \text{ ml}/10\text{L}) = 500 \text{ ml}$ of CANNAZYM to the solution. Overdosing additives like CANNAZYM is hardly possible, but it is a waste of money. Overdosing nutrients however is another story. That is why you have to check after you dose the nutrients to the water, if the EC is correct. Good Luck!

Question

Having not used any of your products before I have decided to use it in my greenhouse for tomatoes, cucumber and peppers. Is it ok to use CANNA Terra Professional and CANNA Coco Pro Plus at a ratio of half and half in the same pot? Thank you. Kind regards Sam



Answer

Hi Sam,
CANNA Terra Professional Plus has already 5% coco in it. A higher percentage makes the product more to the coco side. Coco absorbs (eats) a lot of calcium and magnesium away from the nutrient solution in your substrate. That is something tomatoes and cucumber need a lot too. Due to this, if you are going to work on a 50:50 basis you probably will be better off with the CANNA Coco A/B nutrient. However growing on coco is more difficult compared to Terra because it has no lime buffer. The lime buffer in the remaining 50% Terra could be too small and will make Terra after a while very acid. Ideally, we would recommend either growing on 100% coco with CANNA Coco A/B and controlling the pH and EC all the time or staying with 100% Terra Professional Plus and CANNA TERRA nutrients alongside.

Wow. I love this submission forms detail. After a lot of research, I can

When using a Azadirachtin pestcontrol product as a drench, s

I have been using the add it to the nute's or just pour it in?

Question

Hi there! I have used your CANNA TERRA and now I am moving on to CANNA COCO. My question is that if a plant likes a pH at say 6.3 in soil then why, if it's the same plant, in coco does it like a pH of 5.8? It's the same plant so why the difference? Sorry if it's a simple question, I just cannot get my head round it. Thank you!

Answer

Hi! Actually a plant can absorb the nutrients most optimally between a pH range of 5.2 and 6.2.

But...

CANNA TERRA is made of peat, which is an acidic ingredient. We have to lime it to make it stable at 6.0. If we give a lower pH than 6.0 on CANNA TERRA we break down that lime(buffer) more and after a while we end up with just the pH of the peat, which can be 3.5-4.0. The peat will decompose (break down) at that pH very fast, now it is in the air (under water, like in nature, no problem).

CANNA COCO is not limed, but still an organic substrate. If you add acid (pH-) on an organic material, it will burn that organic material away. (Ever spoiled a drop of pH- on your trousers?)

Rockwool, clay pebbles or other inert substrates can handle the whole range in pH. A lower pH will not interfere with the substrate. However, when you give a lower pH, or the plant creates a lower pH in the substrate than 5.0, the uptake of nutrients will chance (deficiencies) and even lower, the root will break down too. Although a root is strong, it is an organic material too.



Question

Hi, could you tell me whether CANNA Coco A/B nutrient contains any ingredients of animal origin or animal by-product either as an ingredient or in the manufacturing process? Many thanks for your help. Charlene

Answer

Hi Charlene,
In a nutshell: no. CANNA Coco A/B is a mineral nutrient and only contains nutrient salts. These we dig up everywhere over the world. These nutrient salts are actually derived from stones whose process of creation took millions and millions of years. Some organic fertilisers and additives can be made from animal (by)products, however the BIOCANNA nutrients and the BIOCANNA additives are not, they are always made from plants or plant extracts.

Hope this helps!

Question

Dear Sir/Madam, I have a full bottle of BIOCANNA Terra Vega which had expired five months ago. Can I still use it? Thank you for your service! Mate

Answer

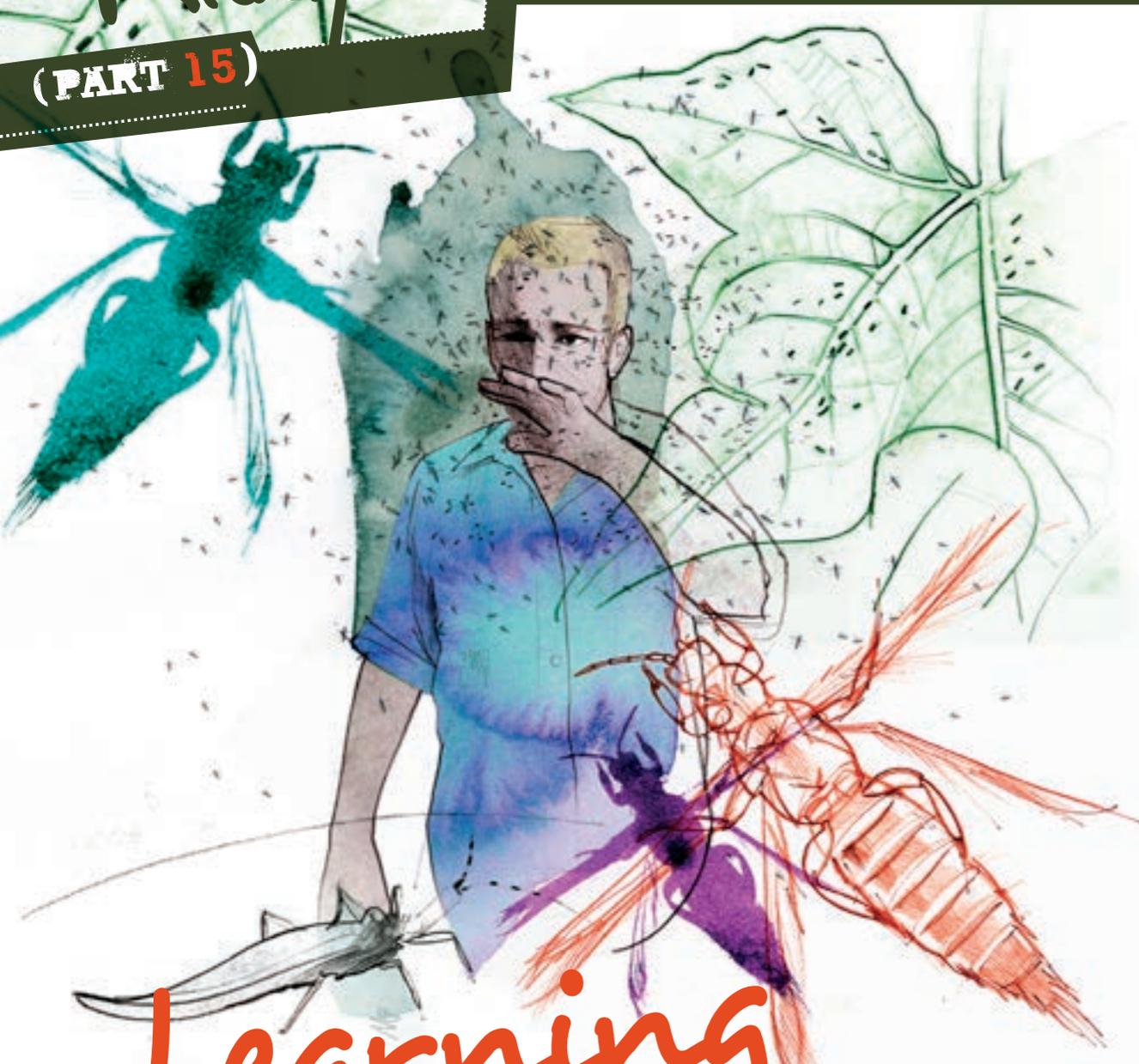
Hi Mate,
It depends; there are a few quick checks you can make.
1) If the sealed bottle is still in good shape (not blown up or inflated) the chance there it is still OK.
2) If you know the smell of a good BIOCANNA Terra Vega and this one is still the same, it is still OK.
3) If after shaking the bottle, everything is in the liquid again (nothing drops to the bottom directly) the product is still OK.
4) If you have an EC meter. After preparing the nutrient solution, the EC should not be higher as 1.0 if it is, don't use it.
However please be aware as soon you open the bottle, this product will then begin to decompose at a much faster rate than normal. Of course we would recommend buying a new one, because an organic nutrient that has decomposed heavily can harm and even kill the plant!



Don & Nicky

(PART 15)

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.



Learning THE HARD WAY

What a difficult few months it's been! I can trace all my problems back to one silly mistake: no lids on my reservoirs. My chilli plants, growing directly above in rockwool slabs, deposited numerous aborted flowers and leaves into their liquid food source, fouling it with rotting foliage and clogging up pumps and drippers with debris. The result? Some plants got fed. Some didn't. Fruits didn't

set properly. Salts built up in the slabs to the point where the run-off tested at more than 3.6 mS—more than twice the strength of the feed solution! Unsurprisingly more leaves dropped and I came to the unhappy conclusion that it was time to start over. Wow! I had finally managed to give chilli plants more abuse than they could handle. A dubious accolade indeed.



The discovery of the thrips!



Silvery marks on leaves due to the thrips damage



The tomato plants transferred outdoors

In a last ditch effort to salvage some viable plant matter, not to mention self-respect, I took some cuttings from these deeply unhappy plants before dumping them. That—of course—was my next mistake as cuttings should always be taken from healthy, vigorous plants! What's more, the cuttings provided extended lodgings for my hitherto unnoticed guest—thrips! These pesky, virus-spreading pests then proceeded to hop on to my young and tender tomato seedlings—about sixty or so specimens destined for the advancing springtime outdoors.

The first sign was the silvery blotches and black spots on the tomato leaves. (Often growers spot the damage before the culprit.) I turned a few leaves over and there they were—dozens of them! There's no sinking feeling quite like discovering pests in your grow room. Experience tells you that they only thing to do is clear it all out, disinfect, clean and start over. Basically about two days of your life—or more, depending on the size of your grow.

I cleared out everything apart from the tomato starts. They were still young and small and, as such, perhaps salvageable. I found some organic pesticide on my shelf—its principle ingredient: azadirachtin, derived from neem.

I made a moderately strong solution and sprayed my seedlings liberally—being sure to achieve contact with both sides of the leaves. Next time I'll read the instructions more carefully and wear a respirator. You don't want to inhale this stuff.

A week later and it was like they were never there. Azadirachtin interferes with thrips' feeding and development cycle. Some growers apply a root drench as well to target any larvae lurking in the growing media but I decided on a different strategy. After the dust settled I deployed an army of *Amblyseius cucumeris*, a predatory

mite that targets the hatching eggs and larvae of the thrips. The mites came in sachets full of vermiculite and sustenance to keep them alive during transit. I decided to open up the sachets and pour them directly on to the growing media in each pot. I also hung a few extra sachets around the plants for more gradual, slow release.

I have since potted on my best tomato plants to five litre pots and given away the rest to neighbours in their nursery pots. (I'm forever buying new nursery pots for this reason.) I chose to remain reticent about the thrips, pesticides, predator mites or the mineral fertilisers I used to boost growth. Most of the beneficiaries are clueless wannabe hippies who consider it unnatural to even prepare the soil with organic inputs. They are lucky to even get a salad bowl's worth of tomatoes at the end of the season—suckers. In contrast, and yes—to imbue them with jealousy—I lavish considerable attention and expense on my outdoor plot each year. This time I dug some really deep holes in my allotment and remediated the planting sites with a sizzling-rich mixture of bat guano, chicken manure, seabird guano, feather meal (great for slow release), bone meal, powdered sea kelp and plenty of organic compost. When nighttime temperatures reliably reach 14 degrees Celsius or more (about mid May in this part of the world) it's time to plant out. 14 degrees is my minimum for outdoor, unprotected tomatoes. I prefer to plant out on mild, cloudy and humid days of around 18 or 19 degrees—a nice gentle transition from my grow room to the great outdoors.

I've retained the best specimens (the offspring of the Baxter's Bush determinate variety I grew earlier in the year indoors) and intend to take multiple cuttings as a basis to experiment with different types of hydroponic feed. Hopefully it will be the last I'll see of the thrips for a long while as I intend to grow right through the summer in my basement. Fingers crossed it will be pest free. •



INDIAN SUMMER

DID YOU KNOW THAT...?

- A chemical called chlorophyll helps make photosynthesis happen.
- Chlorophyll gives plants their green colour.
- As summer ends and autumn comes, the days get shorter and shorter. This is how the trees *know* to get ready for winter.
- During winter, there is not enough light or water for photosynthesis. The trees will rest, and live off the food they stored during the summer. They begin to shut down their food-making factories.
- The green chlorophyll disappears from the leaves.
- As the bright green fades away, we begin to see yellow and orange colours. Small amounts of these colours have been in the leaves all along. We just can't see them in the summer, because the green chlorophyll covers them up.
- The bright reds and purples we see in leaves are made mostly in the fall.
- In some trees, like maples, glucose is trapped in the leaves after photosynthesis stops. Sunlight and the cool nights of autumn cause the leaves turn this glucose into a red colour.
- The brown colour of trees like oaks is made from waste left in the leaves.
- It is the combination of all these things that make the beautiful Indian Summer foliage colours we enjoy each year.
- But what is an Indian Summer? While it is not the formal name of any time of year, it is a commonly used expression that describes the sunny, warm days of fall after the colour of the leaves start to change.
- As well as being warm, the atmosphere during Indian Summer is hazy or smoky, there is no wind, the barometer is standing high, and the nights are clear and chilly.
- A moving, cool, shallow polar air mass is converting into a deep, warm, stagnant anticyclone (high pressure) system, which has the effect of causing the haze and large swing in temperature between day and night.
- The time of occurrence is important: The warm days must follow a spell of cold weather or a good hard frost.



What's HAPPENING



MAKE WAY FOR THE **MINI** VEGETABLES!

In Game of Thrones the dwarf Tyrion Lannister is massively popular, but not only in the fantasy TV-series are dwarves popular. Dwarf or baby veggies are taking the world by storm. Small is the new black.

But there are differences. By Marco Barneveld, www.braindrain.nu

Tomatoes the size of pearls: juicy massively sweet pearls. Mini-squash so adorable you almost not want to eat them. Thumbelina carrots. Were some people are battling for the biggest; others are trying for the smallest. We love them for their youthful good looks, and that's reason enough to eat them. But what are they?

Most baby vegetables are the real deal. Babies that is. They're harvested early and immature vegetables. Baby zucchinis, for example, are squash that have been picked prematurely when they're skinny and tender, before they reach the Zeppelin-like proportions that zucchinis left on the vine can attain in the blink of an eye. Baby fennel is legitimately young fennel: its liquorice taste is not as strong as that of the fully mature plant; and baby corn, sometimes, adorably, called cornlettes, those teeny cobs eaten whole, featured in Asian cuisine really is very young, prematurely picked corn. These are the veal of vegetables: tender and mild and innocent.

Fraudsters

Except when they're not. If some baby veggies are like baby cows, then others are more like full-grown midget cows, or they're not even cows at all. Baby broccoli, a.k.a. broccolini, is actually a hybrid of ordinary broccoli and kai-lan, a leafy broccoli relative also known as Chinese kale. The result is a slender, floppy broccoli with babyishly small florets. It's smaller than run-of-the-mill broccoli, but it's not a baby.

Take baby spinach. Anyone, confronted with baby spinach, would assume that they were eating infant, immature spinach, harvested in its carefree salad years before it had time to develop into serious-minded, grown-up spinach. This is, however, not true. Baby spinach is a small-sized version of conventional flat-leaf spinach. It's not a baby. It's a shrimpy but mature adult, the spinach equivalent of a toy poodle.

Baby cucumbers for another example, are a tiny, but adult, form of seedless Persian cucumbers. Baby beets, which come in both red and white, are adult beets that grow no larger than ping-pong balls. Baby cauliflower springs from miniature breeds whose heads, technically called curds, are just two inches across. They are veggies with a Peter Pan syndrome.

Fake dwarfs

Some vegetables have real babies and fake ones, too. Like mini onions. *Scallions* might be sold as baby onions but they come the Welsh onion, a different species altogether. Or *bok choy*: grocers sell a baby version harvested before it gets too big and fibrous. A true infant, perhaps, but also a hack; an Asian dwarf variety claims to be the real thing. Even the baby carrot, most of the time a very young carrot also has a real dwarf variety mentioned earlier: the Thumbelina carrot, a mini carrot that is roughly the size of a golf ball when harvested.

Other Lilliputian vegetables have more convoluted histories. Baby avocados, for example, also called *avocaditos* or cocktail avocados, develop from unpollinated avocado flowers, essentially the avocado version of virgin birth. Rather than fat leathery pears, baby avocados are the size and shape of dill pickles, seedless, and with butter-coloured flesh.

If you want to grow minis on your balcony or patch of land: go for the real dwarfs. They take up less space and they are fun to grow. Plus you might dazzle your public. One last thing: no throwing with the dwarfs. You know better than that. •

Let's go even smaller!

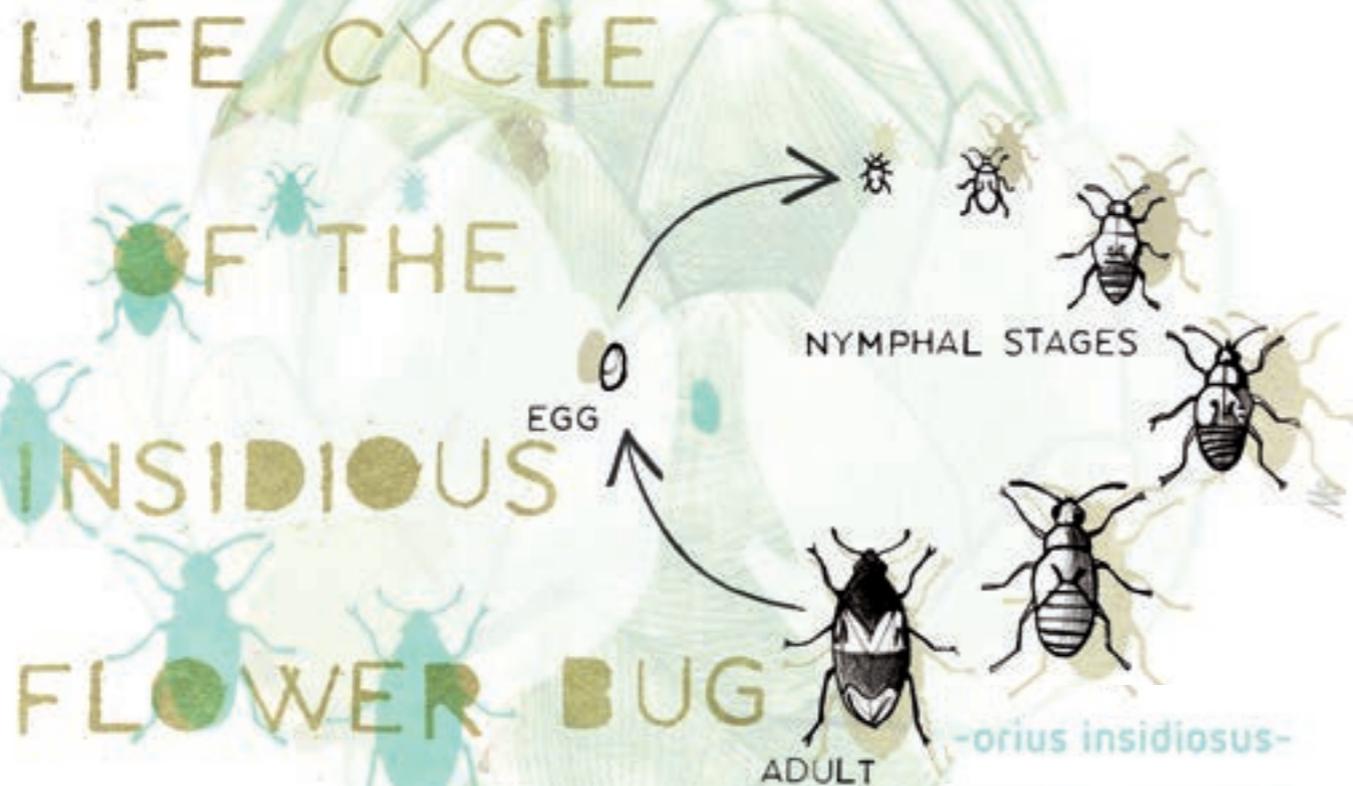
Baby veggies? Let's go even smaller with micro greens: positively neonatal veggies. Radish, arugula, cilantro, basil, spinach, purple mustard, kale, and red cabbage leaves just one to two weeks old. They are used to add color and taste to salads, sandwiches, and soups. Growing micro greens is relatively easy. A shallow plastic container with drainage holes, such as a nursery flat or prepackaged-salad box, will facilitate sprouting and grow out on a small scale. And they are soooo good for you. They have the highest concentrations of vitamin C, carotenoids, vitamin K, and vitamin E, respectively. In general, micro greens contain considerably higher levels of vitamins and carotenoids, about five times greater, than their mature plant counterparts, an indication that micro greens may be worth the trouble of delivering them fresh during their short lives. It also proves that small might be better in the case of vegetables. •





Pests & DISEASES

Minute pirate bugs (also known as flower bugs) are small, fast-moving predacious insects in the order Hemiptera and family Anthocoridae. Orius is a true bug, which means it has a long rostrum (feeding tube). It uses its rostrum to pierce its prey and drain the contents, killing the pest. There are several species of minute pirate bugs in the genus Orius.



MINUTE PIRATE BUGS (ORIOUS SPECIES)

Although Orius are polyphagous, they often show a strong preference for a particular type of food. They can feed on all stages of thrips, aphids, mites and other small Arthropoden (arthropods). Occasionally the flower bugs also feed on plant sap, but usually without inflicting great damage to the plant.

The species *Orius laevigatus* naturally occurs throughout the Mediterranean basin, from the Atlantic region of Western Europe to the Eastern Mediterranean, including Israel. *Orius majusculus* is a native of Central and Southern Europe and Asia Minor. The latter type can spontaneously migrate into

greenhouses, especially in July and August. In Europe, the species *Orius laevigatus* is used most often as a biological control, *Orius majusculus* is used to a lesser extent.

Orius insidiosus is widespread in the US and Canada. It is also found in Mexico, Central and South America, Cuba, Puerto Rico and other Caribbean islands. It is used in America for the biological control of thrips, but should not be used in Europe because of possible disturbance of the natural ecosystems where invasive species can drive local native species to extinction.

Appearance

Orius are hemimetabolous, meaning that they do not undergo the complete change of form between a larval phase and an adult phase in the way for example a butterfly does. Instead, their young are called nymphs and resemble the adults to a greater or less degree. The nymphs moult several times as they grow, and each instar (stage) resembles the adult more than the previous one. Wing buds grow in later stage nymphs; the final transformation involves little more than the development of functional wings and functioning sexual organs, with no intervening pupal stage as in holometabolous insects.

Adults are about 2-5mm long, oval to triangular in shape, somewhat flattened, black and have a characteristic white patch on their back.

Nymphs are colourless when they hatch, darkening to yellow, then dark brown as they grow. Fifth-stage nymphs have wing pads. All nymph stages have red eyes.

All stages of *Orius* move very quickly. The adults are good flyers and move around efficiently to locate prey. Adults are attracted to, and often found in, flowers.

Orius spp. occasionally may bite humans, but the bite is only temporarily irritating.

Lifecycle

Females lay tiny eggs 2-3 days after mating within plant tissues (main stem, leaf vein, flowers or petioles) where they are not easily seen. These hatch into nymphs which develop through five wingless nymphal stages. Egg incubation is generally 3-5 days and development from egg to adult takes a minimum of 20 days under optimum conditions. Females lay an average of 129 eggs during their life span, and adults live about 35 days. Females stop laying eggs when the daylight is less than 12-14 hrs. and *Orius* will diapause when day lengths are less than 11 hours. Several generations may occur during a growing season. Optimum conditions are temperatures over 59°F (15°C) with relative humidity over 60%. Females lay the most eggs at temperatures between 68°F (20°C) and 86°F (30°C). Above 86°F egg laying slows down considerably and survival of adults and nymphs is reduced. Higher temperatures and a good food supply are more important than the type of plant or relative humidity for rapid population buildup.

Use

The minute pirate bugs *Orius laevigatus* (Europe) and *Orius insidiosus* (USA) are voracious beneficial insects against thrips. Adults eat all mobile thrips stages, while nymphs prefer thrips larvae.

Orius will feed on virtually any soft-bodied insect that is small (close to their size or smaller). They are particularly fond of thrips, mites, aphids, whiteflies, leafhoppers, many kinds of insect eggs and tiny newly hatched caterpillars. Moreover, *Orius* also eat pollen, which enables them to build up a population in pollen bearing crops without the presence of prey. Both immature and adult bugs can consume numerous preys daily. For instance one study estimated the prey consumption of *Orius* to be 30 spider mites per day. They sometimes kill more prey than strictly necessary for their own feeding.

Orius holds its prey with its front legs and inserts its beak into the host body, generally several times, until the soft body is empty and only the exoskeleton remains.

Orius are also available commercially for mass release, particularly in greenhouse settings.

Important!

Only use products that are permitted in your country/state and crop. Check local registration requirements. CANNA cannot be held liable for unauthorized use. •



Figure 4: An adult Orius Niger up close



Figure 5: Minute Pirate Bug



Figure 6: Minute Pirate Bug in the nymphal stage



ENZYMES IN ACTION PART 2

WE HAVE HAD A LOOK AT WHAT ENZYMES ACTUALLY ARE AND HOW THEY FUNDAMENTALLY OPERATE IN GENERAL. FOR SOME OF YOU THOUGH, THAT MAY WELL NOT BE ENOUGH. YOU WANT TO KNOW EXACTLY WHAT IS HAPPENING TO YOUR PLANT IN THE DEEPEST DARKEST DEPTHS OF ITS ROOT ZONE AND PARTICULARLY HOW ENZYMES FACILITATE THOSE ELUSIVE PROCESSES. FORTUNATELY THAT'S PRECISELY WHAT WE ARE GOING TO BE DOING OVER THE NEXT FEW PAGES.

By NICO HILL BSc Floriculture / Horticulture

Rather than just regurgitate the usual generic marketing phrases like 'increases nutrient uptake' or "prevents disease" and glaze over any actual useful information about how they do so, we are going to go balls deep into them and see exactly how and why enzymes are so crucial. Following on from the previous article, this will focus more on the hows and whys from the point of view of the plant itself.

Enzymes and their applications

Let's start at the very beginning shall we? That's usually a very good place to start, at least according to Julie Andrews anyway. One of the first questions most growers ask themselves when considering a new product is when and how is it applied. Quite a crucial one really. You've just spent a fortune on some bottle of liquid your mate just recommended so naturally you want to make sure you are going to be using it correctly. With enzymes, that detail is on the surface of things pretty straightforward. You want to make sure there is as little amount of dead plant material messing things up in your media as is possible. Essentially making enzymes beneficial to use at almost any point of growth. So what if you are starting off from scratch with brand spanking new

pots, fresh new media and cuttings with the most glorious white and vigorous roots you have ever seen? With everything so fresh new and vigorous how can enzymes play a role there?

All too commonly you will see and hear recommendations that the use of enzyme products is only really necessary when you are re-using your growing media. "It breaks down dead roots doesn't it? Well I'm a fantastically green fingered gardener me. I don't let them get to the point where they have any dead roots. I'm literally God's gift to plants" Even if this were the case and you were in fact God's gift to plants, you will still find your media riddled with dead root material throughout all stages of your grow. Sorry to break it to you, we will explore why very soon.

The use of enzymes when re-using media is of course an ideal route to go down, there is no denying that. They break down the old roots and help to prepare the media for the following crop almost effortlessly for the grower. Likewise, when used in a natural outdoor environment, they are ideal to use to further break down any other random dead plant roots you will find in outdoor soils. Their use should be no means limited to that practice

ROOT TIP AND HAIRS

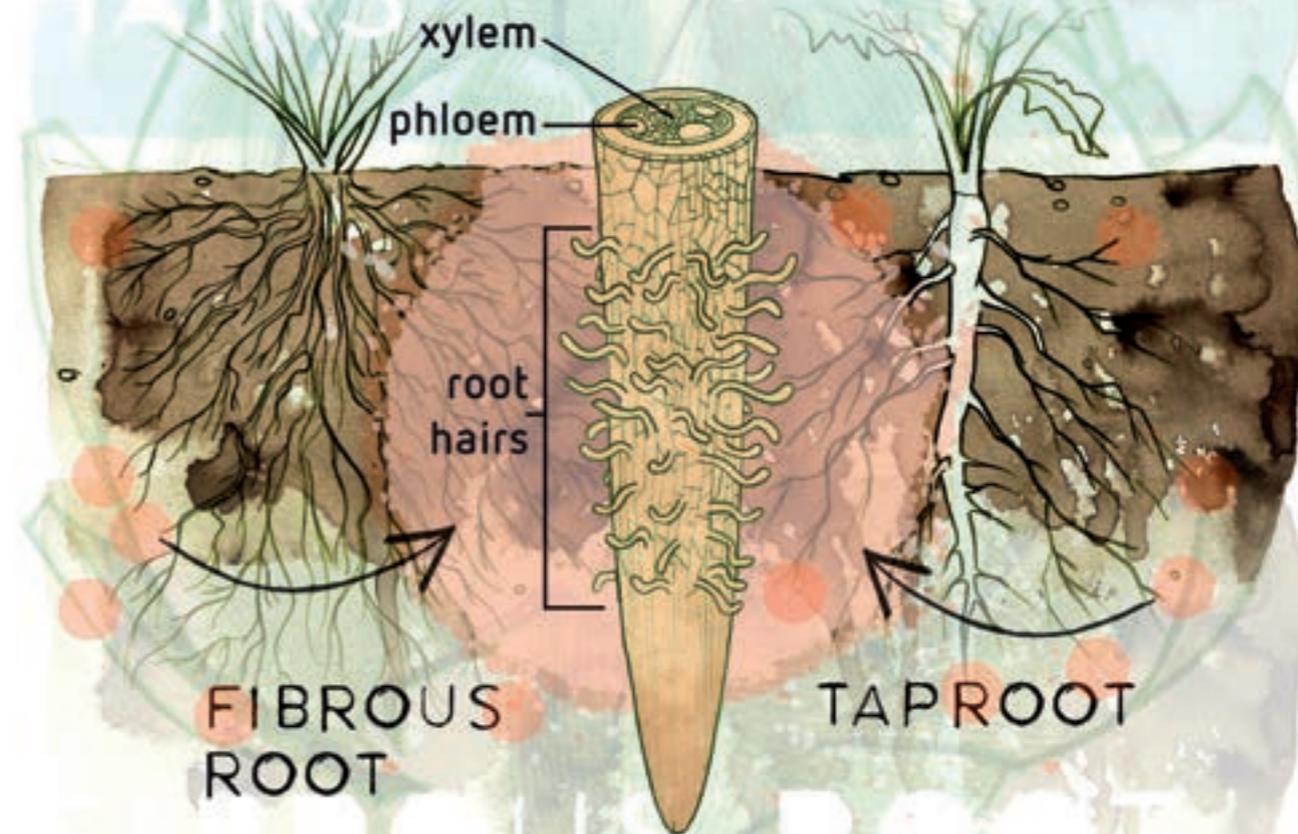


Figure 7: Tap root system and fibrous root systems. with sections of roots pointed out, labeled accordingly.

though. I can almost hear the gasps of disbelief from some of you at the back. So let's all sit back a minute, take a few deep breaths and have a closer look at exactly why that is shall we?

Roots Manoeuvre

At this point it is probably a good idea to stop talking about enzymes and start talking about plants. That's why we are all here isn't it? The love of all things green? Well yeah the top part of the plant is of course the visually pleasing side of things, but underneath that luscious green topiary lies the key to making all that fruit possible. A well functioning root

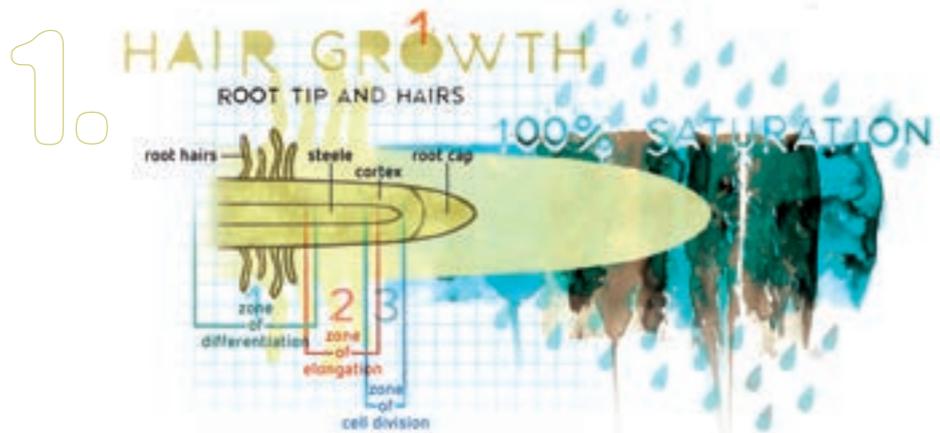
system is essential for a well functioning plant as a whole. In the above illustration you will see a generalised view of two typical root systems. The first is a Tap Root system and the second is a Fibrous Root system. "Why are there two types?" I hear you cry. In general, tap root systems will be produced from dicot plants when grown from seed. The very first root that makes its way out of the shell is called the taproot and the rest of the root system grows from that. However, if you then take a cutting from that plant the first root it produces will not be taproot, as it would have done from seed. Instead it begins a new life with a fibrous root system.





ENZYMES IN ACTION PART 2

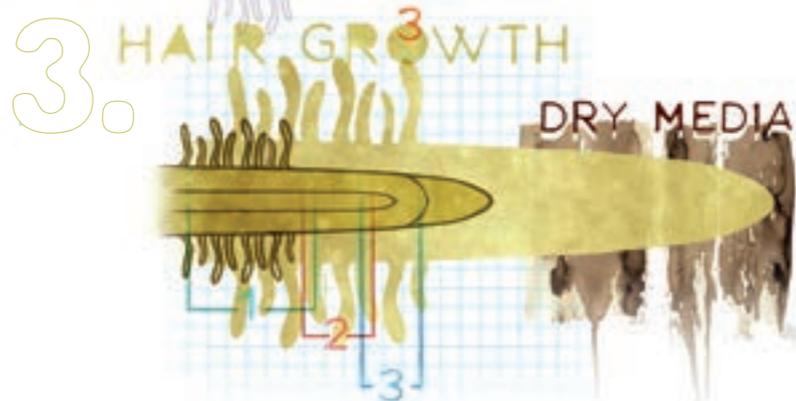
In either case, out of the entirety of the root system, the only parts that are capable and responsible for the actual uptake of water are the root hairs. You will notice that they are the tiny little bits right on the ends. In practice these are microscopic, way to small for the naked eye to see. If you take a look at the following diagrams, you will see what each root tip looks like. Try not to snigger; yes it does look at bit like a penis. The bits we are interested in here are the sections surrounding the root hairs. In particular, we want to look closely at what happens each time you water your plant.



Here you can see the medium is full of water, the small number of root hairs can easily take up enough water from such an abundance. **Phase 1**



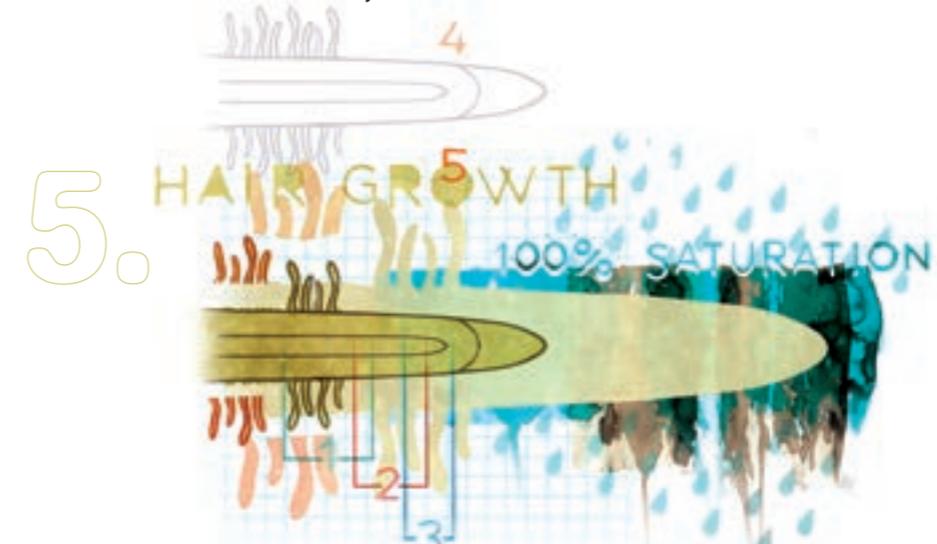
As the amount of available water becomes relatively limited, the root tip elongates and more hairy roots are created, to maintain optimum root pressure. **Phase 2**



With the water content now heavily limited the root tip elongates even further to produce even more hairy roots, to ensure transpiration rates don't exceed the root pressure. **Phase**



After watering, the high amount of root hairs are no longer necessary as optimum root pressure can be achieved from less root hairs in the freshly saturated medium. **Phase 4**



To ensure root pressure doesn't exceed transpiration rates, the root now sheds a large bulk of the hairy roots, leaving the dead material in the media. **Phase 5**

This entire process then repeats itself over and over until you eventually harvest your plant. It turns out that the life-giving act of watering a plant will actually kill part of it off. How's that for some good old-fashioned irony? Every time you water your plant more and more dead hairy roots will be accumulating throughout the media as the root mass grows. Taking up precious space in your plant pot and providing food sources for diseases; if only there was some way to get rid of them all. Oh yeah, that's right. Enzymes.

Secondly, dead plant material means a food source for harmful saprophytic bacteria/fungi. So without the use of enzymes, the cumulative build up of dead plant material means you are increasing the chances of contracting a root disease with every watering! Overly dramatic? Maybe, but getting rid of the useless dead matter not only recycles the nutrient locked up in it, but stops diseases from making use of those nutrients for their own sinister purposes!

Returned to whence they came

So then, if we can essentially digest the dead roots in situ with the use of enzymes, what does that actually mean for the root zone as a whole, and what impact will you potentially see on your growth?

Firstly, those dead roots actually contain some decent nutritional elements. For example, the cell walls are essentially comprised of Calcium and Phosphor, similar to the bones of a skeleton in a human. The nucleus of each cell is largely comprised of Nitrogen. Elements like this contained in dead root material will be made available again to the plant. Most significantly, they are available right next to the active part of the root zone, ready for immediate uptake.

Something out of nothing

So you can easily see that the breakdown of the cells instantly has two direct benefits for your plants. There are more benefits to be found though, but are more of an indirect nature. The very act of removing the dead root cells and creating lovely little pockets of space immediately around the active area of the roots also plays a significant role in creating optimal conditions for your roots. "For why" you say? Well that empty space isn't so empty after all, it contains something quite vital for a properly functioning root system: Oxygen.

It is not directly from these air pockets that the roots make use of this oxygen, but rather from the water in the media surrounding those pockets, in the form of



ENZYMES IN ACTION PART 2

dissolved oxygen (DO). The higher the amount of air pockets there are available, the higher the amount of surface area of water there is in contact with that air to absorb the oxygen. Therefore a relatively higher DO level in the surrounding root zone is maintained. While there are many implications, a healthy DO level will result in two key benefits.

Firstly, correct nutrient uptake relates directly to the levels of DO within the water in the media. The metabolic energy that is actually needed for the roots to uptake the surrounding minerals is produced through root respiration. A limited DO level means limited root respiration, which in turn means the root has limited energy and will be unable to take up minerals in sufficient concentrations for optimal growth. Conversely a high DO level ensures high root respiration, meaning roots have plenty of energy to quickly take up water and minerals for achieving optimal plant growth rates.

Secondly, the higher levels of available oxygen in the media mean a much more favourable environment for beneficial bacterial and fungal populations. Encouraging this micro herd to proliferate in your media has many positive implications from further increasing an already

high nutrient uptake, to providing a back up storage of water, to helping to fend off the attacks from anaerobic diseases such as Pythium. There are many ways these little dudes can help you out, so ideally you want to help to create as many of them as possible!

All about the roots an ting

So there you have it. Hopefully now you are a little bit more the wiser about the topic of Enzymes. In particular with this article, how their use actually translates into a tangible benefit from the plants' point of view. If your anything like me, it's all well and good being told "it improves your plants mate" but until you understand actually how and why that is, your unlikely to even entertain the thought using it. As is the way with a lot of things, you need to understand how the plant works in order to see how a particular product is going to be of any benefit.

Achieving an ideal root system is one of the key factors in achieving an ideal yield. Without the healthy foundation of a fully functioning rhizosphere, you are essentially pissing into the wind when trying to achieve yourself a bountiful crop. Enzymes are by no means the be all and end all to achieving this most holy of holy's, but they sure can go a long, long way to help!

A HAIR ROOT CELL

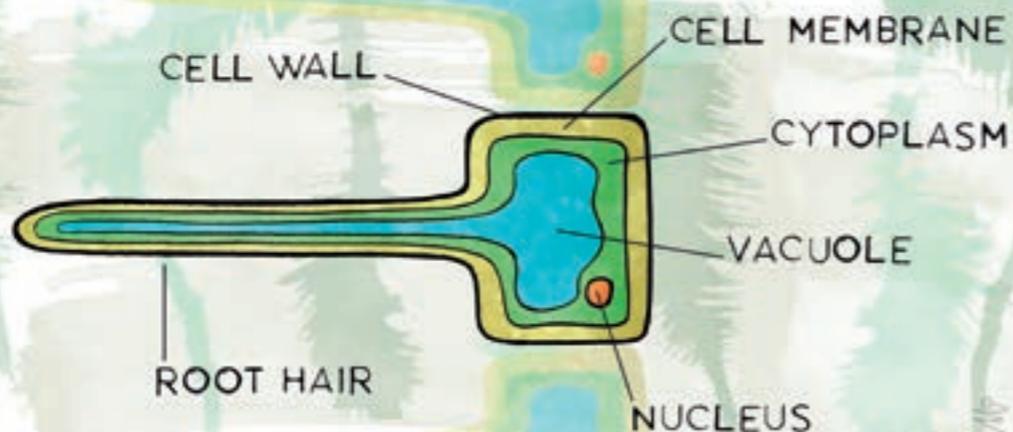


Figure 8: Hairy root cell

Growers

TIP #34

By your friend SEZ

...AND ENZYMES FOR ALL

Enzymes, the right kind, are beneficial to everyone, not just for the green thumb impaired or those who re-use their growing medium. While they can't compensate for all evils, they certainly bring a protection factor that every gardener can benefit from. Many times enzyme additives are compared to insurance policies but I personally prefer to think of them as guardian angels. After all we only call the insurance when bad luck has already struck ;enzymes are better at keeping troubles away than at fixing wrecks

Enzymes are generally lacking in hydroponic and soil-less growing mediums, because most of these are void of the natural beneficial bacterial and fungal activity that normally generate enzymes inthe soils of the great outdoors. Therefore, enzymes are a great addition to almost every growing situation.

By reducing the risks of pathogen outbreak and encouraging beneficial micro-life, a quality enzyme product will not limit itself to cleaning off dead root hairs but it will also optimize the whole root ecosystem. Establishing natural protection around your roots is a far better approach to root diseases than pesticides, whom are not only toxic but also usually not so efficient when it comes to fighting bacterial or fungal pathogens.

As enzymes convert the dead roots into nutrients, sugars that sustain beneficial organisms are also released. With healthier and more diverse micro flora around the roots, nutrient absorption will be improved just as much as the soil structure itself with better aeration and better distribution of the nutrient solution.

While enzymes can repeat their specific functions many times, they do eventually get deactivated and their levels will need replenishing to keep them working. For enzyme additives to function optimally they should be applied regularly to the growing medium. Therefore it is better to apply the recommended dose regularly, rather than opting for sporadic massive dosing.

CANNA recommends that growers who re-use their growing medium should double the dose of CANNAZYM a week or two before the end of the crops, as the amount of dead root material remaining in the medium will be higher than normal and need to be cared for to ensure the new crop starts in a clean and safe environment. However growers should be aware that on their own, enzymes will not "cure" high salt situations, therefore they should always check and make sure the salinity of the medium is low enough not to damage the new plants.

Good luck and happy gardening!

CANNAtalk

SERIOUS GROWERS

CANNAtalk:

- Is published by CANNA BV, a company dedicated to finding the best solutions for growth and bloom.
- Is distributed through local UK retailers and wholesalers.

Editor: Karin Brinkman
 E-mail: info@CANNAtalk.com
 Phone UK office: 0870 240 2991
 Printed by: Koninklijke Drukkerij E.M. De Jong

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#34



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