

# CANNAtalk<sup>®</sup>

MAGAZINE FOR SERIOUS GROWERS

ISSUE 33 2016

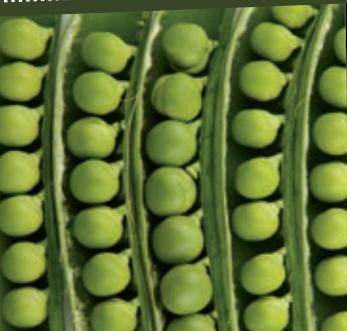
## PROPAGATION

Types and tips



## PASS THE PEAS

A fairytail come true?



## CRAFTING GALORE

Mix, match and merge



Powered by

**CANNA**

The solution for growth and bloom

And more:

Don & Nicky

Factographic

Pests & Diseases

Puzzle & Win

Grower's Tip

Questions & Answers

# GARDEN CONTROLS

New Series By



### Light Timer

- On/Off Times Preset: 18/6 and 12/12
- No Time Drift: Accurate Electronic Timer
- Long Term Reliability: Ballast Grade Relay
- Power Outage Protection:
  - Holds Cycle w/ Built-in Rechargeable Battery
  - 20-min Hot Start Delay
- 120V 12A



### Cooling Thermostat

- Easy Day and Night Settings
- Accurate Electronic Control with External Sensor
- Maximizes Life Equipment with Differential Setting
- 120V 12A



### Fan Controller

- Easy Day and Night Settings
- Accurate Electronic Control with External Sensor
- Stable Room Temperature with Fan Speed Control
- Safety Low Temperature Limit
- 120V 5A 600W



### Cycle Timer

- Easy On and Off Times Setting
- Accurate Electronic Timer
- Day, Night or 24h Operation
- 120V 12A



# HO Talk:

Let's talk about that juicy subject everyone is talking about. Let's talk about sex. And no, we have not turned into some sleazy mag. In this issue we start the conversation on propagation in it's many forms. After reading the article written by CANNA Research on page 4 you'll be completely up to speed on that juicy subject.

We'll stay with propagation in one of its forms in the *What's Happening* section on page 18 of this issue, which is about grafting. I find the *Tree of 40 Fruits* by professor and artist Sam van Aken a wonderful project that shows what amazing things you can do with this type of propagation. What will you create?

The name of the grafting project of Van Aken sounds like it was taken straight out of a legend or a myth. Like *The legend of the fellowship of the Tree of 40 Fruits*. Do you know the legend of peas? It has something to do with naughty fairies. Curious? Go read all about it on page 9.

Oh, and have legendary fun propagating.

Cheers,

Jeroen

# Contents

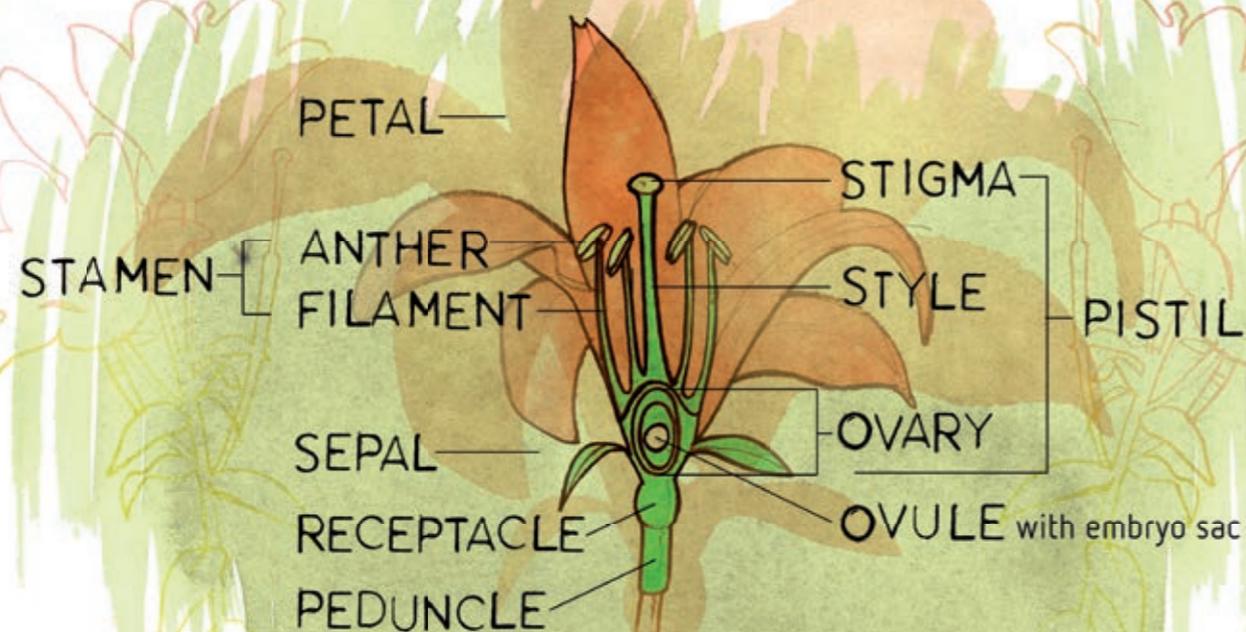
<b>CANNA Research</b> Propagation: Part 1	4	<b>Pests &amp; Diseases</b> Beneficials: Biological Control (IPM)	20
<b>Grow It Yourself</b> Peas	9	<b>CANNA Research</b> The Basics of Vegetative Propagation: Part 2	22
<b>Questions &amp; Answers</b> Your questions answered!	12	<b>Grower's tip</b> Cuttings	27
<b>Don &amp; Nicky</b> Hot chilies!	14	<b>Puzzle</b> Win a 1 liter bottle of CANNABOOST!	28
<b>Factographic</b> Rice Terrace Fields	16	<b>Facts</b> Fighting of the enemy	29
<b>What's Happening?</b> Grafting galore	18	<b>What's next?</b> Enzymes	30





# PROPAGATION

## PART 1



### FLOWER PARTS

Figure 1: Flower parts of a complete flower (male and female parts visible)

PLANT PRODUCTION HAS TO START SOMEPLACE. SURE, IT BEGINS WITH PROPER PLANNING, LOCATION DESIGN, EQUIPMENT ACQUISITION AND INSTALLATION, AND SO FORTH, BUT ACTUAL PRODUCTION STARTS WITH...WELL...THE STARTS. STARTS, FOR THIS PURPOSE, ARE DEFINED AS THE PLANT INITIALS EITHER BEGUN THROUGH SEXUAL OR ASEYUAL PROPAGATION.

By Geary Coogler BSc Floriculture / Horticulture

### Types of Propagation

Sexual propagation is the term used where 2 parental lines are involved that form an embryo that may or may not be encapsulated in what is known as a seed coat, and involves the fusion of 2 separate gene sets. Asexual propagation is where a piece of the original plant is used to form an entire new plant with the same tissue set as the original plant including any localized mutations or specialties. Another type of asexual reproduction is cloning where the gene set from a single cell that is undifferentiated into any plant parts is forced into differentiating into plant parts so that it and all subsequent plants started from this cell are exactly the same gene sets in every way. This is known as cloning usually involving a process called Tissue Culturing.

### Sexual Propagation

Sexual Reproduction in all plants involves the fusion of 2 different sets of genes, sometimes from separate parents and sometimes from the same parent. In the Angiosperm Division of plants (flowering plants such as tomato, cacti, grasses, and so on), the largest most diverse group, these gene sets in the embryo are encapsulated in a seed for protection and in Gymnosperm plants, this new future plant is not and remains naked to the elements (pine, spruce, other evergreens). In the flowering plants, this involves the male contribution, pollen, from a different or same source plant (monocious or dioecious) being transferred to the female part of the flower known as the Ovary which contains the egg or Ovule. The gene sets fuse and a new seed is formed. (See Fig 1) This process allows for the greatest amount of genetic diversity possible. All cells from which the half set of chromosomes (the gene structures), from which the pollen and ovule arise, have 2 sets of the same genes. For instance petal shape could be a single gene set, and the plant cell will contain 2 of these, even though one set may be different in what shape it may produce, and at the formation of the ovule or pollen grain one set will be in one ovule or pollen grain while the other will be in a different ovule or pollen grain. The one that fuses with the other at pollination becomes a part of the new plant and is passed on. Thus the new plant is a part of both and not of a single set of genes or of a single parent gene set. (see Fig 2) The problem is, unless it is a very stable gene set, the grower never knows exactly what they will get until the seed germinates and grows. These differences can be anything seen or not seen. Two seed produced apples may look and grow identical but one set of fruit may be small green and bitter while the other is big, red and tasty. Many more ultimate plants can be produced with seed, and they can initially

be stored for periods of time with minimal concern, but the grower sometimes has no idea of exactly what they are getting. Additionally, unstable gene sets on many varieties, even though always produced from the same parent lines, will produce as many gene sets as seed. The fact that most plants can be propagated from cuttings or divisions greatly improves a grower's chance at producing successful and similar plants and crops.

### Asexual Propagation

Asexual reproduction is the utilization of an existing plant part or full gene set to produce a similar or same plant. That covers a bunch of ground. To facilitate this discussion, the subjects will be split up and dealt with separately. The emphasis of this article is on cuttings, the most important method for propagation as used by growers to insure consistency in crops. To begin this conversation, it is important to keep a few things in mind.

1. One thing to remember is that the genes in any cell, at any time, can mutate. This is a process by which outside influences, such as high energy light, cell division, chemical processes, time / age, or any of many other ways, affect the expressed gene sets. The result is that seldom does the gene set in the plant cells at the tip resemble, with 100% accuracy, the cellular gene set as a fertilized ovule. This can lend itself to many new expressions such as better fruit, different leaf form, size, color patterns/ variegation, and so on.
2. Another thing to remember is that putting roots on a cutting is simply continuing the plant development away from the original plant, stock. Cells away from specialized areas inside the meristems of a plant have a specialization and a purpose. A leaf epidermal cell will divide into the same type cell, but in these specialized areas, cells in new plant parts take on their specialization as they are laid down but start as undifferentiated cells or, collectively, tissue. At some point, a change has to occur to get tissue to change and become undifferentiated once more, in order to become new roots or entire new plants.
3. Finally remember that gene sets never reset the clock on the time or age. This can be extended but there remains a limit. For example, an apple tree may have one limb that produces a slightly better fruit from a mutation in the axillary bud it originated in. If a bud is taken and propagated by cutting, then the new tree will carry the same good fruit, and can be propagated into hundreds and thousands of new trees. The age of the gene set will always remain timed based on that original tree gene. It can be extended but a couple



# SEXUAL REPRODUCTION

## THE FERTILIZATION PROCESS

### DOUBLE FERTILIZATION



Figure 2: Sexual Reproduction – the Fertilization process

# PROPAGATION PART 1

things happen over time: the genes become tired and more mutated, and sooner or later the entire line will die out at roughly the same time.

### Cloning

The taking of any vegetative propagule can be argued to be the cloning of the original plant so there should be no difference in terminology. However, because the horticultural world treats the 2 areas as distinct, and because there are true minor differences, we will speak to the 2 basic forms of vegetative reproduction. Cloning is the process where a piece of tissue is taken from a viable area of a mother (again stock) plant; it is then forced back to an undifferentiated state (callus), where it is then broken up into individual cells. These cells, all being almost a 100% gene match, are then

# TISSUE CULTURE BASIC LINES

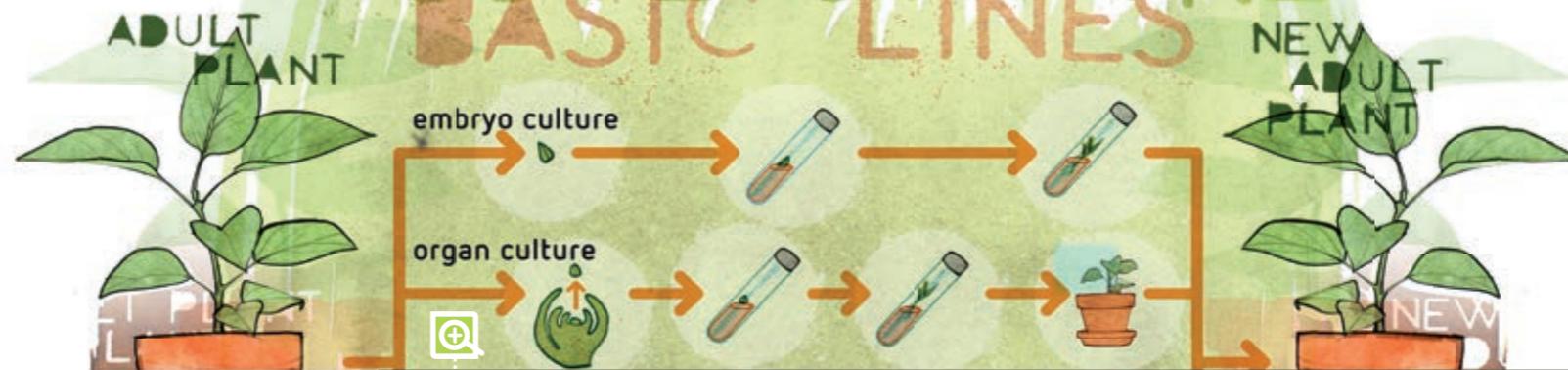


Figure 5: The basic idea in Reverse Osmosis is to pass water through a membrane leaving almost everything behind. Plants do this by natural forces involving gradients. This machine does so by forcing the water through the membrane.

allowed to grow into more callus. The callus is then introduced to certain ratios of minerals, hormones, enzymes and other things and produced into a new plant, each virtually identical to the others. This process is intense and subject to many failures along the way. In the process, it tends to produce enormous numbers of new plants. This means that it is great for producing commercially needed numbers to keep costs lower, but expensive and over-powering for smaller gardens.

There are many variations on this process, all considered Tissue Culture, but the above serves as an easy example. (See Fig 2) Virtually all plant parts have or might have some importance or place in this technique. Meristem culture, or micro-cuttings is more like a cutting but only the tip meristem with a couple new axillary buds are excised from the plant and they then grow roots and a new plant. The advantages are numerous, such as virus or disease indexing, but expensive is the word. Most importantly, all plants respond independently to this technique, what works on one species does not on another. A tremendous amount of research has and still goes into developing the profiles and techniques needed, correct chemical balances, and even the correct timing for things to occur. The equipment requirement to conduct this propagation method is extensive and has to be totally sterile. There remains easier ways. (See Fig 3 and 4)

### Vegetative Cuttings

The method of choice (in cases where it is possible as not all plants lend themselves to propagation by tip or leaf / eye cuttings) is the taking of cuttings. Vegetative propagation includes plants that arise from adventitious buds on the root itself and the root is divided to produce separate plants (division), or other vegetative methods. It also includes the sectioning of stems to include active leaves, tip or leaf/ eye cuttings,



Figure 3: Finished Tissue Culture plantlets ready for transplant  
Figure 4: - Incubation rooms with technicians



or dormant apical or axillary buds, known as dormant cuttings. The idea is that the plant with an active growth tip meristem, axillary bud, or dormant bud will either root through the change of epidermal tissue or callus formation at the cut, into a root meristem and form a new connection to the vascular tissues. This is also possible through specialized structures such as aerial roots/ holdfasts, or arising from the leaf node tissues to produce a new plant and root system. Many possibilities exist and plants can be different. Some



# PROPAGATION PART 1

plants will also respond in multiple ways. (See Fig 6 and 7) When this new root systems develops, if the plant has an active more centralized crown, the junction of the root vascular system and the top vascular system, then a new crown is formed and must be dealt with correctly. Some plants have less identifiable crowns or have the ability to root readily along the stem, in which case less concern must be maintained. Crowns tend to be areas of high energy use and can require larger amounts of Oxygen to function correctly. While the cutting, when disconnected from the root tissue will usually put on new roots, these new crowns will not respond well to burying deep and will generally not root or will die before new roots form causing issues with the top portion at the least. These activities are triggered to occur by combinations of triggers such as light levels (or lack thereof), hormone accumulation and / or disappearance, starch accumulation, and other activities including stress. Some readily rooting plants such as Ficus spp. will root from the stem and nodes when the humidity is high and light levels lower, producing aerial roots that grow to the ground convert from an aerial root into a normal root to help supply the needs of the plant. The roots that do form tend to be designed for the environment in which they arise such as in water based systems or soil based.

## Conclusion

Plants tend to lend themselves to being propagated. It is as if they figured out how to keep a single copy of



Figure 6: Adventitious root initial from epidermal tissue change as well as Callus root initials at cut end of propagule.

their genes going forward when it is really a survival mechanism from long ago perhaps. To maintain all the desired characteristics, the only true way to achieve this is through vegetative propagation. It is possible to stay close with stable gene seeds that are non-hybrid, but still a risk of mutation remains much higher. Also, a vegetative propagule tends to reach maturity faster as well as its' tissues remaining at the same maturity of the stock or mother plant, for example juvenile verses adult tissues..

In the end, there are many techniques to use in propagation. They can all be difficult or easy so the grower must select the best, most practical and successful way for accomplishing their needs based on the plant as all will be different. Learn more about taking cuttings on page 22. •



Figure 7: Adventitious and Callus roots form from the initials

# GrowIT YOURSELF



# PASS THE PEAS

AW, ISN'T SHE ADORABLE: ROUND AND SWEET, VERSATILE AND HEALTHY. THIS ULTIMATE COMFORT VEGETABLE USED TO BE WHITE AND HARD. PEAS ARE GREEN NOW THANKS TO A MISCHIEVOUS FAIRY BOY AND THE MERCY OF THE FAIRY QUEEN IF WE MUST BELIEVE THE LEGENDS. AND WHY SHOULDN'T WE?

By Marco Barneveld, [www.braindrain.nu](http://www.braindrain.nu)

Once upon a time pods and peas were white and the peas were hard. Nobody cared about them because they looked unappetizing because they were always dirty and

too hard to eat. A fairy boy used them one day to shoot them from his blowpipe at his teacher. He was caught. His punishment was to turn all pods and peas lush green, soft



and sweet so they could hurt no more when shot from a pea shooter. The boy worked and worked but there were just too many. The Fairy Queen noticed and took pity over the fairy boy. With one wave of her powerful magic wand she turned them all into what the teacher demanded: green pods with green peas that are soft and sweet. Or so is told. You've got to love myths and legends.

### Sub-Himalayan

For the less romantic, more scientific souls out there, sweet, delicious green peas are one of the ancient cultivated vegetables grown for their succulent nutritious green seeds. Peas probably have originated in the sub-Himalayan plains of northwest India. Today, this versatile legume is one of the major commercial crops grown all over the temperate, and semi-tropical regions.

Botanically, pea plant is an herbaceous vine. It belongs to the family of Fabaceae, in the genus *Pisum*. Scientific name: *Pisum sativum*.

Pea is a quick growing, annual herbaceous vine which requires trellis to support its growth. It flourishes under well-drained, sandy soil supplemented with adequate

moisture and cool weather conditions. Short stalked, green pods appear by late winter or early spring. Each pod measures about 2-3 inches long, swollen or compressed, straight or slightly curved, filled with single row of 2-10, light green, smooth edible seeds we call peas.

In general, the pods harvested while just short of reaching maturity, at the point when the peas are green, soft, sweet and edible as raw. Allowing the pods to mature further would make the peas less sweet, bitter and light green to yellow.

### Health benefits

We don't usually think about green peas as an exotic food in terms of nutrient composition, but we should. They contain a unique assortment of health-protective phytonutrients. One of these phytonutrients, a polyphenol called coumestrol, has recently come to the forefront of research with respect to stomach cancer protection. A Mexico City-based study has shown that daily consumption of green peas along with other legumes lowers risk of stomach cancer, especially when daily coumestrol intake from these legumes is approximately 2 milligrams or higher. One cup of green peas contains at least 10 milligrams, a great reason to pass the peas daily. Even though green peas are an extremely low-fat food the type of fat and fat-soluble nutrients they contain is impressive. Recent research has shown that green peas are a reliable source of omega-3 fats. In 150 grams of green peas, you can expect to find about 30 milligrams of these fats. This very small but high-quality fat content of green peas helps provide us with important fat-soluble nutrients from this legume, including sizable amounts of beta-carotene and small but valuable amounts of vitamin E. Yes, pass those peas.

### Environmental friendly

Green peas also stand out as an environmentally friendly food. Agricultural research has shown that pea crops can provide the soil with important benefits. First, peas belong to a category of crops called 'nitrogen fixing' crops. With the help of bacteria in the soil, peas and other pulse crops are able to take nitrogen gas from the air and convert it into more complex and usable forms. This process increases nitrogen available in the soil without the need for added fertilizer. Peas also have a relatively shallow root system, which can help prevent erosion of the soil, and once the peas have been picked, the plant remainders tend to break down relatively easily for soil replenishment. Finally, rotation of peas with other crops has been shown to lower the risk of pest problems. Grow the peas? Grow the peas.

### Grow it yourself

St. Patrick's Day is the traditional time to plant peas in Northern Europe. If your garden soil is workable and not too wet, you can get the seeds into the ground. To speed germination, soak the seeds in water for at least a couple of hours before planting. After planting, keep the seeds well watered. If you are afraid of slugs, snails and mice, and you have the space; you may want to raise them indoors in individual pots 3 inch (8cm) deep or in root

trainers. Once the plants are around 6 inch (15cm) tall, plant them outside.

When your pea plants are a couple of inches tall, think about offering them support so they won't topple over into a tangled snarl. Depending on the variety, pea plants can grow up to 6 ft. tall, and trellising is one option. The stakes for this trellis are fastened securely to the raised bed with a screw gun. Once the stakes are in position, netting is stapled to them. Another way to support peas is to build a four-pole tipi, and a third way is to use brush offcuts. Here's a tip you might not have thought of: fasten your pea vines to their supports with strips cut from old stockings or panty hose. It's smart recycling, and it stretches as the vine grows.

### Harvesting

The trickiest thing about harvesting peas is knowing when they're ripe. You don't want to pick them when the peas are undersized, but if you wait too long the peas will lose their sweetness and turn bitter. Morning is the best time to pick, because the sugar content is highest then. At pick ripeness the outer shell will be bright green, not dull and waxy. Continue to pick the vines as the peas ripen. If you do that, the plants will keep flowering and continue to produce, at least until the weather gets really hot.

### Prepping the peas

The first task in pea prep is shelling the peas. If you plan on freezing them, follow these steps to preserve their flavor and color. When picked, the sugars in peas turn quickly to starch, but you can stop that process by blanching. Cook the peas for a couple of minutes in salted boiling water until tender, then dunk them in ice water to set the sugars and preserve the bright green color. Next, drain and dry the peas, then spread them out on a baking sheet covered with parchment paper. That way, the peas will freeze separately, without clumping. Put the baking sheet in the freezer, and once the peas are frozen, transfer them to a plastic bag for long-term storage.

### Eat it yourself: Fresh Snert

The winters in The Netherlands can be cold and the Dutch love to skate on the frozen rivers and lakes. There is nothing better than a hot steaming cup of snert, Dutch pea soup, when you leave the ice. Originally the soup is made with split or dried peas but it's even better with fresh peas from your own garden. For the vegetarians amongst our readers, just use a vegetable broth and leave the meat out.

# RECIPE



# FRESH SNERT

For two quarts (liters) you'll need:

- 2 quarts (liters) of water
- 1000 grams of fresh peas
- 500 grams of streaky bacon (cubed)
- 1 big carrot
- 1 big leek
- 2 leaves of laurel
- 20 grams of parsley
- Half an onion
- Half a celeriac
- Pepper
- Salt



Boil the water gently with the cubed streaky bacon and the laurel. Take out the bacon and add the peas. Blend. Add the bacon again. Also add the carrot, the leek, the parsley, celeriac and onion. All cut small. Let it simmer for about 30 minutes. Add pepper and salt to taste. Put on your iceskates, wear an orange shirt and

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

## Question

Hi, I have a quick question about your CANNA COCO line. I'm running a 1000W ebb and flow, 18 square feet. Conditions are:

- 17 days into 12/12
- 10 gallon reservoir, 1 small air-stone with water temps in low 60s to 67 tops.
- Usually 63 or under and covered from light.
- CANNA Coco A and CANNA Coco B applied at half strength according to feeding schedule.
- CANNA PK 13/14, full strength
- H Enzyme Product, full strength
- CalMag Plus, 80% strength

I use pH Down as necessary (tap water is about 7.5). I adjust after the nutes are mixed. I run the reservoir between 5.5 and 6.2, with 90% of the time being between 5.8 and 6.1 to help magnesium uptake. I change and thoroughly clean res every week.

I add a competitors enzyme product first, and let it sit an hour. Then I add the PK 13/14, wait about an hour. Then the CANNA Coco A, wait 30 to 45 minutes, and add the CANNA Coco B. Hour later, then I add the CalMag. I feed once a day. Since I began using the PK 13/14 a week and a half into flower (about a week ago) the res becomes cloudy about 2 or 3 days after a change. It's a slight, milky white cloudiness. Water smells fine, just a sort of mineral smell that's hard to describe. First time it happened, I dumped and cleaned. This time, I took a water sample and observed. After 36 hours, the water is cloudier, large amounts of foam are being frothed up by the airstone, and some of the milky cloudiness is precipitating into larger white chunks that I can't identify. Water from the sample I took 36 hours ago is also starting to show small chunks, but they were not there when I took the sample.

This did not start until I began the PK 13/14. My gut tells me it's something to do with how that PK 13/14 is interacting with the other nutes or possibly the air stone or pH Down. I doubt it is the enzyme, because I hadn't started using it yet the first time the res went cloudy.

I love your nutes, and want very badly to keep using them. I think they are clearly one of the two best, probably THE best, coco line on the market.

Can you give me any advice on what to do here? Add them in a different sequence, change the ratios, lose the air-stone, sacrifice a goat, whatever? Thank you.

## Answer

Hello, Well, no need to bring livestock into the solution...at least not yet.

First, I have no idea why you are at half feed, need to be full rate. CalMag is not needed, but may seem like a cheap solution if using RO water. Better is to use regular water if below about 400 ppm TDS out of the tap. Otherwise mix tap water back to get 200 ppm and save the CalMag. If this is against your views then simply feed at the upper range we give you in the feed chart. Your pH is fine. Mix the A, then once you stir it mix in the B, then once stirred, add CANNAZYM because it is specific to root health, add the RHIZOTONIC, and let sit 30 minutes then set your pH. Then let it sit another 30 minutes. Then add the PK 13/14 and verify the pH. Finally remove the air stone! These are only needed when the roots sit in water not in a true flood and drain system as you describe. They introduce air, particularly CO<sub>2</sub> that drives the pH around.

Now, I suspect the cooler water with a Phosphoric acid pH down and an overdose of free Calcium/ Magnesium is causing your headaches. You are adding extra Phosphate in the down, then all P in the PK, then all that free Calcium (CANNA Coco A & B is loaded already) looks for a home and binds up as Calcium phosphate, an insoluble solid in most cases. The air stone drives it even faster and does other things as well.

So, change the water from super soft RO, go to a full rate, shorten the time in the mixing, back up on the Calcium, then pull the air stone. Then give it a week and let us know how it is progressing. Cheers!



Hello, I get magnesium deficiency around week 3 in flower on a 9

## Question

Hello, I get magnesium deficiency around week 3 in flower on a 9 week crop and it continues until harvest. I use CANNA Coco A & B at a rate of 9ml/gal. I use RO water at an EC of 0.0. I use CANNA PK13/14 weeks 4.5 to the beginning of week 6 at 5ml/gal. I water once per day achieving 20% runoff. Medium only 1/2 dries out between watering. Am I doing something wrong? How do I remedy?

## Answer

Hello, Thanks for the question. The issue is the RO water. RO water causes pH issues which then cause availability issues. Then RO water is super soft water which means it will bind up many nutrients to harden up the water a bit, especially the divalent ions like Calcium, Magnesium, etc. The fix is to reset your feeding from the lowest range to the upper range. Increase to about 11- 13 ml/gallon for an EC of 1.4 - 1.7. Start at the 11 ml range and work up. This should do it. Everything else looks fine.

## Question

Hello and good morning, I was wondering if I can add molasses to my reservoir. I'm using CANNA TERRA line in a less than ideal potting soil mix. I can't afford the CANNABOOST now and would like to get some sugars in there. This is my first time not using organic fertilizer and I want to be sure before I go for it. So far I'm super impressed with things. I can't wait to go full coco with you guys on the next run. Many thanks, Jason.



## Answer

Hello Jason, Thanks for the question. You can use Molasses, sugar, or any other sweetener you want, even with the CANNABOOST as they are not at all the same thing. Sugar just adds a reaction in the root zone that basically releases CO<sub>2</sub>, CANNABOOST works on the immune response of the plant triggering some basic plant reactions that improve overall plant carbohydrate concentrations while boosting energy levels and enhancing a plants ability to ward off attack from insects, pathogens, and disease causing organisms. CANNABOOST contains no simple sugars and does not depend on decomposition to function. Hope this helps.

## Question

Is there a specific order you have to add the nutrients and additives to the feed tank? Which one first, or is there some that don't mix well together etc. . I do terra and coco and I am thinking of Deep Water Culture maybe next year. Kindest regards

## Answer

Hi, You can find some directions below, based on using CANNA COCO and a 5 gallon reservoir.

1. First of all, you want to make sure the water is 68°F. If you don't have a thermometer, you can also leave the bucket with water in your living room for one night to warm. (the bigger the tank the longer it takes)
2. Then add 80% of the recommended dose of CANNA Coco A & B in your bucket.
3. First A, stir well and then B. (stir well again)
4. After that the needed additives (RHIZOTONIC, CANNAZYM, CANNABOOST and PK13/14)
5. Always stir well before you add the next additive.
6. Add the remaining 20% CANNA Coco A and later on B, until you reach the right EC level.
7. Actually, measuring EC is checking up on your mixing, to insure you didn't make a mistake in dosing.
8. If the EC is done, you measure the pH.
9. If you have to adjust this (the numbers are in our feed chart too) you will probably use a pH minus product.
10. Watch out though, match to the tank size or volume to be made. You don't need much. It is often better to dilute the pH minus with some water before putting a few mills in the bucket.
11. Check your EC again.
12. Sometimes the EC will increase because of the pH control. It means your tap water is hard.
13. If you have this problem, put less CANNA Coco A & B in.
14. Wait another hour and check EC and pH again. Adjust if needed and after that you can water the plants as needed. In soft water areas you can also put the additives first and then you go on with the nutrients and finally the pH control.





# Don & Nicky

(PART 14)

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.

With my freezer full of tubs of home-grown tomato passata and my "jungle" of indoor tomatoes finally harvested and taken down, I set about cleaning and disinfecting my grow room. It's amazing how much dust and dirt builds up in just a single growing cycle—but nothing some hot water, bleach and elbow grease couldn't conquer!



## Hot CHILLIES!

My next project? Hot chillies! Not the devilishly hot, inedible kind—but definitely spicier than the Tokyo Hots I grew in coco coir and perlite last year. They sort of lost their poke as time went on and I longed for something hotter. Also, I pledged not to open another bag of coco for a while. Don't get me wrong, I love the stuff—but, as a grower, it's easy to fall

into a rut and I was keen to try something new. First though—the seeds! After some online research I purchased some 'dwarf' chili seeds—three varieties: Prairie Fire AGM, Cheyenne F1 and Purple Tiger. My goal was to grow 16 compact plants in a 2.3 square meter area—so dwarf varieties were a



- 1 Chilli seedlings in rockwool blocks (4 inch) under 315W ceramic metal halide
- 2 The first Cheyenne F1 plants pop through the netting canopy filling up nicely
- 3 My 'sea' of 16 dwarf chilli plants—even and homogenous beneath 1200W of light.



must. Being tropical plants, chillies don't really respond to photoperiod as a cue to start flowering, but you can certainly steer them if you let nighttime temperatures drop to less than 64 F(18C) or slightly less and the root zone dry out a little between irrigations. However, these particular dwarf chili varieties have been bred to naturally form a compact shape and size—or, at least, that's what it said on the seed packet.

After a quick germination period (thanks largely to a heat mat and thermostat) I suddenly had dozens of new seedlings thriving in rock wool starter plugs under a 250W metal halide lamp. (My T5 fluorescent fixture stopped working months ago.) A few weeks later and my young seedlings were happily transplanted into 4-inch rock wool blocks. I was irrigating manually at this point, just dipping the blocks, as the young plants weren't particularly thirsty. I also had to supplement humidity levels with a humidifier as relative humidity was hovering around 45%. Many indoor growers have to do this during the early stages.

*When plenty of roots were poking out of the blocks I decided to take the plunge and go all out for rock wool in the form of one meter "gro-slabs".*

Commercial greenhouse growers can knock out two or three massive tomato or sweet pepper plants out of a single slab—so surely I could manage four dwarf chili bushes in each! After pre-soaking with pH-adjusted water, I loaded up the slabs with a moderately dilute nutrient solution, cut some holes for the blocks and some drainage slits at the bottom equidistantly between the planting sites. Finally I lay my plants on top. I timed this to perfection, as I had to be out of town for five days—the ideal duration for the plants to initially root

into their new slabs. No irrigation necessary. It actually helps to leave them alone. Fortunately I returned to sixteen super healthy looking plants!

Next step was to create ... the tropics in my basement! As such, I decided to keep a 12-hour photoperiod and really step up the light intensity to tropical levels! To this end, I combined the spectrums of a 630W ceramic metal halide (basically two 315W lamps housed horizontally in the same fixture) and a 1000W double-ended HPS lamp with a sealed, air-cooled optic chamber. (This way convection heat is removed without passing air over the lamp itself.) The result was a 2.3 square meter area of such blistering intensity (1000 umol average over the canopy) that I spent the first night worried that perhaps I'd gone too far.

As I already mentioned, chillies are not sensitive to photoperiod so I could've opted for a fraction of the light intensity, spread over more daylight hours, but I really wanted to give my plants an authentic 'tropical experience'—also, I figured that the intensity would penetrate deeper into the plants. Irrigated by a simple homemade dripper system, one stake per plant, soon all 16 specimens spread out to form a beautiful canopy, guided by some soft-mesh netting, and, just as I started to worry about the jungle coming back to haunt me, they began to flower! By complete luck it looked like I had judged my plant spacing and numbers perfectly. However, it was still relatively early days.

I created a hanging reflective panel to bounce light back into the growing area and topped up my two reservoirs servicing the four rock wool slabs with 21 Gallon (80L) of nutrient solution each! This should mean I don't have to perform change-outs so often. Wish me luck! Hopefully by next issue I'll be harvesting the hot stuff! •



# RICE FIELDS

## DID YOU KNOW THAT...?

- Rice is a member of the grass family (Gramineae). There are more than 10.000 species of grasses, existing in different habitats. Grass is an important nutrition for both herbivorous animals and humans, like for example maize, wheat, barley, oats and sugar.
- Worldwide there are 40.000 varieties of rice, the three major categories are named: Indica, Japonica and Javanica.
- Rice thrives best under extremely moist conditions and

- moderate temperatures. The ideal condition to produce rice is in a humid climate with temperatures around 24°C. Average plant height varies between 1,3 and 16,4 ft.
- In many Asian languages the word for rice is the same as the collective noun for food itself.
- Around the world you'll find different ways to produce rice. We distinct four types of ecosystems: irrigated, flood-prone, rain-fed lowland and upland zones.

- The unique thing about rice is that it can grow in flooded conditions; some species grow in water 16 feet deep. What makes this possible is an efficient air-gathering system consisting of passages in the upper leaves of rice plants that draw in enough oxygen and carbon dioxide to nourish the entire plant.
- It takes 1.300 gallons of water to produce 2 lbs. of rice.
- When the production of rice is not done with machines, it

- often takes between 1000 to 2000 man or women hours to raise a crop on 2.5 acres of land. This makes rice one of the world's most labor intensive foods.
- Besides rice wine, vinegar and beer, the distilled plant can produce excellent digestives like grappa and sake.
- There are two Japanese car brands that were named after rice. Honda means 'the main rice field' and Toyota can be translated into 'bountiful rice field'.



# What's HAPPENING

## TREE OF 40 FRUITS



## GRAFTING GALORE

A plant that grows tomatoes and potatoes at once, a tree that has forty different fruits, avocado bearing sassafras? Has the world gone mad? No, the world has always been mad. It's just having fun with grafting. And so might you, if you're mad enough . By Marco Barneveld, www.braindrain.eu

We know. It sounds mad, but it is not as mad as it sounds. There is no scary genetic modification necessary either. Enter grafting. Grafting is a horticultural technique that's defined as attaching a twig (scion) from one tree to the stem of a tree seedling (rootstock). The scion becomes a permanent part of the tree over time. In most cases grafting will work with all plants that are from the same genus. Tomatoes and potatoes are actually related to each other. They are both members of the nightshade family just like sweet and hot peppers, eggplant, tomatillos, tamarios, pepinos, pimentos, paprika, and cayenne peppers. Sassafras and avocado are also related so they can be grafted onto each other.

This is actually a practice that has been used for thousands of years and you may be more familiar with it in terms of apple or other fruit trees. In fact most apple and pear varieties cannot be grown from seed but only through grafting. For example the seed from a Haralson apple will produce an apple tree, but it will not produce a Haralson apple tree. Likewise, the seed from a Honeygold apple will not produce a Honeygold apple tree. In other words, fruit trees cannot be reproduced "true" to the original cultivar from seed, grafting can only reproduce them.

### Tree of 40 Fruits

Enter, the *Tree of 40 Fruits* created, or better said 'in creation', by the American Syracuse University Professor and artist Sam Van Aken. He took the whole concept of grafting to the level of grafting galore. His trees will bear 40 varieties of stone fruit, including plums, peaches, nectarines, apricots and cherries and he received worldwide attention with the concept. Van Aken has planted 16 trees in seven states across the country. "Each space is unique," Van Aken said about the various art museums, university campuses and private land where the trees are grown.

At its core, this tree is art. Van Aken hopes, as he explains in the video, that people would stumble upon the tree and wonder. "Why are the leaves shaped differently? Why are they different colors?" In the spring, he imagines passers-by would notice blossoms of varying colors, and in summer, they would see copious varieties of fruit growing on one tree. But it's taken on a much bigger role than he anticipated: educating the public about how agriculture practices have changed over the centuries.

Van Aken's project uses more than 250 varieties of stone fruit. Each tree has a different combination of heirloom varieties. It has become a conservation project, too, since commercial markets have reduced the diversity of available stone fruits.

The trees grow more diverse in color and fruit each year. Van Aken typically plants them with 20 of the 40 varieties already growing. He returns over several years to prune and graft the rest of the varieties, until it reaches 40. The first tree was planted in 2011 and he expects it to be in full blossom in about three years.

### Don't be frightened

Grafting is one of those tasks that can frighten novice gardeners. Like it's something that only experienced gardeners can understand and carry out correctly. Rubbish. You just need some imagination, plant from the

same genus, a sharp knife and some grafting clips or see-through tape.

Wait until the weather is warm and there's plenty of sap flow, which means the grafts will take easily. Cut the rootstock seedling flat, and then carefully split the stem vertically. Cut the scion seedling at a sharp angle, and insert it into the slit you made in the rootstock stem. Push the two together, getting as much contact between them as possible, and then hold the graft in place with the grafting clip or tape. Easy as pie. Be patient though. It can take many weeks for the graft to take. You know it has taken when the buds on the scions start to grow. You'll also see callusing around the graft points.

Grafting is great for experimenting and having fun with growing, essentially having fun with Mother Nature. Will you dazzle your friends with a multi-grafted citrus tree full of lemons, limes, tangerines and oranges? Imagine how far you could push the limits? In your small garden, it allows you to grow a number of different tree varieties in the space of one tree.

Or what about The-Giant-Nightshade-Graft-Extravaganza with potato, tomato, hot peppers, paprika, eggplant and so on hanging from one plant? Start your own art-project, like Sam Van Aken, on your balcony, patch of land or in your greenhouse. There is so much to be discovered and you might just be the one discovering. Are you ready to graft? It's not as mad as it sounds. •

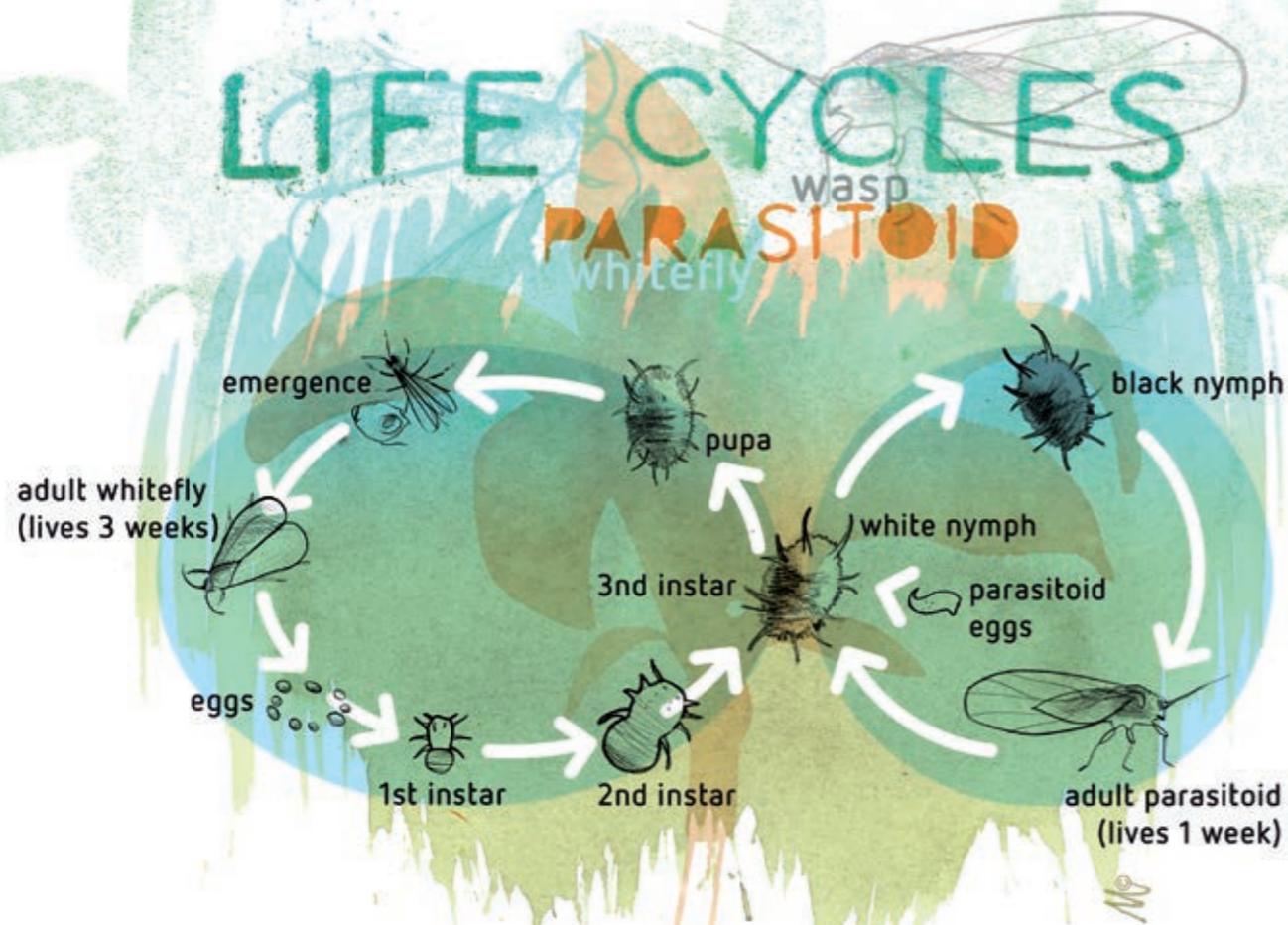


Figure 8: Cherry tree grafting



# Pests & DISEASES

In the last CANNAtalk we explained a bit about Integrated Pest Management (IPM). One of the categories within IPM is biological control. In this article we will look a bit deeper into the use, strengths and weaknesses of biological control.



# BENEFICIALS

Biological control is a component of an integrated pest management strategy. It is defined as the reduction of pest populations by natural enemies and typically involves an active human role. Keep in mind that all insect species are also suppressed by naturally occurring organisms and environmental factors, with no human input. This is frequently referred to as natural control. This guide emphasizes the biological control of insects but biological

control of weeds and plant diseases is also included. Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids, and pathogens. Biological control of weeds includes insects and pathogens. Biological control agents of plant diseases are most often referred to as antagonists.

Predators, such as lady beetles and lacewings, are mainly free-living species that consume a large number of prey

during their lifetime. Parasitoids are species whose immature stage develops on or within a single insect host, ultimately killing the host. Many species of wasps and some flies are parasitoids. Pathogens are disease-causing organisms including bacteria, fungi, and viruses. They kill or debilitate their host and are relatively specific to certain insect groups.

Biological control requires a bit of knowledge and common sense from the grower. Introduce beneficials at the right time. The earlier the beneficials are introduced the lower the numbers that are needed and the better the effect. Some beneficials can even be introduced preventatively. Become acquainted with the biology of the beneficials. Some predators need a specific time, humidity or temperature to establish. They also have different reproductive rates, knowing their lifecycle is important to know when and how much to introduce into the pest.

Ensure that other natural enemies are not harmed by the application of natural products e.g. plant extracts and minerals, which contain components with a controlling or protecting effect against pests and/or diseases. These may be less selective than is indicated. And of course do not use pesticides, as they will also kill your beneficials.

## Advantages of Biological Control:

1. Biological control is a very specific strategy. The vast majority of the time, whatever predator is introduced will only control the population of the pest they are meant to target, making it a green alternative to chemical or mechanical control methods. For example, whereas weed-killing chemicals can also destroy fruit-bearing plants, biological control allows the fruit to be left uninterrupted while the weeds are destroyed.
2. Natural enemies introduced to the environment are capable of sustaining themselves; often by reducing whatever pest population they are supposed to manage. This means that after the initial introduction, very little effort is required to keep the system running fluidly. It also means that biological control can be kept in place for a much longer time than other methods of pest control.
3. Biological control can be cost effective in the long run. Although it may cost a bit to introduce a new species to an environment, it's a tactic that only needs to be applied once due to its self-perpetuating nature.
4. Most important of all, it's effective. Whatever pest population you want controlled will no doubt be controlled. Because the predator introduced will be naturally inclined to target the pests, very often you'll see the pest population dwindle.

## Disadvantages of Biological Control:

1. It's a slow process. It takes a lot of time and patience for the biological agents to work their magic on a pest population, whereas other methods like pesticides provide immediate results. The upside to this is the long-term effect biological control provides.
2. If you're looking to completely wipe out a pest, biological control is not the right choice. Predators can only survive if there is something to eat, so destroying their food population would risk their own safety. Therefore, they can only reduce the number of harmful pests.

3. While it is cheap in the long run, the process of actually setting up a biological control system is a costly endeavor. A lot of planning and money goes into developing a successful system.

4. Biological control can be fickle. Ultimately, you can't control whatever natural enemy you set loose in an ecosystem. While it's supposed to manage one pest, there is always the possibility that your predator will switch to a different target - they might decide eating your crops instead of the insects infesting them is a better plan! Not only that, but introducing a new species to an environment, adds the risk of disrupting the natural food chain.

In the end, it's up to the person with the pest problem to determine whether the advantages of biological control outweigh its disadvantages! •



Figure 9: Caterpillar with eggs



Figure 10: Ermine Moth



# THE BASICS OF VEGETATIVE PROPAGATION

## PART 2



NOW THAT WE HAVE LEARNED ABOUT THE TYPES OF PROPAGATION IN THE FIRST ARTICLE ON PAGE 4 IT IS TIME FOR A SECOND LOOK AT VEGETATIVE PROPAGATION OR THE TAKING OF CUTTINGS FROM A STOCK PLANT TO BE USED AS A START FOR A NEW PLANT. A FEW YEARS AGO, CANNATALK PUBLISHED A PIECE ON THE TAKING OF CUTTINGS, THE HOW AND WHY OF THE PROCESS. IMPORTANT THINGS NEED TO BE KEPT IN THE SPOTLIGHT, AND THE PROCESS OF PROPAGATION IS NO EXCEPTION, AND IT IS THE FIRST STEP IN CROP PRODUCTION. HERE THE ORIGINAL ARTICLE THAT APPEARED IN CANNATALK ISSUE 6 IS PUBLISHED AGAIN IN AN UPDATED AND EXPANDED FORMAT.

By Geary Coogler BSc Floriculture / Horticulture

### Vegetative Propagation

Nothing could be so simple; take a pair of scissors, cut some tips off a plant, stick them in the ground and away they go, right? Wrong. OK, then take some scissors, cut some tips off a plant, stick them in a new \$300 miracle rooting machine and away they go, right? Sorry, wrong again. While the steps are close, there is much more that goes into it before and after to insure success. An expensive machine is not the answer, doing your homework is.

but also the where to cut, the how to cut, what to use to cut, and the how to care after cutting are equally important. Why, because you want to be successful in making good use of every possible cutting. It keeps down the number of stock plants and reduces the amount of room required for keeping up with production. It also will result in even rooting between cuttings with a lower count of 'blind' cuttings; blind cuttings don't readily form roots.

### Stock

To begin, cuttings (not clones which come from a single cell usually from tissue culture) are a reflection of their origin. Just like a newborn baby that is a reflection of its mother's health and genetic strength, plant cuttings were a part of the original *stock plant* and as a part, shared in the critical balance of light, air, water, and nutrients. If the stock plant was deficient in say Phosphorous, then so too will the cutting be deficient. This problem becomes compounded by the fact that the cutting no longer has legs and a way to get to the kitchen for a light dinner or the sink for a drink. The future plant will show a problem rapidly and throughout the cutting's development period. It all starts with the stock plant.

The stock plant needs to be actively growing but not pushed, remember we want to force roots after the cut and the cutting does not need to be locked into a vegetative growth surge. Ensure the plant is getting regular feedings but do not overdo especially with the Nitrogen as this will cause an imbalance in carbohydrate storage resulting in soft cuttings that have little energy for rooting. Overfeeding will reduce the number, size and quality of the root initials. The fertilizer ratios that could be used are as varied as the number of plant species the cuttings can come from. So, no recommendation will be made other than how the stock plant is growing. If you are working strictly with *terminal cuttings*, you want them to be as tight as possible, avoid too much internode stretch. Cut back on the Nitrogen if this becomes apparent.

There are four different types of cuttings to consider; Hardwood (deciduous species), Hardwood (narrow leaf evergreen species), Semi-Hardwood, and Softwood (Greenwood) cuttings. There are also many ways to cut and treat cuttings depending on the type it is. These methods are based on the type plant (woody to soft), production time (seasonal changes) and end use. To keep it simple, and since it is common to all types of wood, although confined to only spring growth for woody plants, we will discuss the Softwood approach.

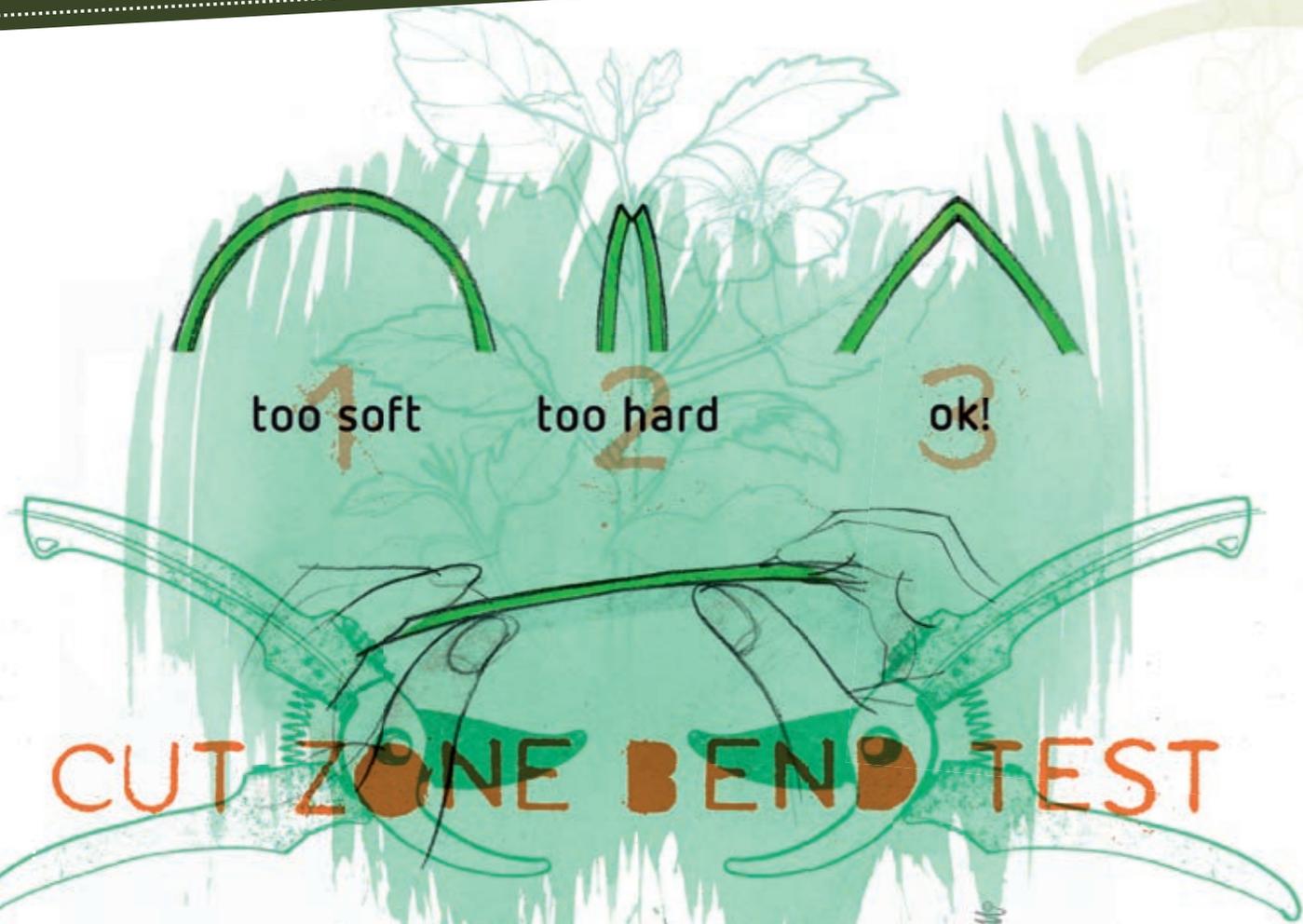
The right location to take a cutting lies between too soft and too hard. There is a zone on every terminal that transitions between low carbohydrates / high Nitrogen and high carbohydrates and low Nitrogen; you want the middle zone. How do you tell? Most of the time this is known by experienced growers, but new or less experienced growers might want to do the bend test. You take a tip still on the plant and bend it where you want to take the cutting, bend it back double on itself. There are 3 things that could happen: it just bends (high Nitrogen and low carbs), snaps in half or nearly in half (high carbs and low Nitrogen), and one spot that will partially break but not through (just right). Here is the cut zone. This is the section of the stem where roots will most readily form. Now if we only knew where in the internode to cut.

The internode is the section of the stem between leaf sets. Some plants form new roots from the node (where the leaves attach), some form them along the internode section. The key is to cut close to the node on those that form at the node and halfway for those that root along the internode. The grower has an option here, to cut it straight or angled. Callus forms faster and seals off the stem quicker on a straight cut. This is a must to keep disease down and get the stem sealed. Cut flowers like roses are best cut on an angle because they need the water to pick up and the wound to stay open to transfer this water. However, some species that are hard to root, form callus quicker if the slant cut is used or if the tissue on the stem is cut along the length of the stem as a small cut. The option is the grower and what works best for them and the plant. If one way has more issues, try the other. From a commercial point of view, straight cuttings are the norm and allowances are made for the average success rate for the species being propagated. Additional cuttings are taken to cover the loss percentage. Also key is taking care to avoid crushing the tissue at the cut itself. Use a very sharp knife or a set of by-pass pruners (or scissors if it is the only option). It is near impossible to accomplish this totally, but the

You also want to avoid any other nutrient deficiencies; the plant should appear healthy with glossy green leaves and thick cuticles. Keep the light level up during growth periods but try to reduce the amount of lumens the plants see by about the week before taking your cuttings, but not so low stretch is induced. Once the cuttings are removed, they will be going into a reduced light environment which can be as big a shock as losing the roots. Make sure the stock plant has been watered a couple hours prior to cutting. It is also wise to make sure that the stock plant has been in a stable growth routine and not dried down, as example, excessively in the last 2 weeks. A stable, vigorous, healthy stock plant will yield the same in cuttings. Now that we have assured the stock plant is as healthy as it can be, it must be time to get out the scissors.....no.

### Taking Cuttings

Taking a cutting requires care, for the cutting not the grower. Not only does choosing the correct tip to keep,



# THE BASICS OF VEGETATIVE PROPAGATION

## PART 2

impact can be reduced by selecting the proper tool. The cut needs to be clean and crisp. It really depends on the material being cut. **Herbaceous** material and very thin **woody** material is best cut with a knife designed for this, it is very sharp and listed as a propagation or budding/grafting knife. The next best option is a bypass pruner. This has 1 blade and one arm that catches the work so it is still a cut but has more pinch than a knife. Scissors, anvil pruners, and fingers should be avoided and used only where cutting is done for the results and not for taking a viable cutting. They crush the stem. Remember we want a nice, clean cut.

### Rooting

Next is dealing with the cutting from cut to plant (stick). All cuttings need to go directly to 100% humidity when cut. The longer the interval of dry, the worse the cuttings will do. If you have to work large areas, use wet cheesecloth

or burlap to wrap the cuttings in. Keep them dark, cool and moist. Is there an advantage in allowing the cuts to dry some before sticking them in medium? Yes and no: herbaceous cuttings do not show as marked a difference in results as woody plants but they do rot less frequently, then again, they also root faster because the lack of lignin in the stem of herbaceous cuttings allows faster rooting. It is for this reason that these type cuttings are not allowed time to dry off. Work them as soon as possible to keep the auxins flowing down the stem since they need to work at the bottom. A word of caution here: if the grower uses a rooting chamber that sprays a mist up onto the stems of a cutting and provides no top humidity control, perhaps he would be better off cutting them on a slant. This allows for water penetration since these units depend on this route to supply the water demands of a cutting.

Acceptable media for rooting has to be or should be close to the medium that will be used for growing them on: use inorganic for those systems that are inorganic and organic with organic systems. You have to match the properties. Plants develop new roots with characteristics suited for the medium and subsequent job they must do. If you are growing in soil or soilless mix, it makes little sense to put roots on a cutting by using a water based rooting system; the plant then has to devote time and

energy to converting those roots to roots that will work in the new environment, where water is more scarce as are minerals. If you intend to grow on in clay pebbles, then root in something like water, rockwool, or floral blocks. This will insure root compatibility from the start. Avoid sticking the cuttings too deep; while Tomatoes can handle being transplanted deeper, most things can not. On plants that root at the node, you need to just bury the node, on the others, leave the node above the medium. Finally, make sure you water the cuttings when done. This ensures a seal on the stem and settles the cutting into place.

Now what do we do? Let's see, we fed the stock plant, took the cuttings, stuck the cuttings....now get it under 100 % humidity. This can be done with anything from a dome to a mist system. Some plants are not particular and will take it drier (others much drier) but if the plant is not a cacti, or succulent, then it will probably benefit from this approach. Humidity cuts down the water use and supplies water, which keeps the leaf turgid, the systems functioning, and the processes processing. Keeping the lights at a lower intensity will enhance rooting while decreasing leaf functions to survival levels. It will slow transpiration while necessary components are utilized at the root sites to build a new root structure. Keep the atmosphere around the cutting warm (not hot), keep the humidity up (100%), and keep the root zone temperature warm as well about 76° F (25° C). Hold this humidity till root initials and / or callus tissue is seen, then you can allow some time below 100% but above 80% to encourage root growth. When roots are seen in the surrounding medium, time to get them to 80% humidity and no more free water sprayed on the leaves in order to limit disease issues. When the roots hit the outside of the root cube or pot or whatever, transplant them.

### Transplanting

The timing here is important. If a grower waits till they have a root ball formed, the roots are old, 'pot-tight', and prone to growing on with less branching. Don't wait; the roots need some size but not a mass. Hold off on stimulants until the cuttings are transplanted. Unless they are rooting into medium; then use them soon as roots are noticed (some stimulants can be supplied through the leaf earlier). Rooting hormones are used before sticking a cutting into the rooting media though. Following the earlier advice on allowing the new cuttings' fresh wounds to dry some before sticking will do almost as well as fungicidal powders. The grower should never transplant fresh rooted cuttings into too large a container, use an intermediate size. For instance, do not transplant a 1 inch cube with rooted cutting into a 5 Gallon (20 L) container, use an intermediate size like a 4 inch for root formation. The plant won't care and it will be less likely that this one gets over-watered.

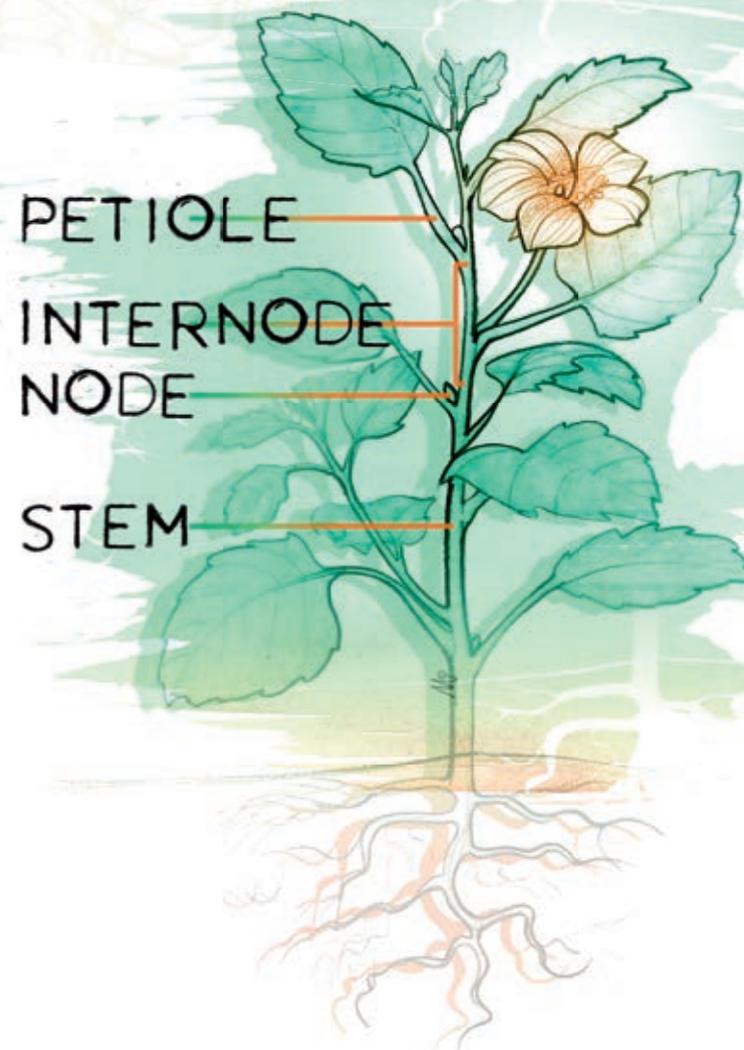
A critical point to make at this juncture: roots require 100% humidity to avoid damage. The longer the tips are exposed to air, the greater the damage that is done. Keep the time it takes, from pulling plugs and exposing the roots to the air, until they are buried in their new home, to a minimum. Do not harvest hundreds of plugs

in the morning then wait till the afternoon to plant them. Harvest, or remove from the starter trays exposing the roots, only what can be done in 15 minutes. Once planted ALWAYS water them in, with or without feed based on the medium and certainly adjusted to the bare minimum needed.

A cutting that is being transplanted the first time does not need to be jammed into a container that has an ocean of media. A cutting that is 4 inches (10 cm) tall should not be put into a 5 Gallon (20 Liter) container right away. Drop it into smaller container first and allow it to gain root volume, then move it up. The same rules apply, once the roots are making it to the outside of the root ball in good numbers, but loose, move it up. This will keep water constant, avoid over-watering, insure adequate nutrient availability, and make cropping easier. Keep the mediums in the smaller container the same as the final home.

### Care of the Transplants

The application of fertilizer is dependent on the medium as to timing and amount. If fertilizer is applied to a medium like soil or peat, then a fair amount will adhere to the particles either directly or through bind sites. If there is not enough plant to use these nutrients, then they stay around and add to what ever additional is applied next and can



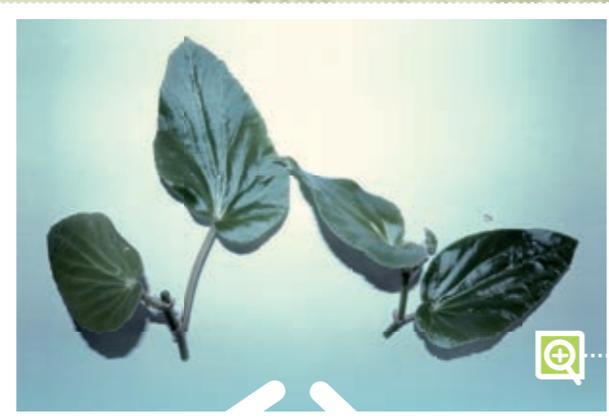


Figure 11: Cuttingsplit: Taking Cuttings: 2 cuttings from a single tip

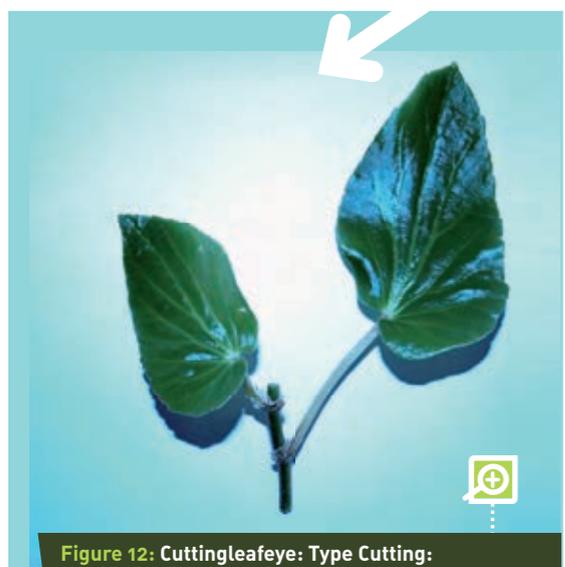


Figure 12: Cuttingleafeye: Type Cutting: The Leaf-Eye cutting with no tip and 2 axillary buds

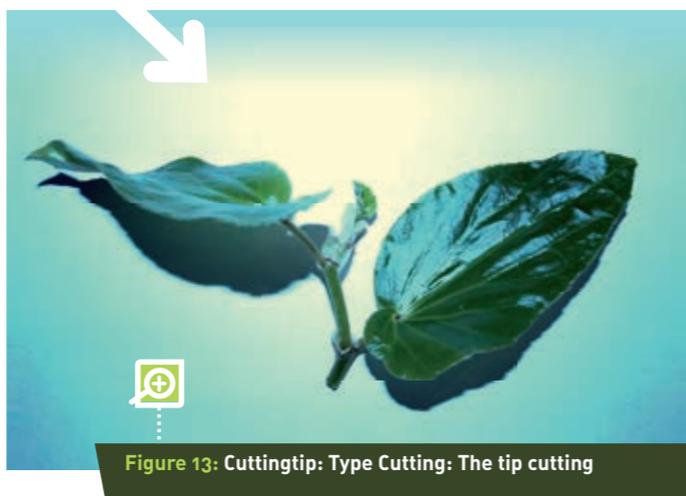


Figure 13: Cuttingtip: Type Cutting: The tip cutting

# THE BASICS OF VEGETATIVE PROPAGATION PART 2

ultimately lead to high salt issues. So, feed new cuttings and plants lightly and increase in proportion with the roots. Foliar feeds can be applied to leaf surfaces but in light amounts. Nitrogen does have a tendency to leach out of leaves under a mist system as well as some other elements. Usually, little foliar feeding is recommended where roots form in less than 5 days. What the terminal accumulated while a part of the stock plant should suffice. There is little advantage to it beyond this interval. The root system is, after all, the best way to introduce materials to the plant. This holds true throughout the plants life, feeding is best done through the roots. If a plant has problems with this so that foliar applications

are required, there is a problem elsewhere that should be fixed.

Taking cuttings is easy, especially with the right plant. Some plants don't cut well at all. Some take weeks to put on new roots, some are starting new roots while still on the stock plant. The grower has to know what is possible with the plant / crop they have chosen in order to know what to expect.

Is it always wise to use rooting powders to get 12 hours worth of faster rooting, or does it cost more than the benefit? If a crop can typically be anticipated to throw 10% blind or deformed cuttings, should a grower take 10% more cuttings than needed to cover this? Yes, a grower has to work with the averages to win, or change course. Remember, cutting on anything alive has consequences, to the cutting and stock subject. Take care of the stock and the cuttings and succeed time after time.

For some additional hands-on tips make sure to also read the Grower's Tip on page 27. •

# Grower's

# TIP #33

By your friend SEZ

## CUTTINGS

Taking cuttings is easy, making them grow roots... Sometimes a bit less. Many times, lower than expected success rates are caused by the grower overcomplicating things or making basic, avoidable, mistakes. If you follow the next tips closely, you should also, like many others enjoy 90%+ success rate!

First, cuttings are a "photocopy" of the original, so make sure it looks good before "copying" it. It is crucial that the stock plant is very healthy before taking any cuttings. Confirm it has been well watered and that there are no signs of pests or disease. It is a good idea to feed Rhizotonic to the stock plants both in the root zone and on the foliage a few days before taking cuttings. This helps making the plant healthier and more stress resistant. Definitely a good thing, for both the stock plant and the cuttings, as the cuts are no doubt in a big shock.

Secondly, because the rooting will occur in a warm and very damp environment (75°F / 90-99%Relative Humidity), make sure everything involved is very clean, this means the trays, domes, tools used to take the cuttings and your hands. Remember cuttings perform better when it is warm and moist, so do fungi and bacteria.

Without going into the "gel or powder" debate, you should know that like most hormones, levels need be very precise to get the desired effect. This is why you can find different rooting products, with different concentrations of active ingredients (usually I.B.A.) meant for different type of stems, from soft to hard wood.

Using the Hardwood version on soft tissue will not make it root faster, to the contrary, it may inhibit rooting for a long while. Then you need to know that either gels or powders, because of what they are made of, have a slight desiccating effect. If you apply too much it will dehydrate the epidermis of the cutting and it's surrounding, which may kill the cuttings before they strike a new root. Follow instructions on the product and remember that when they say "remove excess", they mean it.

Another common source of failure is grower's impatience. Once cut off from the mother plant, the cutting is obviously no longer replenished in moisture by the roots, therefore you will need to keep leaf transpiration to a minimum. This is done by keeping the area around the leaf very humid; this is why many choose to use the tray and clear dome combination which is easier than keeping the whole room above 90% RH. Avoid taking off the humidity dome! Each time it is removed it causes a brief drop in humidity and the leaves will "let go" of some water, eventually leading to levels being too low for them to survive. The cuttings are in some kind of suspended animation, so until they get the first root out, it is way better to leave them quietly alone.

There are some thermo/hygrometers that are designed to be installed on the dome itself to show you exactly what is going on inside, helping you keep levels where they need to be. They are great, but there are also some ways to approximately figure out humidity levels, for free. This is done by looking at the condensation level on the dome. While being very approximate, it will give you an idea of what is going on inside. If the condensation line is halfway, you likely have around 50% RH, if you have water droplet on the top part, you are likely over 100% which is a bit too much. On the other hand if you see no condensation at all, you should promptly increase humidity within, as RH is likely under 50%. A fine mist of Rhizotonic solution (8 ml/Gal) will bring levels back up quickly while providing vitamins and some rooting aids to the fragile cuttings. Again, less is better, a fine mist does a better job than an intense soaking, remember the goal is only making humidity higher.

After a few days, slowly acclimate them to "normal" humidity levels. By slightly opening the vents on top of the dome and making a small gap between the tray and the dome to create a small airflow, some growers use a pen as a spacer to achieve this. Pay attention!! If you see the cuttings begin to wilt, promptly mist them and re-seal the dome and try again the next day.

Once the cuttings have rooted, they will require feeding... Time to use CANNA Start!

Good luck and Happy Gardening  
Your friend Sez!!! •



# 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 CANNABOOST



			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			

WIN 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](mailto:editor@cannatalk.com) and mention CANNAtalk 33 is enough), and if we pick your name,

**A BOTTLE OF CANNABOOST  
COULD BE COMING YOUR WAY.**

## Winner puzzle #31

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



## BEES AND BUGS TO THE RESCUE

With the increasing population some researchers have estimated that food-growers will need to double agricultural production by 2050 to keep up with the need. Analysis shows that pollinators could boost small-farm yields.

This could close the gap between the worst and the best of these farms by almost a quarter, says agro ecologist Lucas Alejandro Garibaldi of the National University of Río Negro and Argentina's CONICET research network. The small farms are especially important because more than two billion people rely on them for food in developing nations.

Garibaldi and an international network of researchers wanted to see whether improving pollination could make a noticeable difference. The team used the same sampling protocols to observe 344 fields on large and small farms in Africa, Asia and South America over the course of five years. Monitoring 33 crops, such as coffee, apples and raspberries, the researchers kept track of which pollinator visited and how often. The low-yielding farms on average produced only 47 percent of the yield that did best. On the small operations, the sheer density of pollinators visiting crop flowers made a bigger difference in the amount of food produced, the researchers found. On larger farms, pollinator diversity mattered more: Those farms with a greater variety of pollinators produced more food. Analyzing the way yields responded to the number of pollinator's shows that improving pollination could help close the yield gap.

# Facts

## FIGHTING OFF THE ENEMY

To protect themselves from bacterial assaults, plants use mystery compounds that interrupt the bacteria's plans. Researchers from the Spanish National Research Council in Granada recently identified one of these protective compounds. The secret weapon for disarming bacteria is called rosmarinic acid. It mimics a molecule that the bacteria use to 'communicate' with each other about changes in population density. The scientists speculate the compound fools bacteria into sending signals to the troops to invade a plant before the microbes are in full strength. Making it easier for the plant to withstand his enemies. Tino Krell and his colleagues from the Council think the rosmarinic acid might be useful for limiting bacterial crop damage. *This news was reported by the Science Singling*



## BEAR FRUIT

Researchers from the University of Nottingham have found that traditional fruit gardens planted by native communities in the Malaysian rainforest increase the diversity of the animals that make it their home. The study has shown that the impact of humans can have positive outcomes for the conservation of this precious ecosystem when managed effectively. It suggests that traditional agroforestry systems introduced by the indigenous human population could be useful in supporting endangered and vulnerable species of animals. Dr Markus Eichhorn, forest ecologist in the University's School of Life Sciences in the UK, said: "There has been a long history of misunderstanding between managers of nature reserves and the people who continue to live inside them. In this wildlife reserve we have found that the traditional practices of the local indigenous people can have some benefits for animal conservation. This means that it is possible for both groups to work together for common goals." *The research is published in the journal Biological Conservation*



DON'T MISS IT

## WHAT'S NEXT

Pardon me? You just read though an entire issue of CANNAtalk and rather than being pleasantly satisfied the first thing you do is ask for more? Well, we can hardly blame you to be honest. We are already looking forward to the next issue as well. What is it going to be about? Well, we will be shedding some light on one of our favorite products: Enzymes. People use them all the time; life simply couldn't exist without them. So what exactly are they? Why is it that using enzymes can be so beneficial to your plants? Join us next issue to find out!

## CANNAtalk:

- Is published four times a year by CANNA Continental, a company dedicated to making the best solutions for growth and bloom.
- Is distributed through CANNA dealers in the USA (find the closest dealer near you through [www.canna-hydroponics.com](http://www.canna-hydroponics.com)).

**Editor:** Iloņa Hufkens  
**Email:** [editor@cannatalk.com](mailto:editor@cannatalk.com)  
**Printed by:** Koninklijke Drukkerij E.M. De Jong

**Contributors issue 33:**  
 CANNA Research, Marco Barneveld, Mirjam Smit, My friend SEZ, Don and Nicky, Toby Adams, Milou van Dobben, Robin Zwijnenburg.

CANNAtalk doesn't just write about nature, it is also committed to preserving our natural environment. Did you know, for example, that this paper comes from sustainably managed forests? And that your favourite magazine is printed in a carbon-neutral printworks?



The world's first WATER-SOLUBLE & STABLE azadirachtin bio-insecticide



Available in 8.45 fl oz, 1.06 pt and 0.88 qt



**Controls over 500 SPECIES !**

**HARMLESS to birds, mammals and beneficial insects**

**NO KNOWN pest resistance and resurgence**

**3% Aza: The STRONGEST liquid aza on the market !**

**nutri+plus**  
[www.nutri-plus.ca](http://www.nutri-plus.ca)

*naturally came from the earth*



MICHIGAN: [www.biofloral.com](http://www.biofloral.com)  
 USA: [www.biofloralusa.com](http://www.biofloralusa.com)



## CANNAtalk

All editorial is copyright. All rights reserved. No part of this publication may be reproduced in any form without prior written permission of the publisher. The publisher is not responsible for any inaccuracies. Material which has been contributed does not necessarily reflect the opinion of the publisher. It is assumed that any image from widely distributed sources, such as the internet are in public domain although these images are often passed on between websites which makes it sometimes impossible to trace the original source.

English You reap  
what you sow.

Dutch Zoals men  
zaait zal men  
oogsten.

In other words, growers who know CANNA can be confident they'll yield quality plants.

**Welkom to the Dutch way to grow.**