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:

HQTalk:

Enzymes. You got to love these little bio-chemical helpers. Perhaps you don't quite know why yet, but after reading this issue you'll know everything you need about these tiny little, protein based missionaries.

Personally I am a big missionary of spicy food. I am not ashamed to say that I like it hot, very hot. I eat red peppers fresh. I drown my food in Tabasco. But... The ghost pepper is just a little bit too hot for me. It's food for daredevils. But they are great fun to grow, if you are a bit experienced. I did try the recipe that comes with the Grow it yourself in this issue: ghost pepper salt. Hot dang. You've got to try it.

When I look outside the office window I can see the leaves turning red. Indian summer is coming. Do you know why they turn red? You will after reading the Factographic on page 16.

For now I wish you all happy growing. It will go even better with those little enzymes. I promise you.

Cheers,

Jeroen

Contents

Foto courtesy of Trinh nữ, Mác cở, 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 visualize 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.

Yeah 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: 1. Co-factors. Molecules (like Iron or Zinc ions) that increase the rate of reactions,

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2. Co-Enzymes. Organic molecules (commonly derived from vitamins) that bind loosely to enzymes and help them function or 3. 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). *(See figure 1)*

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. *(See figure 2)*

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 catalyze 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. *(See figure 3)*

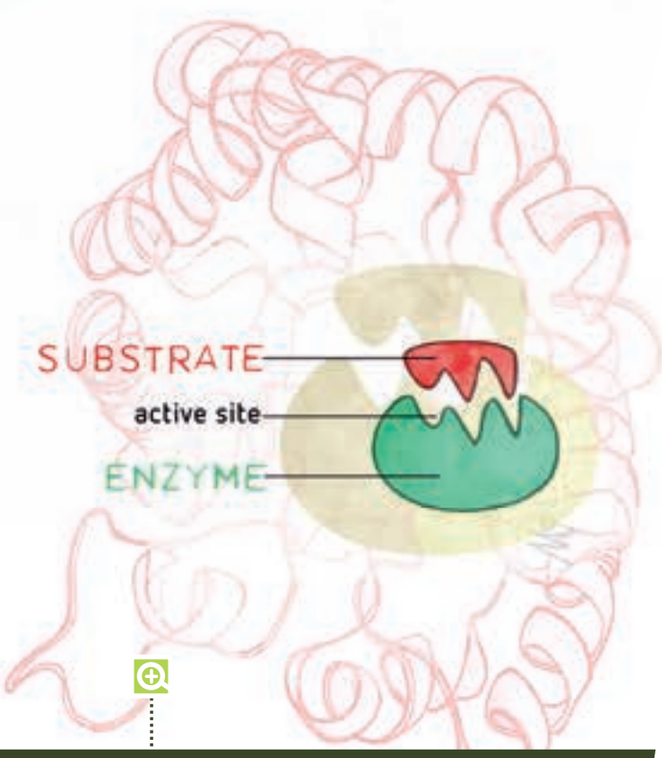

Figure 1: The physical shape of the active site, perfectly matches the substrate. Each unique enzyme has its own unique purpose.

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 centers 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.

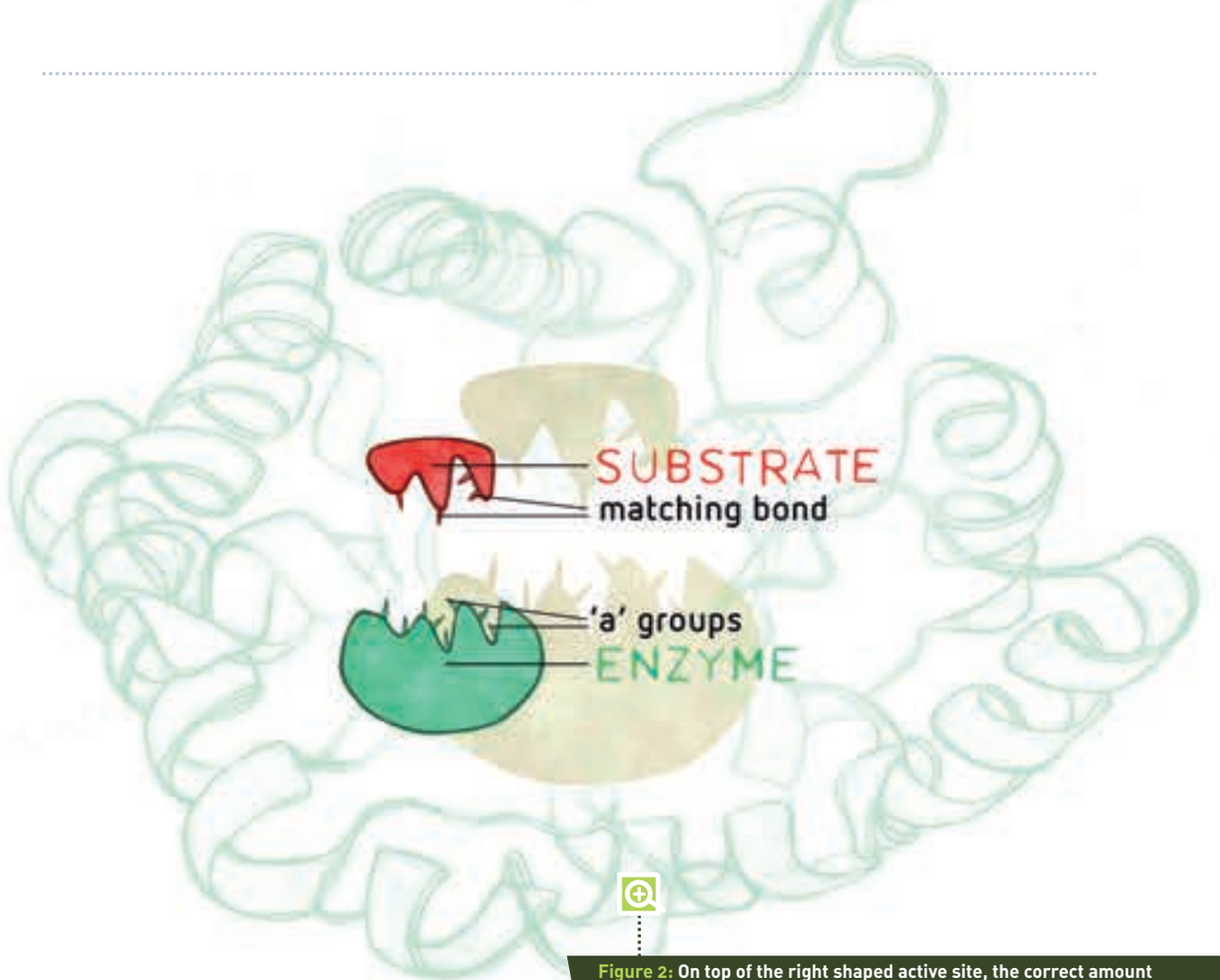

Figure 2: On top of the right shaped active site, the correct amount of R bonds must be in place for the reaction to be possible.

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 dollars 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

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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 (www.cannagardening.com/video and watch one of our top scientists show you how (we do let them out occasionally). All you need are some cups, paper, applesauce, 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. •

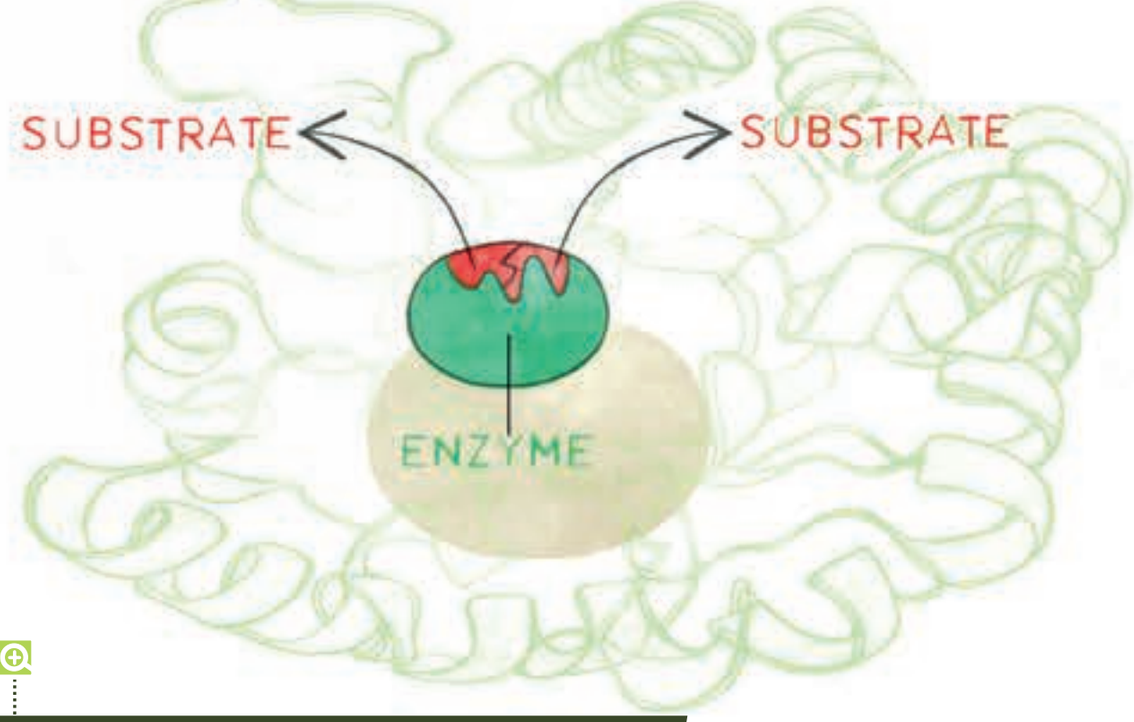


Figure 3: The substrate combines with the enzyme, which lowers the activation energy of the reaction and the substrate is split into the resultant products.

GrowIT 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 colored 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 the mark as the world soon figured out, but the names had stuck even though 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. Since the pepper is easy to grow and to cross breed, many varieties of these ladies popped up around the world with the ghost pepper being currently 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 flavor. However, about 45 seconds after putting in your mouth, the fiery sensation starts and continues to intensify for a further 10 to 15 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 half an 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 then citrus fruits, massive amounts of vitamin E and a lot of Carotene. 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. It is also the active component of pepper sprays used for self-defense. 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 tumors 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 also has potent antibacterial properties that fight and prevent sinus infections, or sinusitis. As 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. It 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. Furthermore, 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.

The list of health benefits doesn't stop there. It also helps in losing weight. Capsaicin increases metabolic activity. This, in turn, helps to burn calories and fat. You like it a bit less chili and bit more chill? Well, about 80% of the capsaicin in a chili 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 come 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 optimally 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 75F. Seeds for ghost peppers take around 35 days to germinate in very warm soil between 80-90F while keeping the soil consistently moist.

Use full sun fluorescent light bulbs to maintain temperature and humidity. Fertilize the newly planted ghost pepper plants and then two or three more times during the growing season. Alternatively, use a controlled release fertilizer to feed during the whole growing season. Lastly in the care of ghost chili 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 color orange or 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 if stored 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 pepper!•

RECIPE

GHOST SALT

This recipe will give you the most out of the taste of Miss Ghost pepper. It will also preserve her. 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 flavor.

You need:

2 cups of ghost peppers or 1-cup ghost pepper puree.
2 cups of sea salt.

Do it like this:

Rinse peppers and remove stems. Place peppers in blender and blend until fine. In a clean jar, mix the 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 is eventually 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-hydroponics.com, to submit your question.

Question

It seems that if the 5 gal pots get more than 1 quart of feed at a time that the leaves curl down and look like a bird's claw. Could this be caused by fungus gnats?

Answer

This should not be the case except where the roots are damaged or the container too big. Make sure you re-pot to the size of the plant. Seedlings are started in small cells and transferred to 4 inch containers for a few weeks until the roots fill the container, a couple weeks, then moved to a gallon size container and then veg starts. Once the containers roots have filled out, move to the 5 gallon and hold veg for a couple weeks to develop roots and the top to a form to finish, then switch to flower. Getting to a 5 gal container takes 3 steps after the cutting has roots or the seedling has developed its 2nd set of true leaves. Make sure there are holes in the container to allow the water to drain!

Watering to drain allows gravity to remove the excess and the pores to open. The medium will only hold a certain amount of fluid. Watering at the correct point allows the roots to fill the container. If the roots are damaged, they have to grow past it which will take many days if damage has been done. Make sure you have the correct room conditions in humidity and temperature and water will flow correctly. Allowing the roots to sit in undrained water for more than 20 minutes will kill the roots. If you can access the root mass and find there are few if any then you know the problem. The root mass, done correctly, will equal the top mass. There may be a volume difference as the roots are confined and the top grows open, but the mass should be as close to the same as possible. So give it some time. Let me know if you do see the roots how they look but I think this entire issue is the water regiment the plants are under, and once there are issues, they will be persistent. Patience is the word, or start over is the other option.

Hope this helps,

Question

I use CANNA Coco A/B . When I use CANNABOOST can I mix it with A/B? Can I mix COCO A/B with both boost and PK 13/14?

Answer

Hello Sid,

Thanks for the question. Yes you can mix CANNABOOST with CANNA COCO A/B but only after mixing the A/B in the tank water. Do not mix them together at full strength.

First mix the A/B in the water as normal, and then add CANNABOOST. PK 13/14 can also be added to the tank mix after mixing the others in the tank water.

Question

Wow. I love this submission forms detail. After a lot of research, I can now see why I chose to go all CANNA for my first attempt at growing. Couple bags of 50L coco, CANNAZYM, COCO A/B, RHIZOTONIC and PK 13/14 is all I need correct? I have a 5x5 tent in my basement with some LED lights. My other question is what would you suggest the best way to water this set up for a first time grower? I had planned on putting a 20 gallon reservoir in the basement and just use that to hand water. Some people are telling me this is the wrong way and I should use a recirculating system. Thoughts? Thank you for time and help ..

Answer

First welcome to growing. Second, always, always keep it simple. Your system sounds fine however you will not produce great results with LED lights. They are not yet ready for anything other than seedling/ cutting work although many claim great results. Try it anyway and if you are not opposed to a little more electric use, add a 100 watt flood light in there to compensate for some missing wavelengths and to provide some UV light to help the pores know when to open and close. From this website, you should be able to download some of the articles from the CANNAtalk magazine on light.

While there, download a copy of the Coco Infopaper which will detail all the important things you will need to know, such as NEVER apply plain water to the coco medium once started as it will destroy the buffer and cause issues.

The tent and nutrient line are great; it's all you need for fertility. Follow the mix instructions for middle range feeding for start. Water, with nutrients, when 50% of what the container will hold is gone. You can do this by weight initially until you have a feel for it. Weigh a container full of medium before you add solution, add solution until you have good drainage, allow the container to stop dripping then weigh again. When half of the weight difference is gone, it is time to water again. Be consistent with when you water to avoid issues. Watch the temp and humidity close with the ideal range temperature mid 60's °F at night and below 85°F day is best. Humidity is best about 70% first few weeks dropping to 45-50% at harvest.

You do not want to start growing re-circulating, it is not for newcomers. Use the coco for a few crops to get the hang of all things. Also, there is no significant difference in quality or quantity of yields in re-circulating over a medium based system like coco, and the headaches are much, much less.

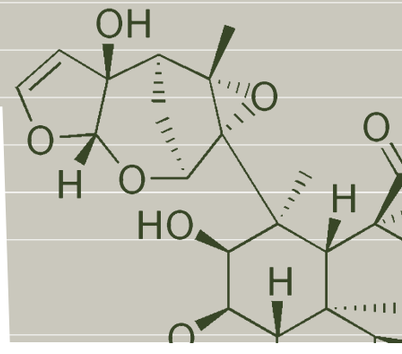
Having a tank setup in the basement is fine, but you really want the water temps above 62F if possible. Also it is best to use up the solution in 5 days' time. When I grow 4 or 5 large (5 gal) containers, I mix up about 7 gallons of feed then use it up when ready to water. Then, as the plant gets bigger, I will mix a tank worth.

When you do water, it is much better to water coco until you get good drainage at least 20% of what the medium will hold, so if it will hold 5 quarts of solution, I will wat er with 6 or 7 quarts. Drainage washes out unused ions and keeps problems low. Use PK 13/14 about 3 weeks after you change the light cycle for about 10 days on an 8 week flower group or a little longer for 9 or 10 week crops.

Otherwise, give the Coco Infopaper a good read, and have a look at the many articles we have available on the website about growing on Coco. And, we will always be here when you need us.

Question

When using a Azadirachtin pestcontrol product as a drench, should I add it to the nute's or just pour it in?

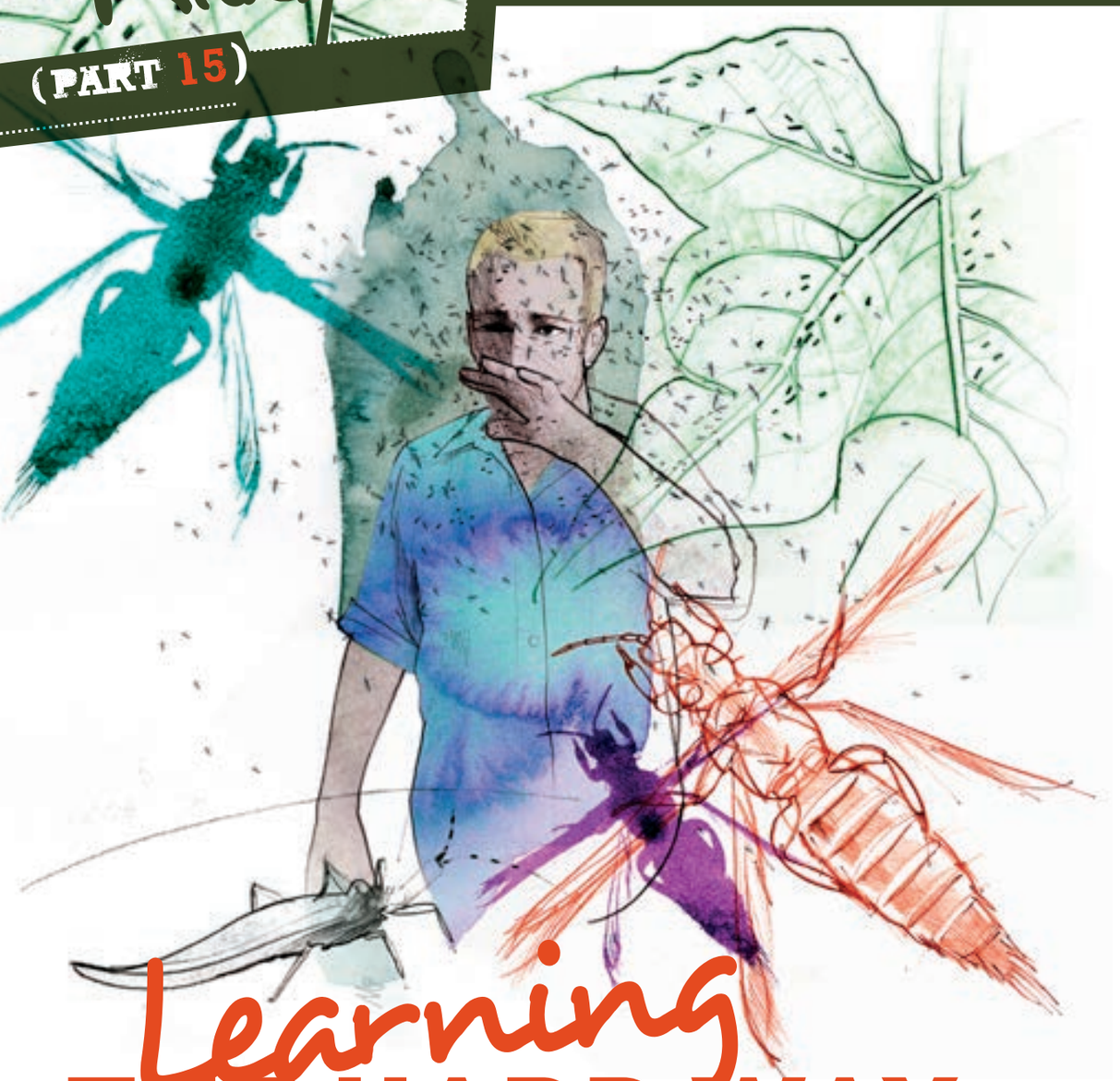


Answer

It is seldom a good idea to add agents of a pesticide nature with fertilizer or other chemicals without seeing how well they act with each other and when applied to a test plant. Prudence will protect the majority of the crop. In the case of Azadirachtin use, it is not a good idea mostly due to the oil based nature of the product. I find that the best method of application is to use it alone not with fertilizer. Follow the directions exactly and you only need a cup or 2, based on container volume. It seems best if used about 30 minutes before lights off then not to drain, just enough to run through the container and not when it is ready for irrigation but about half way there. It will throw your schedule off a bit but when you need this, you need this. In any event, I would try it on a single plant first and look for issues the next day, then go from there.

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 chili 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 chili 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 tomatoplants 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.

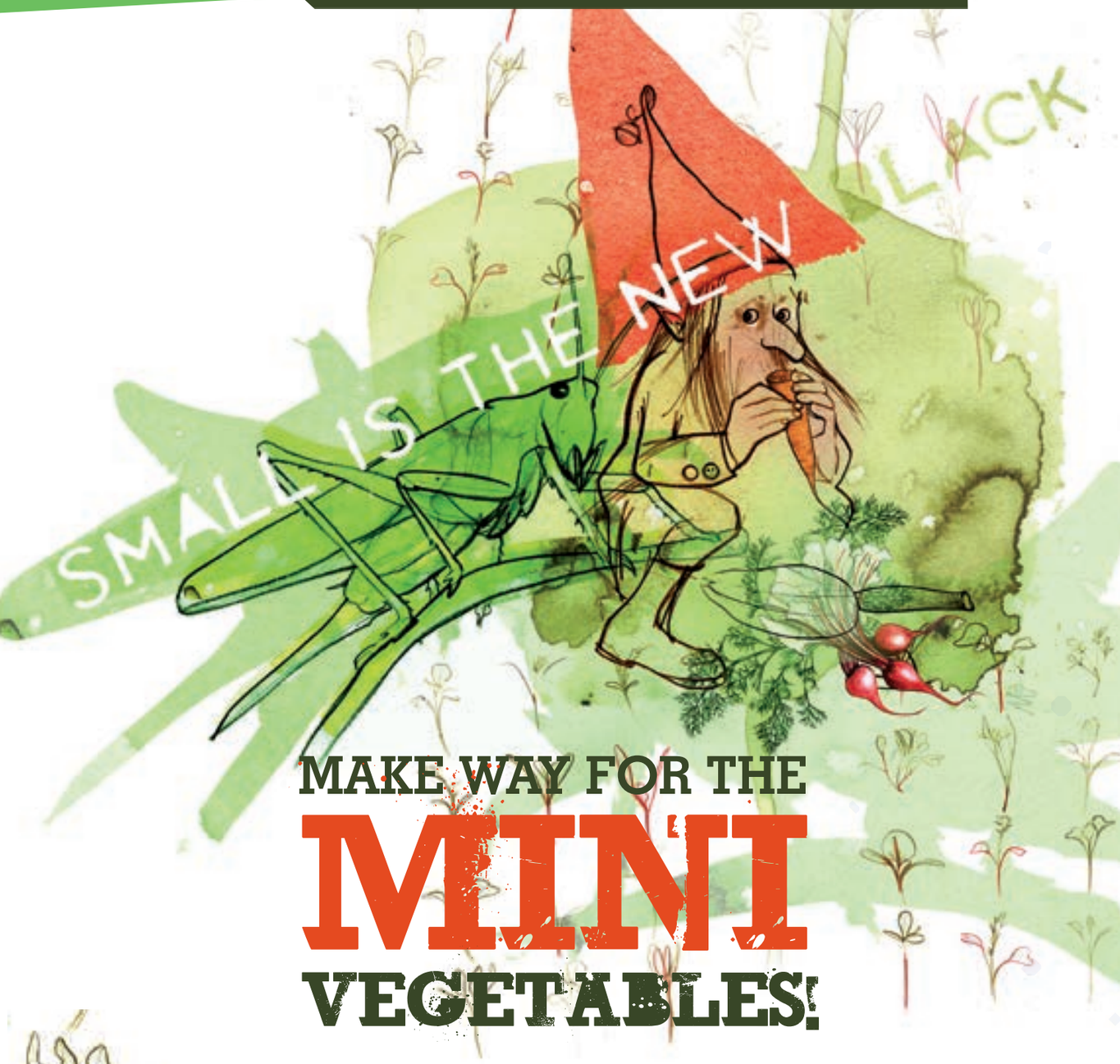
I have since potted on my best tomato plants to five-liter pots and given away the rest to neighbors in their nursery pots. (I'm forever buying new nursery pots for this reason.) I chose to remain reticent about the thrips, pesticides, predator mites or the mineral fertilizers I used to boost growth. 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 tomatos 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 tomatos. 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 color.
- 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 colors. Small amounts of these colors 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 color.
- The brown color 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 colors 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 color 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.



MAKE WAY FOR THE MINI VEGETABLES!

In Game of Thrones the dwarf Tyrion Lannister is massively popular. However it is not only in fantasy TV-series that dwarves are 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, intensely juicy and sweet little pearls. Mini squash so adorable you almost do not want to eat them. Thumbelina carrots. While some people are battling for the biggest, others are shooting 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 are essentially 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 licorice taste is not as strong as that of the fully mature plant. Baby corn, sometimes adorably called cornlettes (those teeny little cobs eaten whole) featured regularly in Asian cuisine is really just very young, prematurely picked corn. These are the veal of vegetables: tender, 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 sometimes 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 infantile, immature spinach, harvested in its carefree salad years before it had time to develop into a more 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, as 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 actually come from 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 the virgin birth. Rather than fat leathery pears, baby avocados are the size and shape of dill pickles, seedless, and have butter colored flesh.

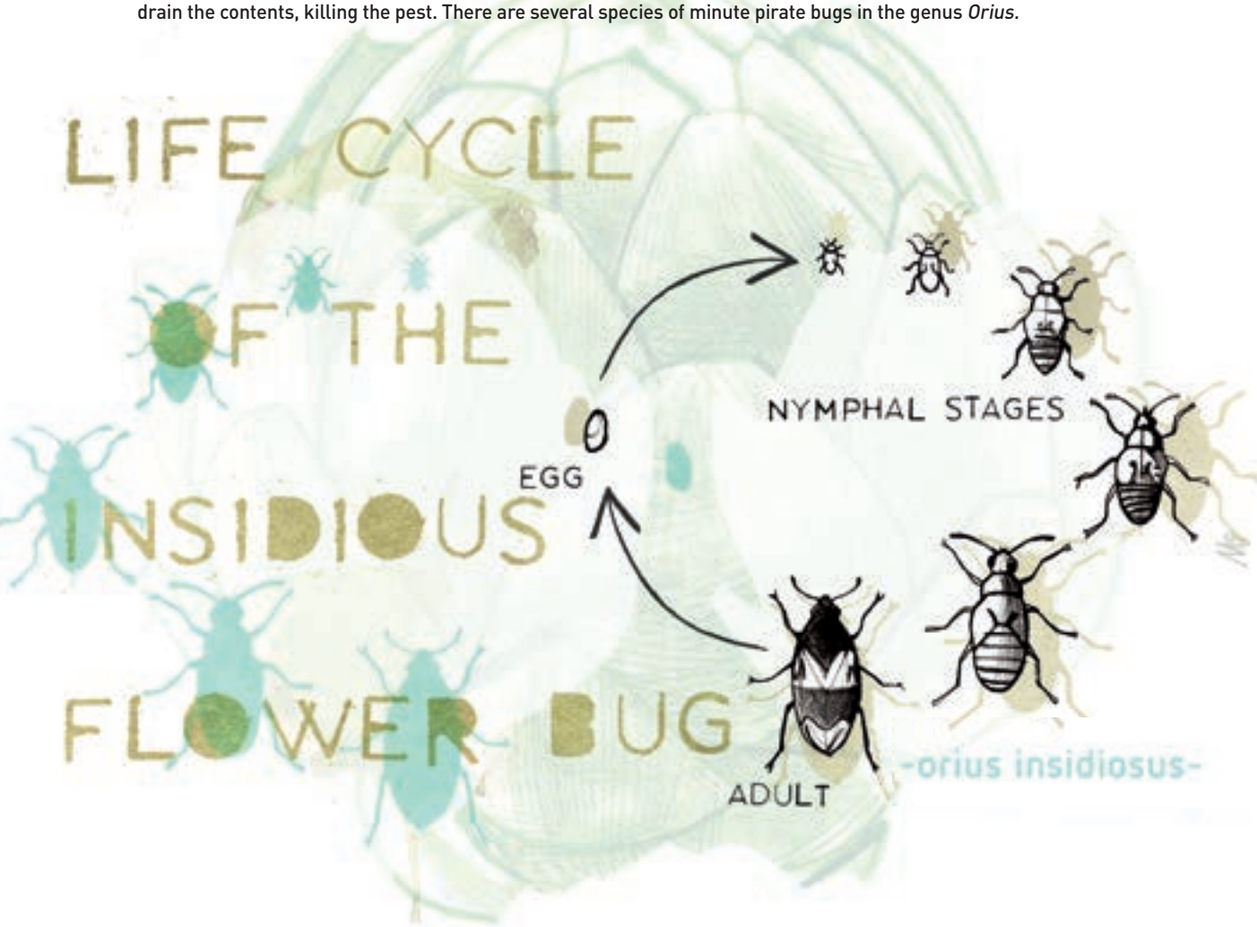
If you want to grow minis on your balcony or patch of land, go for the real dwarfs. They take up less space and they are fun to grow, plus you might dazzle your public. One last thing: no throwing the dwarfs. You know better than that. •

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. Also, 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

(ORIUS 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 Athropoden (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 and is also found in Mexico, Central and South America and to 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 offspring are called nymphs, and resemble the adults to a greater or lesser degree. The nymphs moult several times as they grow, and each instar 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 2–5 mm long, oval to triangular in shape, somewhat flattened, black and have a characteristic white patch on their back.
Nymphs are colorless 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 efficiently throughout 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

2-3 days after mating females lay tiny eggs 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 spans, and adults live about 35 days. Females stop laying eggs when the daylight is less than 12-14 hours 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 20°C and 30°C. Above 30°C 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 prey 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

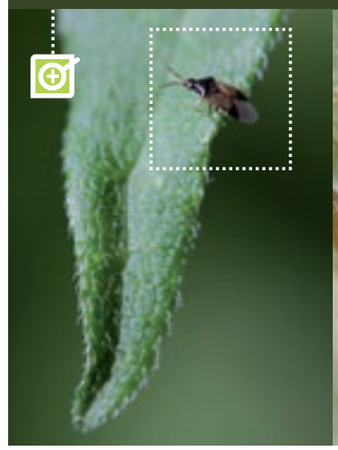


Figure 6: Minute Pirate Bug in the nymphal stage

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 on page 4, 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 straight forward. 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 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?

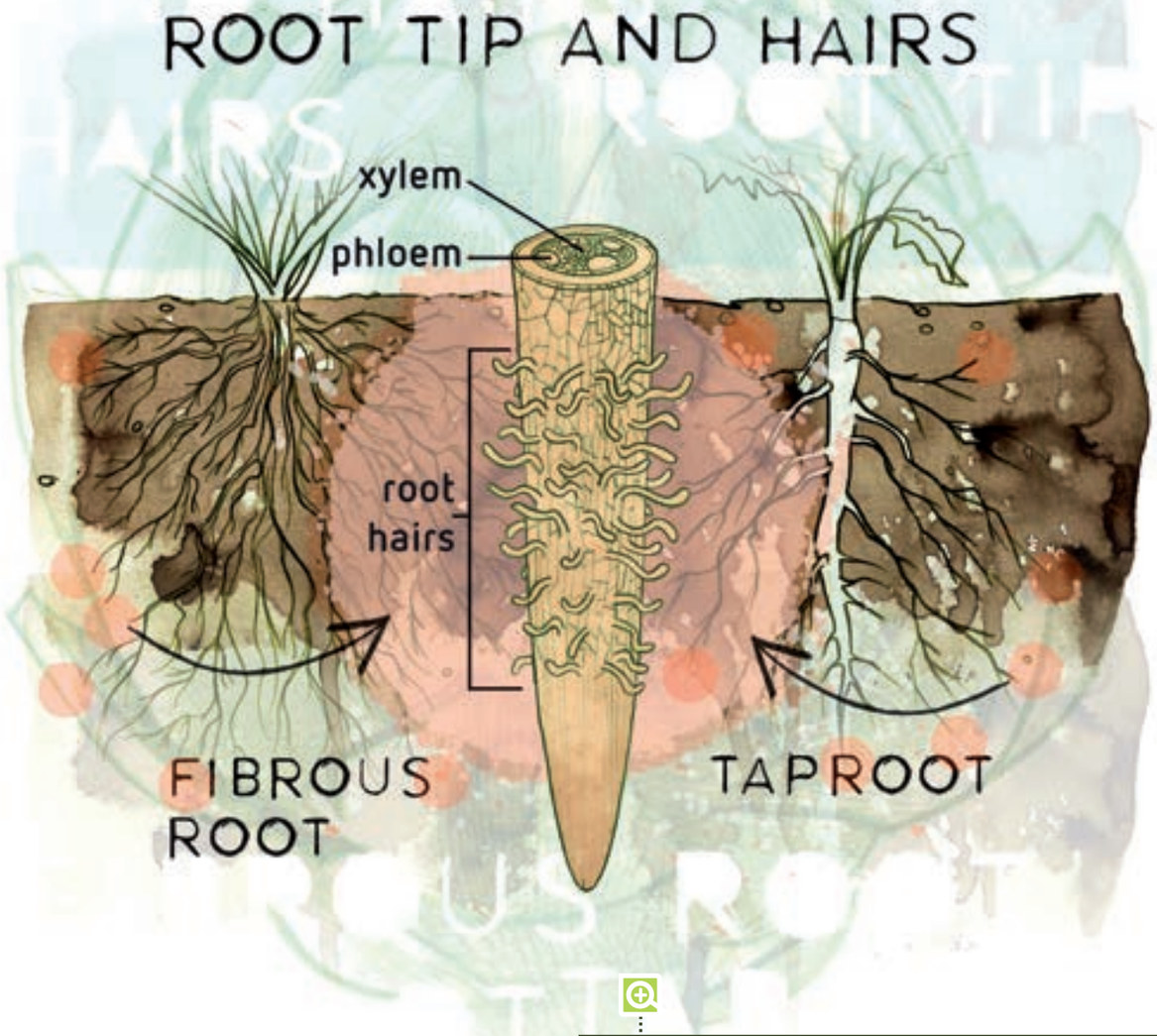


Figure 7: Tap root system and fibrous root systems. with sections of roots pointed out, labeled accordingly.

Roots Manouver

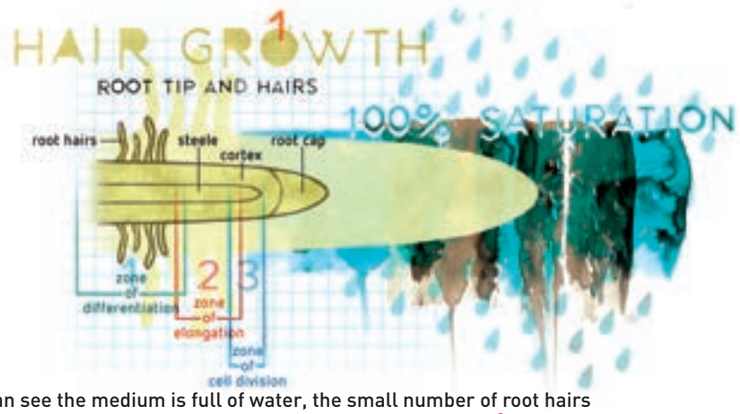
At this point it is probably a good idea to stop talking about enzymes and start talking about plants. That's why we are all here isn't it? The love of all things green? Well yeah the top part of the plant is of course the visually pleasing side of things, but underneath that luscious green topiary lies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

1.



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**

2.

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**

3.

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* **3**

4.

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**

5.

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.

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. Secondly, dead plant material means a food source for harmful saprophytic bacteria/funghi. 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!

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 particularly 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're 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! •

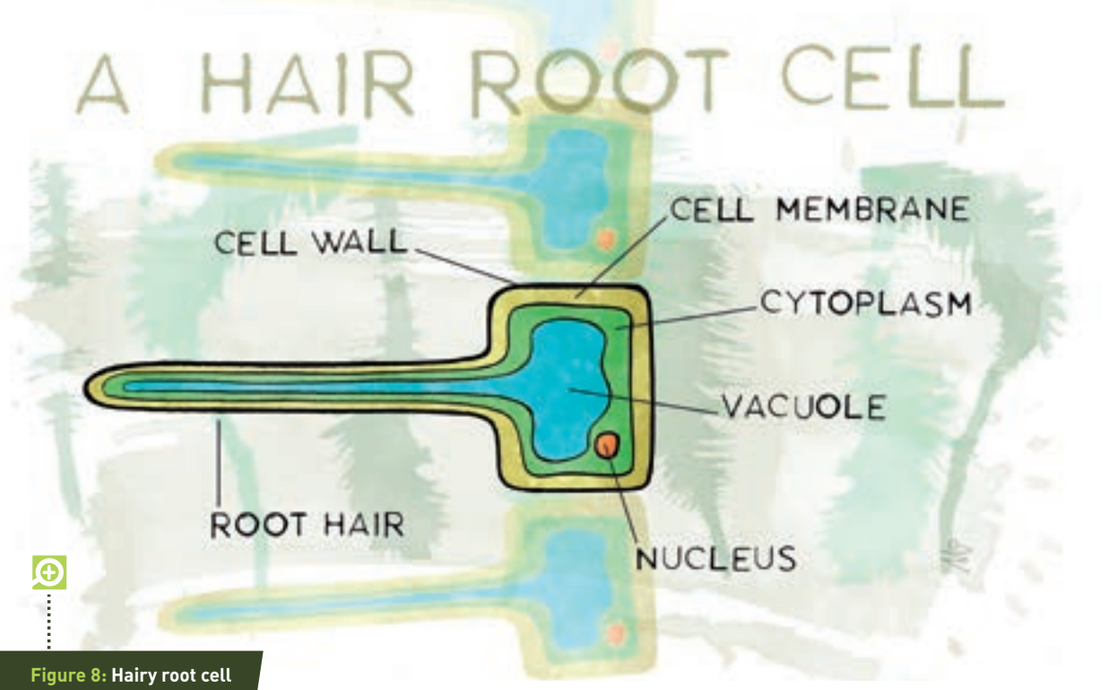


Figure 8: Hairy root cell

Grower's 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 insurances policies, but I personally prefer to think of them as guardian angels. Afterall, we only call the insurance company when bad luck 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 natural and beneficial bacterial and fungal activity that normally generates the enzymes in 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 disease than pesticides, which are not only toxic but usually not so efficient either when it comes to fighting bacterial or fungal pathogens.

As enzymes convert the dead roots into nutrients, sugars that sustain beneficial organism 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 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. 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 salts 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!

Puzzle&WIN

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

WIN A 1 LITER BOTTLE OF CANNAZYM

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

PRIZES

You might be lucky this time! Another great prize is waiting for one of you. You just have to send us the correct solution (sending the middle part of the puzzle to editor@cannatalk.com and mention CANNAtalk 33 is enough), and if we pick your name,

A BOTTLE OF CANNAZYM COULD BE COMING YOUR WAY.

Winner puzzle#32

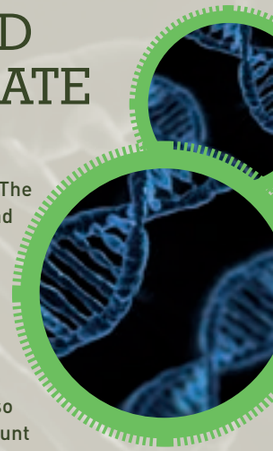
The winner of last Sudoku is **Mr. Williamson.** Congrats on your 1 liter bottle of CANNABOOST! We will contact you as soon as possible to make sure you receive your prize. Enjoy!

Facts

GENETIC CODE CARROT DECIPHERED

Sometimes, the evolutionary history of a species can be found in a fossil record. Other times, rocks and imprints must be swapped for DNA and genetic fingerprints. The latter is the case for the good-for-your-eyes carrot, a top crop whose full genetic code was just deciphered by a team of researchers led by University of Wisconsin-Madison horticulture professor and geneticist Phil Simon. It tells a story of how the carrot has been touched by domestication and breeding practices and influenced by environmental and geologic change, and it fills in a family tree of relatives that otherwise appear distinct. It also reveals how carrots have become so good at accumulating carotenoids, the pigment compounds that give them their characteristic colors and provide them with their nutritional strength. The study cannot answer why the first crops were purple and yellow, though it can verify that it is not because of flavor. The genes for color and the genes associated with preferred flavors are not connected. But that colored carrots became popular is fortuitous: The pigments are what make them nutritious, and orange carrots are the most nutritious of all, Simon says. Carrots are the richest crop source of vitamin A in the American diet. The study also reflects a shift in how plant breeders operate, by taking advantage of new technologies to answer basic questions about cultivated crops.

NEW METHOD TO ACCELERATE RESISTANCE



A team of scientists from The Sainsbury Laboratory (TSL) and The Genome Analysis Centre (TGAC) has developed a new method to accelerate isolation of plant disease resistance genes. Plant pathogens such as late blight can evolve rapidly to overcome resistance genes, so scientists are constantly on the hunt for new resistance genes. Professor Jonathan Jones and colleagues from his lab at TSL pioneered the new technique, called SMRT RenSeq.

The technique consists of two main steps:
1. A sub-set of DNA sequences are "captured" using a method that selects long DNA molecules that carry a sequence that is commonly associated with resistance genes.
2. These DNA molecules are sequenced multiple times to make sure the code is determined as accurately as possible using the novel long-read SMRT technology.
This results in a very reliable DNA sequence for each candidate resistance gene. The scientists believe it will significantly reduce the time it takes to define new resistance genes.

CHINESE SKULLCAP MAY TREAT CANCER

A new study, published in the journal Science Advances, has revealed how the popular Chinese herbal remedy Huang-Qin (Scutellaria baicalensis), also known as the Chinese skullcap, produces compounds which may help to treat cancer and liver diseases. The Chinese skullcap is cultivated in China, Siberia, Mongolia and Korea. It is a herb used in traditional Chinese medicine to treat a variety of conditions including epilepsy, hepatitis, infections, and cancer. It is often used in combination with other botanicals such as PC-SPES and sho-saiko-to. Previous research on cells cultured in the lab has shown that certain compounds called flavones, found in the roots of the Chinese skullcap, not only have beneficial anti-viral and anti-oxidant effects, but they can also kill human cancer cells while leaving healthy cells untouched. In live animal models, these flavones have also halted tumor growth, offering hope that they may one day lead to effective cancer treatments, or even cures. It's exciting to consider that the plants which, have been used as traditional Chinese remedies for thousands of years may lead to effective modern medicines.

NUTS FOR COCONUTS

WHAT'S NEXT

Who doesn't love a lovely bunch of coconuts? Smutty innuendos aside, coir is fast taking over the scene as the hydroponic substrate of choice. It's what all the cool kids are using nowadays. With its ease of use and excellent physical properties, it's pretty easy to see why. Are you keen on knowing about the production process and what the current global situation with that is like? Or the science behind how it actually works, particularly when used with other amendments? Well, wonder no more faithful reader. We are on hand to break it all down for you (excuse the enzyme pun) so you can get even more out of your nuts. Alongside all your usual favorites like Grower's Tip or the ongoing tales of Don and Nicky, there will be something for everyone in issue 35. Keep your eyes peeled!

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English
What fills the heart will flow from the mouth.
Dutch
Waar het hart vol van is, stroomt de mond van over.
In other words, growers who know CANNA, love CANNA. And tell their friends.
Welkom to the Dutch way to grow.