CANNAtalk®

MAGAZINE FOR SERIOUS GROWERS

ISSUE 14 2011

LIGHT & Flowering

Red and far red light

Graffiti

Art should be a crime

THE MAGIC of mint

NEW:
PESTS & DISEASES

THIS ISSUE:
APHIDS...

And more:

Light Systems
Grower's talk
Cartoon
Pests and Diseases (NEW!)
Questions & Answers
Grower's Tip
Factographic
Puzzle & Win

HQTalk:

During the last two years the months April and May were so hot and dry that it felt like summer! When the official summer starts the weather does a 360 degree turn! The Netherlands and the UK I believe, had problems with draught in the spring and in July we had to engulf some land for surplus water. Will this be the future? Is this the greenhouse effect? A cooler temperature is better for the plants! Unfortunately the days are getting shorter again and autumn is approaching!

This issue of CANNAtalk is all about light! As you might know light influences the temperature as well. Therefore we have a growers tip on how to optimize your temperature condition. Light is an essential element for a plant to live, therefore we have research articles about red and far red light and the different type of light systems including some new systems. But if you flick through the magazine you will notice that we have a new section in the CANNAtalk. The new section is called "Pest and Diseases", this section will highlight certain types of pests or plant diseases. In this issue we tell you everything about Aphids. We were so enthusiastic about the new section we wrote so much and unfortunately we could not fit it all in the magazine! Oops sorry for this, the other part of the article can be found on our website www.canna-uk.com.

Of course we have other sections in this issue of CANNAtalk they are growers talk, a what's happening about Graffiti, Grow it yourself about Mint and last but not least there is an Q&A. If you have any comments/questions/ideas please do not hesitate to contact us. You can either complete the answering card in the back of the magazine or visit the website www.cannatalk.com. We want to hear from you!

Knowledge is power... and the more you read the more you will know!

Karin

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THE EFFECT OF RED AND FAR RED LIGHT ON FLOWERING

WHAT EXACTLY CAUSES A PLANT TO FLOWER? WE DO NOT YET HAVE A COMPLETE ANSWER TO THAT QUESTION, BUT WE DO KNOW A GREAT DEAL ABOUT THE MECHANISMS THAT TRIGGER THE RESPONSE. THERE IS NO SINGLE PHENOMENON THAT CAUSES FLOWERING, NOR IS THERE ONE MAGICAL HORMONE THAT IS RESPONSIBLE FOR IT. PLANTS FLOWER IN RESPONSE TO SEVERAL TRIGGERS THAT LEAD TO A FAIRLY COMPLEX CHAIN OF PHYSIOLOGICAL AND GENETIC RESPONSES, WHICH ULTIMATELY CAUSE A CHANGE IN THE MORPHOLOGICAL CHARACTERISTICS OF THE FLOWERING APICAL SHOOTS. CHIEF AMONG THESE TRIGGERS ARE AN EFFECT OF THE LIGHT KNOWN AS PHOTOPERIODISM.

By Geary Coogler, BSc Horticulture, Hortisol NA Research

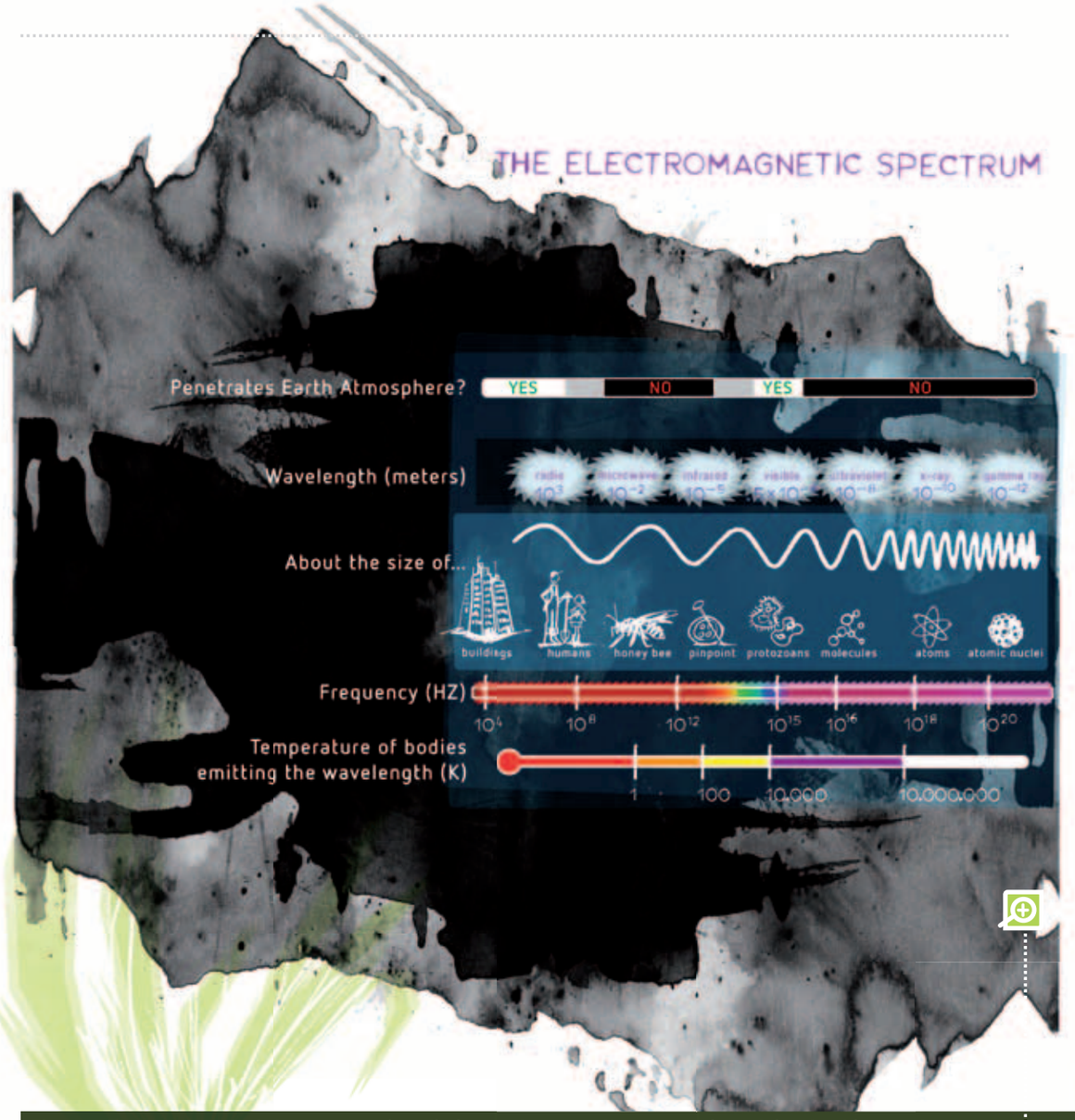

Figure 1: The wavelength of electromagnetic radiation can be as small as an atomic nuclei and as big as a skyscraper. Visible light is also a part of electromagnetic radiation.

Photoperiodism means the plant's response to certain light signals, including both the duration and the quality of the light it receives. Plants do not sense light in the same manner as people or animals sense light. In plants, the part of the electromagnetic spectrum which we perceive as light acts by providing energy for specific photo-chemical reactions in both control and energy production pathways. Animals also use light energy to 'see' the world around them. Light is a duality, existing both as a discrete particle (a photon) and as a wave. The higher the frequency (shorter wavelength), the higher the energy state of the quantum bundle known as a photon (see figure 1). The photo-chemical systems within plants are designed to capture specific frequencies of light and harness its energy to perform chemical reactions.

Plants capture light energy for two basic reasons: to make carbohydrates, and to control some of the thousands of processes that occur in plant cells. Here, we are only interested in process control, but the wavelengths used to make carbohydrates are roughly similar. There are basically four colours of the spectrum that plants work with: UV (ultraviolet) from 340 – 400 nm, blue from 400 – 500 nm, red from 600 – 700 nm, and far red (the start of infra-red) from 700 – 800 nm. These figures are not absolute because actually the colours overlap and a plant will use some of the energy from 500 – 600 nm too, although not much. The plant makes use of different pigments to capture different wavelengths of energy. Broadly speaking, the four bands of electromagnetic energy control the activities of the

RED AND FAR RED LIGHT

plant through three collection points, or light absorbing pigments; cryptochromes (blue and UV), phytochromes (red and far red), and phototropins (blue and UV).
The light collection points act like switches that turn on and off certain processes in the plant, and regulate others. While a human will only perceive the colours (wavelengths or frequency) reflected back to them and experience only a brightening or a dimming of the light level, plants are also sensitive to the light shift among frequencies that show as intensity to us. Plants grown in the shadow of others receive much more red and far red light than they do blue light. They are sensitive to the shift from red to blue light that occurs naturally at sunrise, and the opposite shift that occurs at sunset. They are also sensitive to changes in the time when these daily events occur. The different pigments act as switches that are triggered by the energy of a specific wavelength as a ratio of one frequency to another. Even the absence of light affects a plant's response through these control centres. All these controls affect the process known as flowering.

Light controls the natural rhythms of the plant (as it controls – for example – the sleep patterns of animals too!). These natural rhythms, or Circadian Rhythms, are inherent in all life forms. Life has a series of events it goes through during the course of each day. There are periods of activity and periods of rest. There are times when fuel is consumed and other times when certain activities or tasks are performed. All of these activities become programmed into a more-or-less 24 hour period. It is inefficient to produce the chemicals used for capturing photons when it is dark (although some are). Just like a factory, components need to arrive when needed, stock taking must be done and a minimum level should be kept available, and assembly lines should roll when all the right parts are there. Light determines these rhythms, and not only through its presence but its quality as well.

A plant senses both the quality and the quantity of the light it receives. Based on environmental factors such as air quality or the time of year, the plant will sense a different ratio of colours. This difference is basically measured by the pigments which, when coupled with other triggers and processes, control what the plant 'does', and when. It sets the biological clock in the plant so that all the plant's processes continue to run in harmony. Cryptochromes sense the direction of the light and its quantity. Responses governed by cryptochromes include stomatal function, gene transcription and activation, the inhibition of stem elongation, pigment synthesis, and the tracking of the sun by the leaves. Phototropins, the other blue light receptors, are responsible for phototropism or plant movement, and the movement of the chloroplasts inside the cell in response to the quantity of light as a damage avoidance system. There is also some evidence that they activate the guard cells at the opening of the stomates.

Phytochrome is a complex of pigments that occurs in two basic kinds: one that responds to red light (Pr), and another that responds to far red light (Pfr), depending on the light frequencies that they absorb the most (even though the other frequency will also activate it and blue light too). The two pigments generally convert back and forth, with Pr converting to Pfr with red light and vice versa (although some forms of Pr/Pfr lose the ability to reconvert depending on the amount of light, the intensity, or the quality of the light received). The active form, which triggers responses such as flowering, is Pfr. Red light exerts the biggest influence on photomorphogenesis (the effect of light on plant development) and far red light can sometimes reverse Pfr responses. Phytochrome controls many functions such as gene expression and repression, gene transcription, the elongation of seedlings and stems, germination, photoperiodism (the flowering response), shade avoidance and adjustment to differing light levels, and chlorophyll synthesis.

One example of a red light response is the change in the light interval from long days to short days, which will trigger flowering in short-day plants. This is because the plant senses the change through the ratio difference between red light and far red (or no light), and begins to

Figure 2: As the sun sets, the amount of far red light exceeds the amount of red light and the levels of Pr increase, resulting in a slightly higher concentration of Pfr and a lower concentration of Pr.

Figure 3: The next morning, there is total light again and the ratio of Pr to Pfr returns to equilibrium.

change its physiology from a state of vegetative growth to floral growth. While the plant is receiving light, the ratio of Pr to Pfr (Pr: Pfr) is approximately in equilibrium (in fact, Pfr is slightly higher). Pr is converted to Pfr by red light and Pfr is converted back to Pr by far red light. As the sun sets, the amount of far red light exceeds the amount of red light and the levels of Pr increase, resulting in a slightly higher concentration of Pfr and a lower concentration of Pr. Pr is produced naturally by the plant during the darkness and accumulates. Pfr also slowly breaks down to Pr (its half-life is approximately 2.5 hours). The next morning, there is total light again and the ratio of Pr to Pfr returns to equilibrium. In this case, it could be said that Pfr is like the grains of sand in an hour glass. It is currently thought that when Pfr concentrations are low and Pr is high, short-day plants flower and long-day plants do not. When Pfr concentrations are higher and Pr concentrations are lower, long-day plants flower and short-day plants do not.

If we take two plants, one which is set to flower at a day length of 10 hours light/14 hours darkness (a short-day plant) and the other set to flower at 14 hours light/10 hours darkness (a long-day plant), the period that determines flowering is actually the night. This process is illustrated in figure 4. In effect, the short-day plant needs 14 hours of darkness to accumulate Pr and convert enough Pfr to Pr for the level of Pfr to be suppressed for long enough overnight for a morphological change to begin. This change becomes irreversible after a certain number of days. In a long-day plant, this process is basically the same but reversed. They respond to the presence of higher levels of Pfr.

The length of time for which Pfr is the predominant phytochrome is what causes the plant to begin flowering. However, if the Circadian Rhythms are not right, and initially they will not be, the components needed to effect change may not be present at the beginning and the rhythms will have to 'catch up' before the change begins. Pfr ceases the repression of Florigen, the flowering signal, or it stimulates expression, and the signal makes the plant flower. Basically, the levels of Pfr tell the plant how long the night is.

Figure 4: **Night length affects blooming in many plants. A). Short-day (long-night) plants such as the chrysanthemum bloom when night lasts longer than a critical length. If that critical night length is not long enough, the plant fails to bloom. B). In contrast, long-day (short-night) plants, such as the iris, bloom when nights are shorter than a critical length.**

RED AND FAR RED LIGHT

Florigen, once described as a theoretical hormone, is now generally described as messenger RNA known as FT mRNA. In very simple terms, this is a protein molecule that is produced on a portion of the DNA of a plant in an area known as the FLOWERING LOCUS (T). This protein is like a key which searches out a specific lock that it will fit into. When the lock is turned, this initiates other processes. When combined with another gene known as CONSTANS (CO), it is now generally accepted that this begins the change from vegetative to flowering states. So the change to flowering by a plant involves external signals which affect, control and run the processes of the plant and trigger gene expression. All of this is triggered by the changes in the light which are picked up by the plant.

There are basically five types of flower response in plants. There are short-day plants (SDP), which simply require a shift to short days and long nights in order to flower. There are long-day plants (LDP), which require the opposite. Then there are long-day short-day plants (LSDP) and short-day long-day plants that require a specific amount of time as a long or short-day plant followed by a short day or long day to flower. Finally, there are day-neutral plants (DNP), which require the same light functions but flower on triggers other than day length. In all cases, it is not only the type or quality of the light received which triggers flowering, it is also the duration of the light (in all cases but the DNPs). To be precise, it is the duration of the absence of light at night which triggers flowering, but based on processes and metabolites (Pfr, etc.) that the light has driven. It is important to understand that there are thought to be many other processes which play a role along with those described here, including the interaction of other genes and hormones such as GA (gibberellic acid).

Light is critical for all life, but especially plant life, where it not only produces the substrates for growth and metabolism, but it also establishes the rhythms and cycles of daily routines. Light controls critical aspects of survival and propagation; it sets the tempo for life in all organisms. Just as importantly, not all light is equal as far as a plant is concerned. The correct ratios of light (blue to red, red to far red, and so forth) have to be available for the plant to function correctly. Just like everything else, a plant can get too much of a good thing. In the end, however, while light is absolutely critical to plants, it is only a part of the overall equation of life. •

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Questions & Answers

There are at least as many different questions about growing as there are growers in the world. Many CANNAtalk readers and other growers send us their questions through the website www.canna-uk.com, asking for our help to solve their cultivation-related problems. As always, CANNA Research is more than willing to advise!

Question

Question: Hi, I use a bubble bucket for deep water culture, following the dynamic grow schedule available on your site. Right now I'm in the grow phase using CANNA Hydro Vega A&B, CANNAZYM and RHIZOTONIC (normal feeding). I'm getting a lot of algae in the tank, and it is binding to the roots so I have to clean it every 48 hours. The bucket is as good as light-proof and the water temperature is around 20-21°C. I was wondering if I can add hydrogen peroxide (H2O2) to the solution in order to lower pH and kill the algae? I have used H2O2 as an anti-algae solution before, but not with CANNA nutrients. And since the RHIZOTONIC is said to be algae-based, I wonder if the H2O2 will have a more negative effect than positive, overall?

Answer

Algae only grows when light can reach it. Make sure that the tank pipelines, and the substrate surface are all in the dark. You can usually solve the problem by covering the pot with black/white plastic around the plant (small tent). Using H2O2 can be dangerous. It kills organic matter in general, so it will tackle the algae problem, but it could also kill and dissolve the roots of your plants. Our advice: max. 0.43 EC H2O2 while there is algae visible and 0.14 EC if your system is vulnerable to algae. Using H2O2 to control pH is DANGEROUS, but depends on the water. A little is possible but never more than the doses advised here in EC.

Question

Hi, how can you control your EC levels? Also, how can I find out what level my EC should be at different stages of plant growth?

Answer

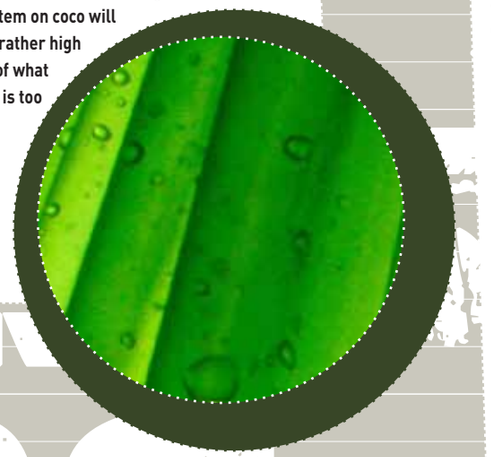
You can control your EC with an EC meter. EC control in the root zone is related to the substrate. You can check CANNA AQUA and CANNA HYDRO immediately. For CANNA TERRA and CANNA COCO, you have to take a sample of the substrate. In general, the EC level in the root zone should not increase if you stabilised the EC you add to the plant. In week 6 the EC of the root zone usually starts to increase, which means you have to compensate by lowering the EC that you give the plants. If you want to know how much we advise adding to the plants, I suggest you visit our website and complete the grow calculator, which will give you a personalised schedule! Please do not hesitate to contact us again for any questions!

Question

I have 12 plants in a 3x3 tray, which have just passed the seedling stage. They have just been transplanted to the coco medium in cloth pots (for their automatic root pruning and nutrient saturation qualities). I am currently flooding the table once a day, approximately one hour after going into the 6-hour sleep cycle. I have added the appropriate amounts of CANNA Coco A&B, RHIZOTONIC, and CANNAZYM to the reservoir. I have also mixed 4 litres of RHIZOTONIC for distribution throughout the topsoil, in an attempt to give the seedlings a boost. The 76 litre flood-and-drain system carries the rest of the nutrients to the plants once daily. Two questions: 1. Am I feeding at the appropriate frequency? (the medium is staying moist between feedings) 2. What is the recommended disposal method for used nutrients? If I dump it in the yard, will it harm the vegetation it comes into contact with?

Answer

To begin, for sanitary reasons, it is best to water when the lights are on. Also, if the medium is still damp or wet, you may be feeding too early. As long as there is moisture, there are nutrients. We usually use a 50% dry rule which means that you should water when the containers have lost around 50% of the water they hold. The best way to see this is by using a scale, until you are able to judge it by looking. To answer your second question: growers typically use it to feed the rest of their garden outside. Using an ebb and flood system on coco will produce tank water with a rather high EC concentration because of what is given off by the coco. If it is too long between tank changes then the water may cause burning on sensitive plants. Check the EC and dilute if above 1.71 EC before you feed it to your garden.



Question

We have a few questions that would really help us. 1) On your label for the CANNA Coco A&B it says to use tap water. We have a sediment and de-chlorination filter on our tap water output. Is this okay to use this with your nutrients? 2) We are using the ebb & flow table system. We want to use your coco fibre, but cannot figure out the correct container to use for this system due to the fibre being so coarse. What do you guys suggest for a container when using the table ebb and flow system? 3) When using the table ebb and flow system with coco fibre (not the loose fill but the COGr), is it better to use the CANNA Coco A&B or the COGr Flores A&B?

Answer

The answer to your first question is yes, you can use your water with the filters. You can even use reverse osmosis (RO) water but we advise that you use a medium to slightly hard water source so RO would require the addition of tap water to bring the EC to above 0.15. The second question is not so easy. The principles of capillary action, gravity, and time all play a role in determining this. Water will move upward against gravity and quickly enough to avoid problems as long as the pores are numerous enough, small enough, and the distance travelled is short enough. I tell you all this because it will help you understand my answer. In coco, we do not recommend any system that provides water from the bottom upwards. I know there are folks who do this, but we do not recommend it. In fact, coco needs really good drainage to remove the excess salts which are released as it decays. If you water from below, these salts and the nutrient salts are forced to the top layer of medium, forming a salt zone that roots will avoid. You can see how this happens by hanging a string over a cup of salty water with the tip of the string in the water. Soon you will see a build-up of salt near the top of the string as the water travels upwards. We recommend top-down watering of the product and I recommend using spray stakes not drippers, especially for larger containers.

THE MAGIC OF MINT

Figure 5: **The 8th, 13th and 17th day of cultivating Mentha Piperita on CANNA Terra Professional.**

THERE IS NO QUESTION ABOUT IT. WITHOUT MINT, THERE WOULD BE A LOT OF PEOPLE WALKING AROUND WITH HALITOSIS (THAT'S BAD BREATH TO YOU AND ME). THE FRESH SMELL AND TASTE OF MENTHOL, THE OIL THAT IS DERIVED FROM MINT, HAS MADE A LOT OF KISSING MORE ENJOYABLE. NOT BAD FOR A LOWLY PLANT THAT, IN GREEK MYTHOLOGY, STARTED OUT AS A NYMPH. ARE YOU READY TO GET FRESH?

Text: Marco Barneveld , www.bqurious.nl

Refreshing and heart-warming

When you hear the words "fresh mint" on a warm summer's day, you'll soon be picturing a long sprig of green mint submerged in hot tumblers or icy silver cups. Sweetened with sugar or honey, or just au naturel – whatever works best for you. Mint is the Moroccan symbol of hospitality, and in the hot streets of the medina, mint refreshes the old men sitting in the street, playing chess or just watching the world go by.
In colder northern climes, mint has other uses too. Mint is used dried or frozen to flavour and garnish roast lamb or vegetables, jelly sauces and creamy desserts. It's a versatile friend for chefs all over the world. Families will sit together and enjoy each other's company. Many cooks like to add chopped mint leaves to scrambled eggs or omelettes, for a change of pace, or to egg substitutes to enhance the flavour. Add the mint at the end of cooking of scrambled eggs or omelettes, because too much heat will turn the mint bitter. Fresh mint leaves add a refreshing twist to salads.

To reduce the effects of tannin and caffeine in your favourite tea, use fresh sprigs of mint, spearmint or peppermint in your teapot with your favourite tea. Tear off a few well-sized leaves, rinse and add them to your teapot. Steep for 2-3 minutes or longer for a more potent flavour.

Healthy little bugger

Whichever way you enjoy mint, it is excellent for your health. In fact, the reason that most of our ancestors grew this pungent herb as long ago as 1500 BC was its many health benefits. Even today, naturalists still use peppermint to treat gallstones, irritable bowel syndrome and the common cold. It was also originally used as a medicinal herb to treat stomach ache and chest pains. To cure stomach aches, the Romans put dried mint leaves in boiling water, and then, when it cooled, they drank it. We still do the same today, of course! Those Romans knew a thing or two. Nowadays, this type of tea is called monstranzo. In the middle ages, powdered mint leaves were used to whiten teeth. It seems that people were vain, even in those dark times. Anyway, mint tea is a strong diuretic and also aids digestion.
All mint contains menthol, the volatile oil that gives mint its characteristic cooling, cleansing sensation. Menthol is an ingredient in many cosmetics and some perfumes too. It is also added to toothpaste. Menthol oil and mint essential oil are also widely used in medicine as a component of many drugs, and are very popular in aromatherapy.
The herb mint belongs to a large family including over 30 species, the most common being peppermint and spearmint. Native to the Mediterranean and Western Asia, mints often interbreed, making it difficult even for an expert to distinguish all the varieties.

Mythical mint

The Greeks believed that mint could clear the voice and cure hiccups. In fact, mint is part of Greek mythology and according to legend "Menthe" was originally a nymph.

THE MAGIC OF MINT

RECIPE MINT COOLER

Ah, those long hot summers... When the sun hits the streets, you want to sit in the shade and rehydrate with a drink that refreshes your body and your mind. Try this zingy Mint Cooler. Here is what you need:

INGREDIENTS
- Half a cup lightly packed fresh mint leaves
- 2 cups lime cordial
- 2 cups club soda
- 4 slices lime

And here is what to do. Put aside four mint leaves for garnish. Place the remaining mint leaves and lime cordial into the blender, and process until mint is finely chopped. Stir in the club soda. Serve in tall glasses over ice. Garnish with fresh mint leaves and lime slices. Truly magic. Again and again. Now get fresh, you hottie!

She made the huge mistake of becoming Pluto's lover. His angry wife, Persephone, was crazy with jealousy and in her rage turned Menthe into a lowly plant, to be stepped upon by everyone. Pluto was unable to undo the spell, but he was able to soften it by giving Menthe a sweet scent so his poor ex-lover would perfume the air when her leaves were stepped on. On warm summer nights the beguiling aroma of the crushed leaves are especially invigorating.

Grow it yourself

Surely we have persuaded you by now... Are you ready to start growing mint? It's one of the easier plants to cultivate. Mint is a perennial and its seeds can be sown in pots or in the ground. Once this tenacious herb takes hold in your garden, it is very easy to propagate the plants by taking cuttings and transplanting them once the roots are well established.
Mint needs humid soil and only moderate sunshine. It will grow in and around all garden plants, not unlike a weed. It is tenacious and often seems determined to spread itself around the garden. The trick is to continuously cut it back and restrict growth, otherwise the herb will spread like wild fire through your garden and take over. The stolons of mint are some of the most aggressive in the entire plant world. If you plant it in the ground, the first year you will wonder what all the fuss is about. The second year you will find a few stray sprouts and by the third year it will be knocking on your bedroom window! Mint will grow 20 feet under weed block and come out the other side and with no water in the middle of summer.

You can also grow mint in pots with other herbs. Legend has it that this is a good herb for keeping ants away from doors and combating mice and fleas. Keep mint leaves near food, beds and wardrobes. Use it to freshen the house like an air freshener. It can bring a fresh herbal fragrance into every room.

Our favourite minty friends

There are about sixteen varieties of mint that you can cook with. These are our three favourites. The first is peppermint, which has a sharp and penetrating, but pleasant, minty aroma. It grows up to one to two feet high, but can reach three feet when in bloom. The lance-shaped leaves are deeply notched when mature and its flowers are usually purple. Pineapple mint gets its name from the slight hint of pineapple in its fragrance, although the aroma isn't always detectable. This mint is good for garnishes because its thick leaves are slow to wilt. It has white spots on its leaves. Last but by no means least, there is spearmint. Spearmint has a fruity aroma and flavour and goes well in many foods including salads, sauces, teas and dips. It has bright green leaves and purple flowers. •

But enough talk.
Let's get chopping!

A word from A GROWER

Grower's TALK

Carl, from Sheffield, UK.
The first years after I started growing, I never encountered any real problems. Unlike many other beginners, I did quite well. What were they moaning about on all those internet forums? Growing was easy! Either that, or I was just really talented.
I was too stuck-up to realise that I'd never done anything that required anything more than very basic growing skills. So when I switched to a more advanced method of growing, my smug smile was nowhere to be seen any more...!

Although I was born and raised in the crowded, industrial city of Sheffield, I've always loved nature and the countryside. So five years ago I decided to start growing plants in my own house. I began with small, exotic fruits in potting mix. I used a watering can to administer water and nutrients. With a minimum of effort, I got good but small yields every time. It was almost too easy.

Last year, I decided I needed a bigger challenge. I wanted to use a more complicated growing system that could produce more and better crops. But apart from a better yield, I was also genuinely fascinated by how these systems could influence the development of plants. With some financial help from my uncle, I purchased an ebb and flow system and decided to use it for chrysanthemums. My uncle is a florist and wanted me to grow some beautiful flowers to showcase in his shop – breath-taking specimens that would attract customers from all over the city. I couldn't let him down so I figured I should use the best products this time, and I'd heard that CANNA nutrients were the best.

I chose to grow on CANNA Aqua Clay Pebbles, because I heard they were good for root development. I used an ebb and flow system because I wanted to grow as many flowers as possible, and this way I could make use of every single square inch I had. I chose the matching CANNA AQUA nutrients, because this is a recirculating system. With an ebb and flow system, you don't need to walk between your pots any more. You can administer all the water and nutrients to all of your plants from one point. Each plant gets the same amount of water and all in all it's less work.

Soon after planting the seedlings, my flowers started to grow. But after a while I saw that the leaves at the bottom of my plants were turning lighter green, and then – horrifyingly – yellow. They were also too small. After a few weeks, I went to the owner of my local grow shop. Were the nutrients causing the problem?
The nutrients weren't the problem, he said. From what I told him, he thought I was probably drowning my plants. There wasn't enough root development. This meant that the plants were suffering from a nitrogen shortage. The roots just couldn't take up enough nutrients, because of a lack of oxygen, he said. Drowning causes a lack of oxygen in humans as well as plants.

So I cut down drastically on the water supply, continuing to use CANNA Aqua Vega. When the flowering period started, I switched to CANNA Aqua Flores. My flowers regained their strength, but they never became real show models. But the next crop of chrysanthemums was a bumper one – big, bold and colourful. Now I know that to get more out of your plants, you have to put in a lot more effort. Growing is no cakewalk, but it's very rewarding in the end!

The MOON

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

- The same side of the moon always faces us on earth, because it rotates exactly 360 degrees during its orbit around the earth.
- The 'dark side of the moon' is not always dark; it gets just as much sunlight as the side we see on earth.
- The gravity of the moon is the major cause of tides in the sea here on earth. The rotation of the earth and the gravity of the sun to a lesser extent also contribute to the tides.
- Since the dawn of man, people have believed that the moon has a profound influence on crops. There is little scientific evidence that this is really so. However, some scientists say that short-day plants may flower more abundantly when exposed to moonlight at night, rather than complete darkness.
- Nowadays, there are still many growers who believe the best time for planting is on the waxing moon and the best time to harvest is on the waning moon.

Pests & DISEASES

CANNAtalk is proud to present a brand new recurring section: Pests and Diseases. Plant pests and diseases are the fear of many growers as they can ruin crops and kill plants. In our first instalment we discuss aphids. Aphids are among the most destructive pests on cultivated plants in temperate regions. They can cause decreased growth rates, mottled leaves, yellowing, stunted growth, curled leaves, browning, wilting, low yields and death in plants. Please note: This isn't the whole article. Because we really wanted to expand on the subject, we decided to put the rest of the article on www.canna-uk.com. **By Iñaki García**

APHIDS DAMAGE AND CONTROL

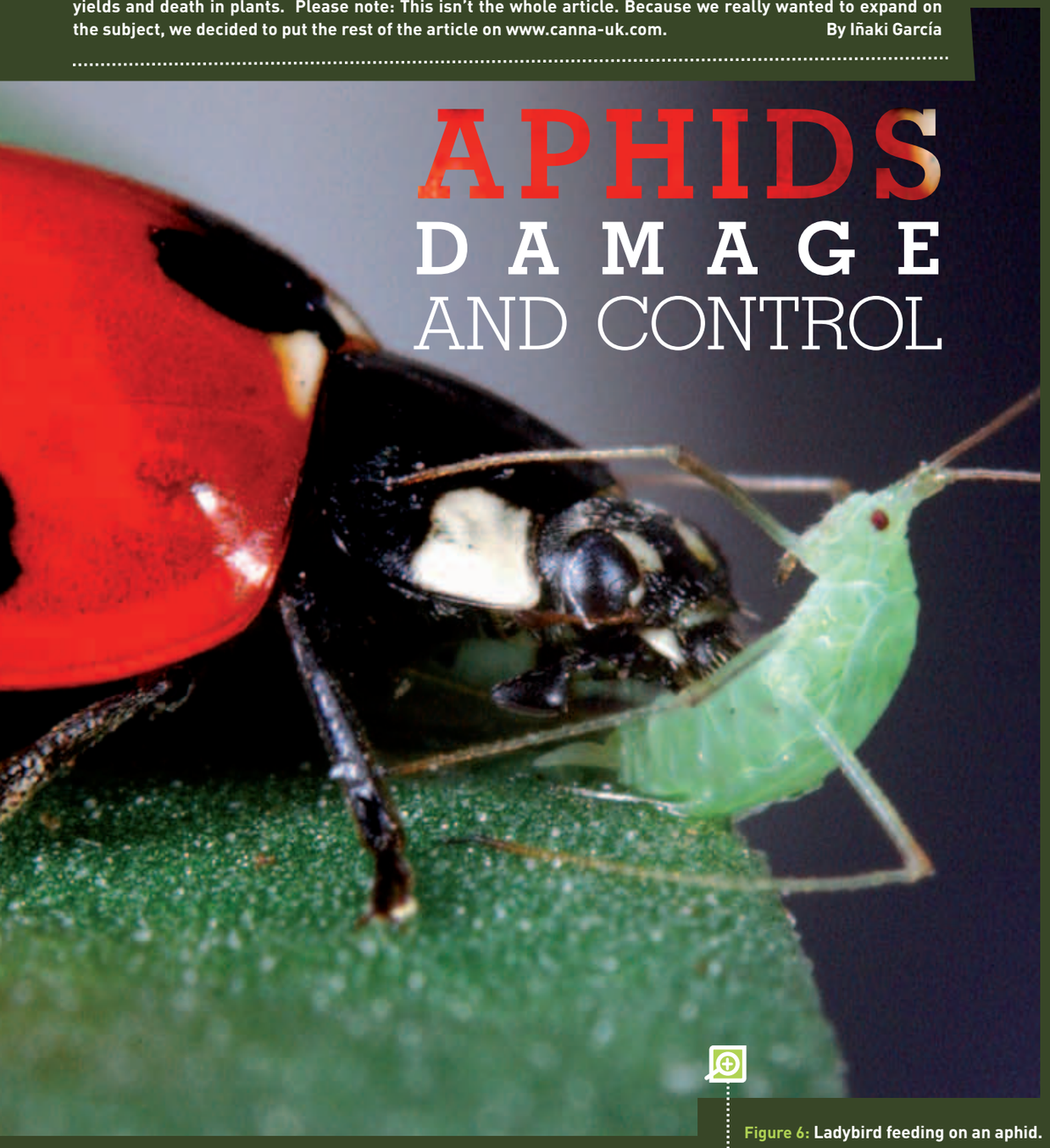


Figure 6: Ladybird feeding on an aphid.

When we refer to aphids, or plant lice, we usually mean a super family of insects which includes over 4,000 species of plant-specific parasites. They are not longer than about 4 mm, have a bulbous abdomen and can be many different colours. Many species bear a common or scientific name that indicates their favourite host plant, either for food or for raising their offspring, or to some of their distinctive characteristics. So, for example, Hyadaphis coriandri prefers coriander, Brevicoryne brassicae prefers crucifers such as cauliflower, the cotton aphid (Aphis gossypii), the cereal aphid (Schizaphis graminum), black peach aphid (Brachycaudus persicae), and so on. All aphids are characterized by a stylus (a kind of syringe needle) that is used to pierce and suck the sap from the plant, and a couple of tubes in the back called cornicles or siphunculi through which the animals excrete a kind of honeydew called cornicle wax. Aphids usually feed on the plant's phloem sap which is rich in sugars, minerals and other elements. The phloem is responsible for distributing this kind of sap throughout the plant. But the aphids also draw fluid from xylem, where raw sap runs directly from the roots. This provides the aphids with water, allowing them to stay hydrated during hot or dry periods.

Life cycle

A generation of aphids survives the winter as eggs, which allows them to withstand extreme environmental conditions of temperature and moisture. In spring the eggs on the plant (primary host) hatch, leading to the first generation of aphids. All the aphids born from the winter eggs are females. Several more generations of female aphids are born during the spring and summer. A female can live for 25 days, during which time she can produce up to 80 new aphids. Spring and summer reproduction occurs asexually – without males. This is known as parthenogenesis. In these cases, the resulting aphids are basically clones of the mother. In addition, the reproduction at this time of year is viviparous – i.e. the young are born live rather than as eggs (oviparous reproduction). When the fall approaches, there is a generation that grow into both male and female individuals. Females fertilized by the males lay winter eggs on the plant where they are, closing the cycle. This entire life cycle, including the viviparous phase followed by a final stage of oviparous reproduction, is known as holocyclic. However, it can also be the case that some species of aphids are always viviparous, and have an anholocyclic life cycle. In these cases, the resulting generations are not clones but are genetically different from the mother. Often, the factor that makes an aphid species anholocyclic or holocyclic is the local climate. In milder regions, a species that is usually holocyclic can be anholocyclic, while in colder climates they are holocyclic (remember that the eggs can resist cold temperatures and that some aphids cannot develop at temperatures below 5ºC). Anholocyclic aphid species overwinter as nymphs or as wingless adults. In both cases, the aphids can be winged or wingless (apterous). Usually the first generation to emerge from the winter egg are apterous but after several generations there can be a lack of space on the host plant, triggering the birth of a generation of winged aphids which can migrate to other hosts. The dispersal of the aphids will also depend on the type of host plant. Some species of aphid develop only on plants of a particular species. These types of aphids are called monoecius. Monoecious aphids spend their entire life in trees and perennials.

The most common species that attack crops are heteroecious aphids. Heteroecious means that they feed on different plant species. Holocyclic heteroecious aphids start their cycle when the winter eggs hatch on the primary host. The primary hosts are usually annual weeds, shrubs or trees. A couple of parthenocarpic generations – reproduced without fertilization – then give rise to a generation of winged females that migrate to the secondary host, which is usually a cultivated plant. In this new environment the aphids reproduce parthenocarpicly for several generations of females until the arrival of autumn, when there is a generation of winged males and females which return to the initial host plant and lay fertilized winter eggs, closing the cycle again.
Winged aphids are not able to fly in a straight line and even light winds hinder their movement. They know where to land through sensory stimuli such as visual (they are attracted by yellow), mechanical, olfactory and gustatory stimuli.
The aphid first introduces its stylus into the surface of the plant and probes to discover if the sap is appropriate as food. In the case of a proper species, the stylus is inserted more deeply to reach the phloem. If the sap is not right, the aphid flies to another plant.

Read all about aphids and how to combat them on www.canna-uk.com. •

Figure 7: 2 aphids feeding on a plant.
This photograph was made by Luc Viatour / www.lucnix.be

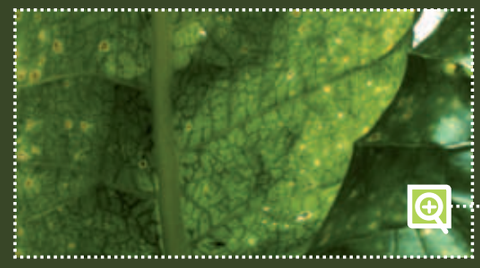


Figure 8: Potato plant damaged by the Potato Virus Y which is transmittable by aphids. The Potato Virus Y(PVY) is one of the best known viruses affecting Solanaceae (tomato, potato, sweet pepper etc.)

What's HAPPENING

ART SHOULD BE A CRIME

What is the point of art, if it does not upset anyone? If it doesn't get people talking? Not much point at all in our view, here at CANNAtalk. One of the few genuinely rebellious art forms these days is graffiti. This kind of street art has actually always been around, but it keeps regenerating itself, as new generations of artists come up with their own interpretations. Each in their own way, they try to make public areas more interesting – or vandalize other people's property – it all depends on how you see it. And spray paint is not the only tool that today's graffiti artists use. They also make use of stickers, stencils, posters and even mosaics.

By Paul van de Geijn

Antique graffiti

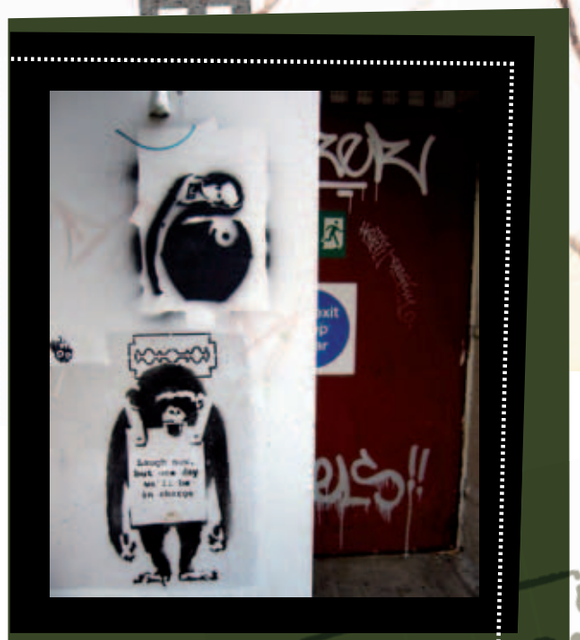
Graffiti is just about as old as humanity itself. Take the paintings made with pigment and animal bones on the walls of caves for example. These were the earliest known form of art, but you could also call them ancient graffiti.
In Roman times, too, there was a lot of writing and carving on walls. The best-kept examples of Roman graffiti can be seen in Pompeii, the Roman city that was preserved under volcanic ash and lava, which was later uncovered to reveal a snap-shot of a Roman city. 'Restituta, take off your tunic, please,' reads one piece of writing on the wall of a bar. 'And show us your hairy privates.'
Graffiti as we know it today first got started on the walls of Philadelphia and New York in the 1960s. Young people from all backgrounds started leaving their 'tag' on walls – a kind of signature mark made with paint or a marker pen. After a while, when everyone was at it, some kids wanted to differentiate themselves. They sprayed their tags onto the wall using fat, bubble-gum letters. Over time, these letters have become more and more intricate.

Since the advent of urban music like hip hop, graffiti can be seen everywhere. These days you even see murals on farmer's barns and village pubs. As long as there is a motorway or a railway nearby, because graffiti artists want as many people as possible to see their work.

Banksy

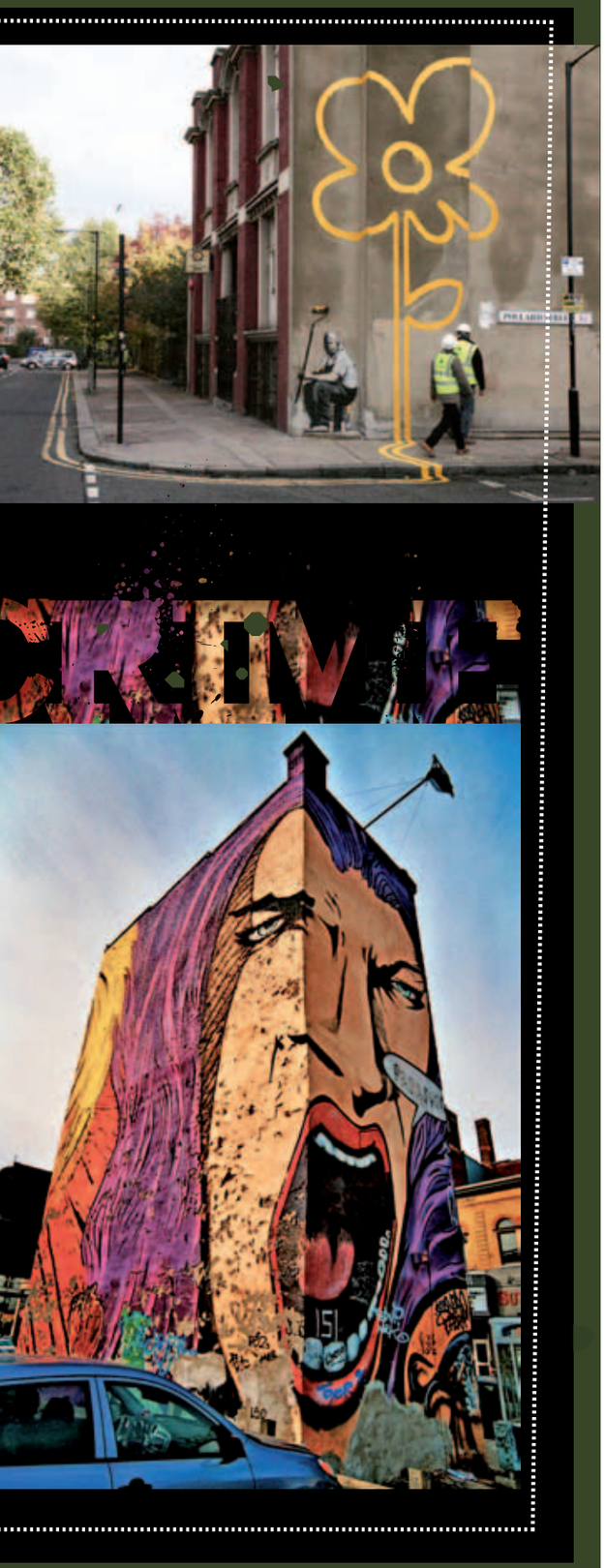
One graffiti artist whose work has probably been seen by more people than any other is the British artist Banksy. This mysterious figure – who according to some is really called Robin Banks and comes from Bristol – uses stencils and elements from the real-world environment. His characteristic style has made him famous all over the world. 'Exit Through the Gift Shop' was nominated for an Oscar at the beginning of this year for 'best documentary', but just missed out on an award.

Banksy works using stencils because graffiti can be done much more quickly that way. Before he started working with stencils, the police would often arrive before he had the chance to finish. His work often looks very realistic, almost like old black and white illustrations from children's books. However, this style is not unique to Banksy. It was originally developed by the French graffiti pioneer Blek le Rat.



Ker-ching!

Anonymous or not, the 'anti-capitalist' Banksy has no problem stepping out of the shadows for buyers and he has earned some serious sums of cash. His monkey wearing a sandwich board – which reads 'Laugh now, but one day we'll be in charge' – was sold for £228,000.
But most graffiti works are never sold at all. The majority of graffiti artists, or 'writers' as they are also known, do it purely for the kick and to satisfy their artistic impulses. And for their reputation on the scene, of course. The highest status is that of 'king' or 'queen'. Painting over work done by a king or queen is seen as a declaration of war. Banksy is a king, for example, and the French



artist Miss Van is a queen, who paints gutsy female cartoon-style figures using acrylic paint. They are often 'provocative and sometimes erotic'. Miss Van, who is from Toulouse in southern France, loves the illegal aspect of graffiti. Because it's against the law, there are no problems with censorship. 'It is also a challenge', she writes on her website. 'Each time I paint on a wall, there is the risk of seeing my work erased.'

Gas mask

Graffiti can sometimes be highly political. The most famous example of politics in graffiti are the murals of Northern Ireland. In this highly religious and divided region, these murals indicate the political and religious views of the surrounding neighbourhood. The most famous muralists are the Bogside Artists. Their work is Catholic and pro-Ireland, but it stands head and shoulders above other murals. They use a lot of black and white, probably because it produces such a dramatic effect. One famous image is of a young boy wearing a gas mask and carrying a petrol bomb during the 'Battle of the Bogside' in Derry/Londonderry, 1969.

Minor deities

Work by the Bogside Artists, Banksy, Miss Van and legendary figures from history like Jean-Paul Basquait (who died at the age of 27 from a drug overdose) and Keith Haring (who died from AIDS at 31) are considered art by most people. But the work of lesser-known graffiti artists is still often viewed by many people – including the authorities – as vandalism. And as such, it is still punishable with stiff penalties. That is certainly the case in the USA. In 2008, for example, 19-year-old Ralph Mirabal was sentenced to eight years in jail and a $5000 dollar fine. Ralph had covered a children's hospital and thirty houses with his tags. 'You spray, you pay,' commented the Texan judge that sentenced him. The members of a church that he had covered thought that the boy – by spending eight years locked up with hardened criminals – would learn his lesson. 'There is a difference between forgiveness and punishment,' said a church spokesperson.

Art is not a crime

Punishing graffiti artists provokes a variety of reactions. 'Art is not a crime,' is one often-heard argument. But even within the graffiti community, there are people who can understand why punishments need to be given out. Reacting to an internet clip showing arrested taggers, 'DlcKxFTR' remarks wryly that 'graffiti is not a crime' but that covering other people's property with paint is – indisputably – against the law. He then admits that he does it himself, and that actually, the fact that it's illegal is part of the kick that he gets from it. 'Half of us writers steal the paint and use a bolt cutter to get in wherever it is we want to write. I'm happy that it's illegal, because it gives me that feeling of being a rebel with a cause.' In other words, art should be a crime... And Banksy – no matter how much some people might see him as a commercial sell-out since his enormous success – would surely agree with that.

Grower's TIP #14

COOL OFF
YOUR GROW ROOM

In the summertime, a grower is likely to encounter the problem of too much heat in the grow room. You can cool off your grow room by changing the location of the air supply.

In the winter it's wise to bring in fresh air at the top of the grow room – above the light – otherwise the plants could be affected by the cold outside air.

But in the summer, this outside air may already be 24°C and the temperature would only rise further inside. Since the temperature of the air at the bottom of the grow room is higher because of the lights, the outside air drops towards the warmer air and warms up to 28°C. The air then starts to rise and leaves the room at 32°C. This way there are a wide fluctuations in temperature within the grow room, which can harm the plants. Also, 32°C can be too hot.

However, if you blow in the air at 24°C from below, it actually cools off the plants underneath the lamps. When the air warms up, it rises, but only gets as warm as 28°C when it leaves the grow room.

The grateful gardener

NEW LIGHT SYSTEMS

LIGHT IS ESSENTIAL TO PLANT LIFE. PLANTS TURN LIGHT INTO SUGARS, WHICH THEY NEED FOR GROWTH AND BLOOM. INDOOR CROPS HAVE TO PUT UP WITH ARTIFICIAL LIGHT, WHICH IS NOT ALWAYS SUFFICIENT. BUT MAYBE THIS WILL ALL CHANGE VERY SOON...

WE ARE ON THE VERGE OF A TECHNOLOGICAL REVOLUTION IN THE WAY THAT WE PROVIDE OUR INDOOR CROPS WITH THE LIGHT THEY NEED. SUPPLIERS ARE PROMISING MORE EFFICIENT WAYS OF USING ELECTRICITY, AND NEW COLOURED BULBS AND LED LIGHTS ARE TAKING THE MARKET BY STORM. THE QUESTION IS WHETHER THESE PROMISES ARE REALISTIC AND WHETHER GROWERS HAVE THE SKILLS TO BENEFIT FROM THEM.

By Pieter Klaassen, BSc

Plants and light

In order to understand the way these light systems work, it is necessary to first explain what light is and how it affects plant life. Light is a form of radiation and as such can be divided into different wavelength categories: visible light, invisible radiation, near infra-red and infra-red.

For plants, light is essential in the broadest sense of the word. Without it, none of its vital processes would be possible: The plant uses light, water and CO2 to make carbohydrates and oxygen (photosynthesis)
The colour (wavelength) and the amount of light determine the shape of a plant (photo-tropism)
A plant 'knows', based on the day length, when to produce flowering hormones and flowers (photo-periodicity)

Photosynthesis

When light reaches a plant's leaves, it is absorbed by cells containing chlorophyll. The two most important forms of chlorophyll, chlorophyll a and b, are most sensitive to blue and red light (see figure 9).
Theoretically these two colours of light alone would be enough to allow the plant to photosynthesise, but in reality every wavelength in the spectrum has its own function in the plant. Usually green and sometimes yellow light are partly reflected back, which is why most plants appear green to the human eye.

Photo-tropism

The way in which the plant grows is not only determined by its genes, but also depends on wavelengths of light it is exposed to, including both visible and invisible light.
UV-A light (340-400 nanometre) and UV-B light (280-340 nm) have a positive effect on the growth of new branches and further have a similar effect on plants as blue light, although there are some differences.
Too much UV-C (←280 nm) can damage a plant.
Far-red light (700-800 nm) penetrates more deeply into the crop than other wavelengths, resulting in a plant, or parts of a plant, to grow and stretch towards the light source.

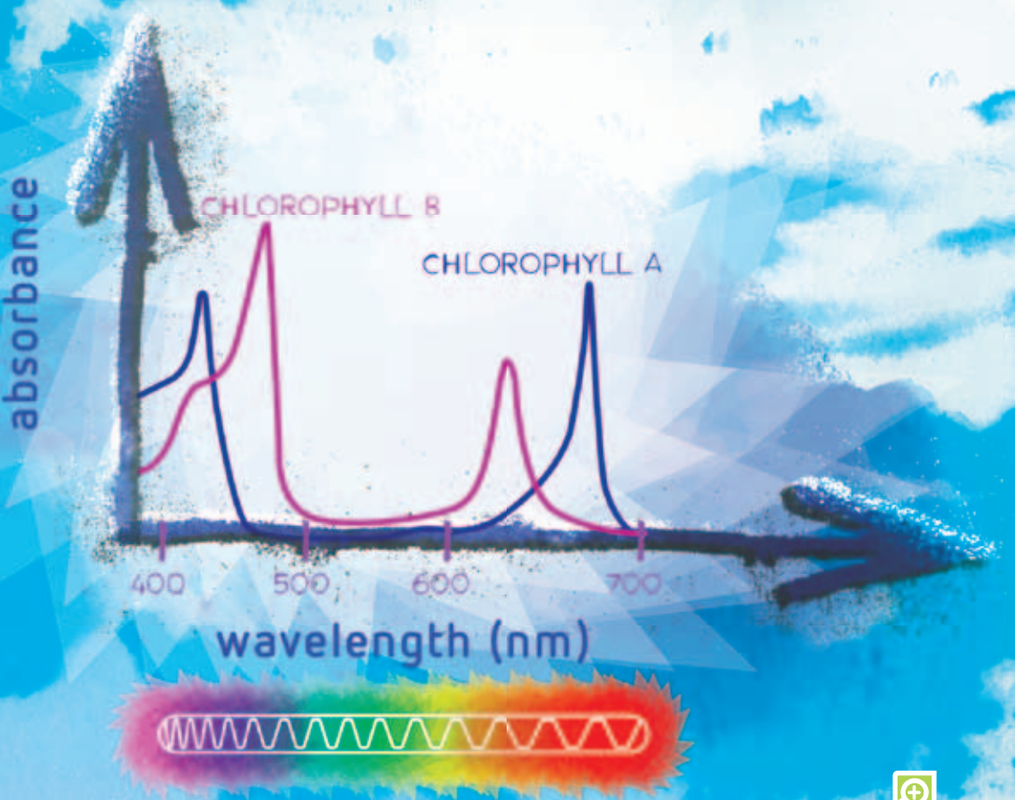


Figure 9: The two most important forms of chlorophyll are most sensitive to blue and red light. Chlorophyll is critical in photosynthesis, which allows plants to obtain energy from light.

Photo-periodicity

Many flowering plants use a photoreceptor protein to sense seasonal changes in night length, or photo-period, which they take as signals to flower.
These plants are classified as long-day plants or short-day plants, though the actual regulatory mechanism is governed by hours of darkness, not the length of the day.
A long-day plant requires less than a certain number of hours of darkness in each 24-hour period to induce flowering; these plants typically flower during late spring or early summer. Short-day plants flower when the night period is longer than a critical length. They require a consolidated period of darkness for floral development to begin, but the specific length of the dark period required differs among species and even varieties of a species. Day-neutral plants flower regardless of the night length.

New light developments

Now that we have a better understanding what light is and how it effects the growth and flowering of plants, we can look at some of the new lighting technologies that have emerged in recent years.
The most common type of photosynthetic lighting in

NEW LIGHT

Figure 10: **High pressure sodium lamps in a greenhouse**

Figure 11: **Fluorescent grow light**

horticulture today is High-intensity Discharge (HID) lamps. These contain a mixture of gases and metals enclosed within a glass tube. As electricity passes between the electrodes at the ends of the tube, the gas-metal mixture heats up and emits light. HID lamps can be either high pressure sodium (yellow light) or metal halide (white light). Sometimes a combination of both types of bulbs is installed to give a more uniform spectrum, while reflectors are used to direct the light toward the plants (See figure 10).

Better bulbs

Until recently, fluorescent grow lights (figure 11) have had a low output and have been too big and bulky to be of much use as a grow light for anything more than starting seedlings. This has changed with the appearance of new compact fluorescent or CFL and T5 full spectrum fluorescent lights. These improved light bulbs are growing in popularity for both propagation and plant growth, as they are energy efficient and extremely effective, especially when used in numbers. While not quite as efficient as HID lights, fluorescents have better colour rendering properties and produce much less heat when compared to HID lights. This allows them to be placed closer to plants greatly increasing their effectiveness.

LED

The application of light-emitting diodes (LEDs, see figure 11) as potential source for assimilation lighting in plant production systems potentially opens up a range of new possibilities. LEDs produce light in a very narrow wavelength range and do not directly emit heat radiation.

The heat which is produced by LEDs due to their limited energy conversion efficiency can be drawn away via convective cooling. As a result, LEDs can be applied at relative dark places close to the crop, in order to increase leaf photosynthesis at locations where assimilation light normally doesn't penetrate. In theory this type of inter crop lighting could significantly increase crop photosynthesis.
At present most commercially available LEDs only emit red and blue light. Even though these are the wavelengths that plants use for their photosynthesis, they are only to be used in conjunction with other forms of lighting, as supplementary lighting or directable lighting. Although new LED systems cover a much wider spectrum, these are mostly still in the experimental stage.

Plasma lighting

Plasma lamps produce a light spectrum similar to that of the sun and are therefore sometimes referred to as artificial sunlight. Plasma lamps use a small amount of sulphur which is excited by a magnetron, causing light emitting plasma to emerge.
Under laboratory circumstances, when compared to plants grown under fluorescent tubes and high pressure sodium lamps, plants grown under artificial sunlight are characterized by longer petioles, a greater leaf unfolding rate and a lower investment in leaf mass relative to leaf area. This means plants grow bigger and accumulate more dry matter, even though the photosynthesis per leaf area is not greater.
The large differences in plant response to the artificial sunlight spectrum compared with the widely used protected cultivation light sources highlights the importance of a more natural spectrum, if the aim is to produce plants representative of field conditions.

Conclusion

A plant needs specific wavelengths of light according to the stage of growth that the plant is in. LEDs, plasma light and specially coloured bulbs require further development before they can be made into products for growers. LEDs are already available for use as supplementary lighting or directable lighting, but it is still up to the grower to judge what his plants need at that particular moment. •

Figure 12: **A LED light**

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Puzzle&WIN

great prices

Win a bottle of CANNACURE

Do the **puzzle** so your plants can **guzzle**...

Because of the great success of the last puzzle, we have a 'spot the difference' puzzle yet again in this issue. Well, are you up for it? Can you spot the 5 differences? It's totally worth trying, because the one who impresses us the most with his/her answer wins a 1 litre bottle of CANNACURE! That's right, CANNA's brand new plant pest and diseases controller, which also is a foliar feed! So get working on those differences and send in your answers!

Winner puzzle #12

We picked a winner at random from all the correct entries we received, and we would like to congratulate

Mrs. Leeanne Fennel.

Congratulations on your bottles of CANNA Aqua Vega and Flores!
We will contact you as soon as possible to organise the dispatch of your prize.

WHAT'S NEXT

Choosing the right growing system can make or break your growing career. If you are just a beginner, you might want to start out simple. Just a watering can, a light and potting soil in pots can be sufficient. If you're more experienced, you could get bigger and richer harvests with a more elaborated system. Read everything on growing systems in the next issue of CANNAtalk.
Of course, there'll be other features too. If you want to read about something that has little to do with plants – except maybe jumping over them – check out our 'What's Happening?' section. Getting from A to B in a straight line, no matter what object or building is in the way... That is the basic principle of free-running and parkour. Read all about these spectacular urban sports in the next edition of CANNAtalk!

systems

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We enjoyed producing this magazine, and we hope you have enjoyed reading it! Maybe you want to thank us for this magazine, or you just have a question. Maybe you want to make a suggestion or comment on one of our articles. Maybe you want to tell us how much you enjoyed something, or perhaps you have a question. Whatever it is, we would like to hear from you. We love to read your comments and find out what issues our readers are facing. So don't hesitate to get in touch!

Write your answers to the puzzle, your comments, questions or suggestions on the answering card below (we'll refund the postage). You can also visit our website or send us an e-mail at info@CANNAtalk.com.

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Solution to the puzzle:

#14

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