

CANNA

Issue No.4 - Spring 08

Talk

Growing on Coco Busting The Myth

Growers Tip

Fifty-Fifty

Research

The influence of colors on plants

What's New?

Reintroducing COGr

The gods
must be crazy

CANNA
The solution for growth and bloom



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HQ's Talk:

After long winter nights, days are starting to get longer and warmer again. The sun is there when we wake up. Everything starts flowering again. You can smell the grass. Yeah, it's definite, Spring is in the air! All these beautiful colors start to appear around us. Trees and plants are turning fully green again. Speaking of which, did you know plants can't absorb the color green and that is the reason why they are green themselves?! You can read all about how this works in the article on page 16. CANNA Research wrote this remarkable article about the influence of colors on your plants. I am pretty sure you'll find some interesting insights here.

This is mainly a coco edition. Our main article "In the spotlight" is all about COCO. You will find a short piece of history in it but we assume you are more drawn by what our specialist has to say about it and the advantages coco has for you as a grower. It was written by one of our specialists on hydroponics and horticulture. If you place more trust in the judgment of a fellow grower, then you must read the testimonial on page 14. Here, Jake from San Diego sets out his experiences with CANNA COCO. On page 19 you can also find a practical and applicable tip from a grower.

In the "What's New?" section, you can find information on a very special, revolutionary coco product named COGr. While not really a new product, it is becoming more popular lately, especially amongst experienced growers and we wouldn't want you to miss out on that.

In addition to the story on colors that affect your plants, CANNA Research also explains, on page 12, why the CANNA COCO nutrient is in 2 bottles instead of one. They illustrate what would happen when you would put it into 1 bottle with clear pictures.

As always, we hope to inform and entertain you with all you need and want to know about growing and we are already looking forward to working on the next issue, which will appear in a new season, Summer!!! If you have any ideas on what that issue should hold please let us know. Browse to www.canna-hydroponics.com and send us all your comments. We appreciate it!

Cheers,
Jeroen, CANNA Headquarters



Growing on Coco Busting The Myth

By Ralph B.

In my travels and correspondence around the world, I find much confusion centered on the use of coconut husk litter, commonly known (after aging) as coco peat or mulch, in crop production. I was first made aware of the product as a potential additive to mineral soil or peat lite mixes in the early 1980's. The thinking then was that it had too many issues to use as a straight mix but did have some interesting side results when used as a fraction in a potting mix, or as a soil amendment to improve soil structure.

It was first introduced to the Royal Botanical Society in 1862 and proved successful initially but dropped out of favor because of the inherent issues with coco peat. Now it has exploded onto the scene in all manner of use from fraction to complete; but what are we dealing with and why such a delay in its acceptance into the general market?



To start, the physical characteristics of coco is unique in that it changes its physical and chemical characteristics dramatically over time. Green or newly harvested mulch is actually the dust (and broken fibers) generated by removing the fibers from the husk of a coconut. This is unusable at this point. After several months of decomposition, it begins to take on some usable characteristics of holding moisture better, the release of Potassium and other salts slows to a reasonable level, and the structure remains intact. There is a fairly short period from this point that the coco peat is usable in container plant production. Ideally, the coco peat has to go further to actually work with the plant correctly, but by then much of the structure is lost and the usable time in situ is severely shortened. While later stages of coco degradation are very acceptable as a soil amendment, it is not suitable for directly growing in. Structural problems are, however, a small part of the issue.

In addition, the availability of the nutrients present is affected on a changing scale along with continuing decomposition. Coconut Palms have the rare ability to utilize seawater solution as its source of water. Seawater has a high EC, or Electrical

Conductivity, which is a measure of how concentrated the salt level is. Plant cells do not exist in this range but much lower. For water to move into the roots of a plant, it has to overcome the Osmotic Potential of the membranes the water molecules pass.

Water moves from an area of low EC to an area of higher EC in an attempt to balance out or achieve equilibrium; where a semi-permeable membrane isolates the two solutions, only certain elements or molecules can cross, typically a water molecule or smaller (selectively permeable), through the process of Osmosis. (Fig A-1) Membranes can also be selectively permeable as well allow-

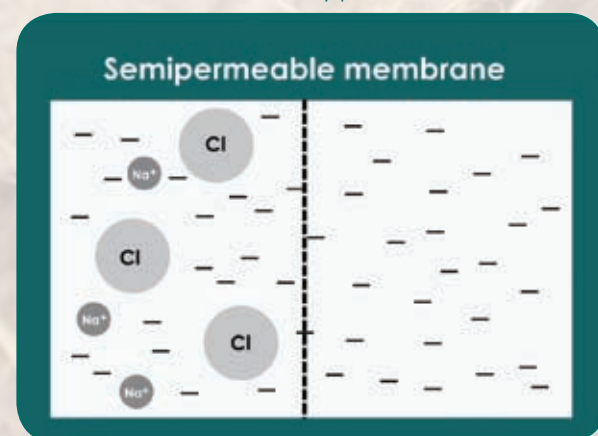


Fig A1: The effect of the plant cell semi-permeable membrane; it allows water to move from and area of higher concentration to one of lower concentration.

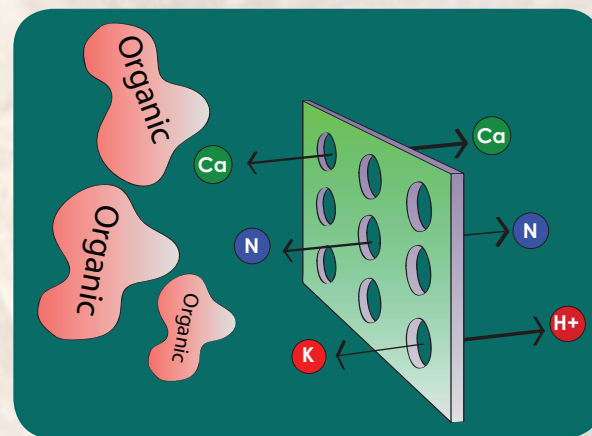


Fig A2: Blocks the passage of almost everything else

ing certain size particles to pass while restricting others. (Fig A-2) In typical soils and container mixes, fertilized at recommended levels, the EC of the root zone moisture

(which includes nutrients [salts]) is lower than the internal EC of the root cells, allowing water to move, or diffuse, across the barrier membranes. As root zone EC reaches EC levels of the plant, water movement slows and eventually halts. Unfortunately, it does not stop here and is capable of moving the other way. In this manner, most 'salt burn' situations arise, but not all. To compensate and get the water in the seawater solution (it is a solution of water plus many and varied salts) to move into the plant, the palm concentrates salts in the areas between the cell walls known as interstitial spaces. This affectively shows an increase in the internal EC while allowing the actual cells to function normally. Additionally, the process of harvesting the fibers also increase EC levels because the coconut husks are first soaked in seawater (the most abundant water supply close to where coconuts grow), which imparts its salts into all the pores of the coconut material. When decomposition occurs, these salts come out in very high amounts, especially Potassium, the most prevalent element found as an ion (salt).

All usable nutrients become available to the plants internal processes as ions, or charged atoms or functional groups like nitrate. Ions affect each other, in fact, in the plants processes they are combined in controlled fashion. In a solution with other ions, and no controls, they still



combine or associate with other ions of opposite charge. They also affect the availability of each other as similar charges. This is known as antagonisms, where one element in a large amount will decrease availability of another where it is in a smaller amount. In this case as the concentration of Potassium increases, the availability of both Calcium and Magnesium decreases. It is more commonly known as locking out. When combined with the effects of pH and temperature, precipitation of these salts can occur. The effect works the other way when Calcium increases, potassium availability decreases. Additionally, Potassium has the ability to almost move at will throughout a plant, it is mostly un-regulated; a characteristic all plants have adapted by harnessing these ions to do work as they move around.

This is all well and good, but how does that affect

pH well, in a very acceptable range for plant growth. While they are fairly solid and big early on, once the peat particles are treated and decomposed to a certain point, they are like sponges with micro-pores that hold water, away from the plant root but available to replenish the larger pores the plant root can access. This effectively limits excess water while holding water in a reserve status. These particles hold onto no ions, only what may fill and dry on the particles themselves, so as long as the medium is moist, nutrients are available. At the proper point of decomposition, the particles form the perfect combination of air-to-water spaces, because of the different fractions now present, which can actually mean more air space to water space with the micro-pores holding a reserve of water, giving a nice water buffer to the grower. There is no oil on its surface, unlike peat moss, so wetting the particle is never an issue. The key in all this is to decompose the particle to the perfect point to achieve this. The problem is still that the rate of salt given off remains high at this perfect point.

By controlling the decomposition process, adding the correct nutrient buffer to adjust the ratio, feeding the plants the correct ratio of nutrients to offset the coco 'give off' will produce the perfect growing conditions. When the medium is not taken into account, the results can be disastrous. Even when fed correctly, and the correct 'buffer' of nutrient ratio sets up, just one (1) watering with plain water will wreck the buffer sending the plant and medium into shock, rapidly escalating the potassium level. Consequently, plants that do not have enough of some ions like Calcium (there are several) from under feeding or washing out, will show deficiency in these and other elements while the Potassium builds up in the plant tissue ultimately to express as margin burning on the leaf surface, mostly at the tip. The first thing the inexperienced grower assumes is that they are feeding too high and have salt issues so they back up the feed concentration and leach the medium. This, of course, magnifies the problem and it gets worse. The key to proper coco growing is to use the right feed to balance the products the coco gives off, not just availability, but ratio of one to another mineral as well.

the use of coconut peat/ mulch with plants? As the coco decomposes, it 'gives off' salts that increase the EC of the medium which will result in burning and imbalances in Calcium/ Magnesium and Potassium balances or ratios; the 'greener' the coco, the worse the problem. About the time this 'give off' slows enough to really grow a crop in, the structure has the characteristics of muck peat and has to have amendments like perlite, sand, pebbles or other large particles added to it to give the medium air. Also, the state of decomposition is at its highest, so what is left will not last long, even being washed easily from the container. We know that if the level of salts AND the ratio of these salts could be controlled at an earlier stage, we would have the advantage of good physical structure and proper nutrient balance.

Coconut peat has some wonderful physical properties that greatly benefit plant growth. To begin, it is renewable so no stripping of natures resources. It makes use of the final product left over from cultivating and harvesting the much prized nut. At the right point in decomposition, the coco peat can be used as a stand-alone medium with no need to add perlite or other persistent amendments. The coco peat itself is fairly pH stable and buffers the

“Coconut peat has some wonderful physical properties that greatly benefit plant-growth.”



Growing on Coco, busting the Myth - By Ralph B.

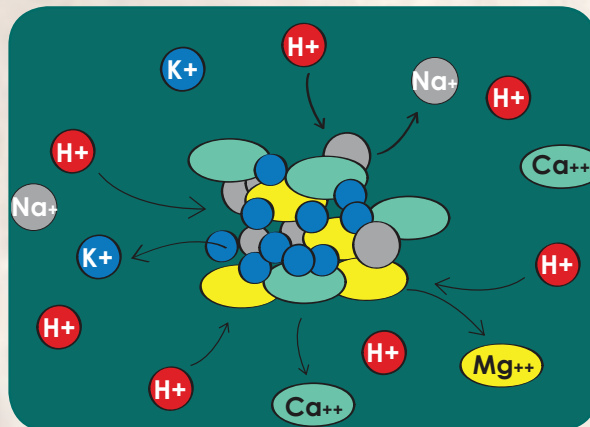


Fig B: Buffers work to balance out the give and take of elements in the medium.

(Fig B) It is equally important to water correctly. Coco peat holds about 33 % more moisture than similar grades of peat based mediums if it is in good structure, but, because a great amount of this is tucked away in the micro-pores, the medium can look dry but still be plenty wet. (Fig C-1, 2, 3) The same rules apply here as soil or soilless mix, water when the container loses 50% of the maximum water it will hold against gravity (immediately after drainage of a newly watered container).



Fig C1: The Feel Test: Looks like time to water



Fig C2: The Feel Test: Feels cool and damp



Fig C3: The Feel Test: Not yet ready for water

Correctly this is done by weight and yes it does change with time, root mass, humidity, temperature and growers temperament (thumb on scale syndrome). By controlling closely the decomposition and particle size, there is no need for using anything to increase drainage like perlite, which happily removes a disposal concern. Even more air space can be achieved by increasing the fraction of coco fibers and husks.

This results in a totally renewable and biodegradable medium that resists compaction. Finally, the pH of the medium, when buffered and controlled, remains constant pretty much throughout its useful life. The medium sets its pH at between 5.2 and 6.2, perfect range, and will hold it there. Unlike peat based products that try to go back to a pH of 4.5 or less within 3 months of being planted. By using the correct age of coco, with the right porosity, coco potting medium should be able to work through almost a year's worth of cropping before changing. The pH stays correct and only the structure changes limiting the useful period.

So, we see that by controlling the ageing process, using the correct ratio of nutrients, using the correct composition of nutrients, and pre-buffering the coco peat, growers can anticipate getting the perfect medium, correctly balanced, correctly composed, with good porosity, a water buffer, and a lot less headaches than peat based soilless mix products. That is great for a start, but to complete a crop, it is critical that the correct nutrients be used as well. Consider coco as needing to be 'fed' along with the plants. Once the medium establishes a buffer, which it will do based on the nutrients it sees right or wrong; the grower can wipe this out by applying plain water to the medium. The medium hangs on to nothing and will readily flush away its nutrients; then the plant will suffer until



Growing on Coco, busting the Myth - By Ralph B.



Fig D1: The numbers of different crops that can be successfully produced on coco is huge. Peppers, cucumbers, thyme, and tomato on coco



Fig D2: Spicy Globe Basil crop in Canna Buffered Coco using Canna Coco A/B nutrients.

the buffer is restored. Always use fertilizer when you water coco that a plant is actively growing in, at least at about EC=0.6 mS/cm3. This will hold the balance or ratio of the nutrients to each other and insure that the plant gets exactly what it needs.

Coco is an ideal medium. Plants thrive in coco when everything is right. (Fig D-1, 2) There is one company that provides all the right components, CANNA. CANNA, always researching new pioneering ideas in the horticultural world, began exploring the coconut option when the peat was just giant piles of debris left over from the production of fibers. This debris was deposited around the landscape of producing countries in giant, rotting piles. Each year sees these piles grow higher. Initially these were the sources of coco peat for CANNA, but before bringing the product to market, they recognized the need for higher controls in order to receive the coveted RHP standard of Holland. They began controlling the product from harvest, through treatment, and into giant concrete bunkers to age to the exact level needed, then buffered, packaged and delivered to the mar-

ket. All this is done without steam sterilizing, which resulted in other beneficial consequences.

By avoiding the steam sterilization to ensure RHP acceptance, CANNA also avoids chemical changes in the medium, nitrate conversions to nitrite forms (toxic to most life forms), and best of all, the natural Trichoderma,



Fig E: Change in nutrient concentration affects growth both high and low, Marigold, var. Dwarf Bolero

inherent in coco, remains active, providing a level of protection to the crop no other company can provide. The structure remains intact, the Potassium release remains a known variable, and the product is still delivered free from weeds, insects, disease and other soil borne problems.

Like all its product lines, CANNA believes in the complete package concept. Avoiding errors is essential. The Coco growing 'system', medium and nutrient line up, were engineered through years of in-house research and countless field tests to provide the correct growing solution, the exact composition and concentration of all the things required for using coco as a growing medium. (Fig E) CANNA COCO nutrients (and COGr) are designed to work with the exact properties of CANNA Buffered COCO (and COGr board). There is no better or easier way to begin and continue the Coco Growing Experience.

For even more info on CANNA COCO, get the COCO leaflet or COCO InfoPaper at your favorite gardening store or check out the Grow Guide at www.canna-hydroponics.com

What's New!

(RE)INTRODUCING COGr!

No, rest assured, we are not going to bore you with the latest news from the Council Of Governmental Relations here. CANNA introduced this revolutionary coco product called COGr, several years ago and it is picking up big time at the moment. We just want to make sure you are not the last in line to discover this product whilst everyone else is harvesting big.

A revolution in growing started when CANNA developed and introduced coco as a growing medium for your plants 15 years ago. In those 15 years we gained a lot of experience through testing ourselves and from the reactions of users. Over the years we got to know all the

ins and outs of this medium which gave us the chance to further refine a high quality product. Eventually, CANNA Research developed a revolutionary coco product with superior qualities and advantages to meet the demands of the most discerning and experienced growers. It is called CANNA COGr, which refers to granulated coco.



This product consists of a sophisticated mix of coconut grit, coconut fiber and coconut granules. The coarse coconut structure of this medium provides COGr with the unique ability of being able to absorb large amounts of nutrients, moisture and air simultaneously which are immediately available to the plants. This makes the medium superior to all other growing media, promoting faster root development and higher yields.

CANNA COGr comes in the form of compressed boards which are pressed and dried. This simplifies transportation and storage. A bit different than other mediums is the fact that you will first have to put in some effort before it is ready to use. Don't let this scare you because it is definitely worth the while. We made the prepping easy by developing a special solution for it. It is called CANNA COGr Buffer Agent.

The COGr Buffer Agent has to be diluted and adjusted to the right pH first. Add the solution to each COGr board with a watering can or hose and let the boards soak for a day. They will increase in volume from about 3 to 17 liters. Drainage slits, to divert excessive water, are made in an instant on the underside. The boards are now ready to use.

As is the case with every system you choose to grow on, CANNA developed a nutrient tuned to the corresponding medium, in this case COGr. There's a VEGA and a FLORES nutrient for respectively the growing- and the flowering stage of the plant. You can further influence the results by ensuring our additives like RHIZOTONIC to make root formation explode (apply when cuttings are just rendered into the slabs), PK 13/14 to add Phosphate and Potassium, CANNABOOST to increase photosynthesis (both during the

flowering period) and to conclude CANNAZYM to break down the root material, are included in your program. CANNAZYM is particularly helpful as COGr is reusable up to three times without any problems or quality loss. Buffering Agent is no longer necessary in this reuse stage so you can start a new cycle right away.

For more information on COGr, check out the product section on our website or get the users manual at your favorite gardening store.

20 Liter Wrench

Finally, they're here!!!

We already had wrenches to make opening up our 5- and 10 Liter cans easy. Unfortunately there were no possibilities to produce our 20 Liter cans with the same size cap as the smaller ones. Too bad, but hey... what to do? Different openings ask for different openers! So, we are pleased to inform you the CANNA 20 Liter wrench is available now at your favorite gardening store.



Two Bottles, One Nutrient;

Slick marketing **or** clever thinking?

CANNA offers a complete COCO program. This means we have COCO medium as loose fill or in the form of slabs, as well as a COCO nutrient which is adjusted to the COCO medium. Unlike nutrients for growing on other mediums, which are usually divided into a vegetative and a flowering solution, this one is not. You still need two bottles; COCO A and COCO B. Is this slick marketing? No it is not!!!

Coco fiber typically contains little Calcium and even less Phosphate; on the other hand it does hold lots of Potassium compared to other type of mediums. These are some of the nutrients plants need but there are not proper amounts of it present in coco coir to cover the plant's needs. This is why CANNA Research developed a COCO nutrient that completes the CANNA COCO medium to exactly what the plants is looking for. It is quite obvious that when using COCO medium, lots of Calcium and Phosphate and very little Potassium need to be added to the coco which is exactly what the CANNA COCO nutrient line contains.

The amounts of Calcium and Phosphate that have to be present for the nutrient to do its job properly are quite high. When you put such highly concentrated elements in one bottle they will conflict with each other sometimes resulting in a slimy residue of sorts. The design problem is: your plants still need both elements and they need them in large amounts, in spite of their conflict.

We found that when you separate these two elements from each other then mix both of them with the water in your nutrient reservoir later on, there is no problem. You could say: they can't live with or without each other. This is exactly why CANNA COCO is divided into a two-part nutrient solution known as COCO A and COCO B. There are two bottles but it is actually only one fertilizer, so you need both of them to work as a complete nutrient.

Where any brand of COCO nutrient is sold in only one bottle with no residues in the container, this should be a 'sign on the wall' for you to know there cannot be high enough amounts of both Calcium and Phosphate present: you're probably being ripped off. The fact that we divided it into two

bottles is actually clever thinking and proof that our formula is strong enough and cannot be put in one bottle.

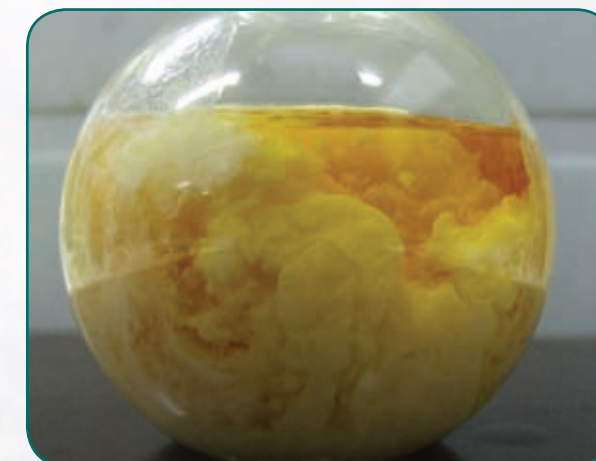
Let us illustrate what would happen when all ingredients are put together in one bottle anyway:



COCO A



COCO B



COCO A + B mixed

The residue doesn't appear instantly, but it will take some time to settle

Tips:

- To prevent any residues from appearing in your nutrient reservoir, always mix the A and B portions separately in the reservoir with a large amount of water.
- First mix the COCO A solution and stir well before adding the COCO B solution to help prevent saline residues.
- Always use COCO A and COCO B in equal amounts.
- When you choose to grow on COCO you need a special COCO nutrient as well. The CANNA COCO A + B nutrient will give the best results when combined with CANNA COCO medium.



GROWERS-TALK

A word from a grower

CANNA COCO:

Hi, my name is Jake and I have grown my own vegetables on coco for a couple of years now. I've always been fairly enthusiastic about this way of growing as it is quite simple. But it wasn't until recently that I was blown away by the results.

The first couple of times I used coco my feelings were mixed. The results were good and it was easier to work with as opposed to soilless mixes. I initially choose the coco from CANNA because they claimed to get such excellent results with it in their own laboratory. I read so much about CANNA's research department and laboratory, over and over again, that I began to wonder if it existed at all. I started searching the internet and found a question form on CANNA's website which they claim is sent to the Research department. I got a little annoyed because I had to sign up and register first. It only took a minute though, so no harm done. I formulated my questions in such a way that they would have to be answered by someone with a degree or lots of experience. My answers came back clear and satisfying. I kept the conversation going to put them to the test a little more, but after some communication back and forth I just knew they were devoted to helping me with anything.

That's when I gave CANNA COCO another look. I honestly told them I use the CANNA COCO medium with nutrients from another company since CANNA nutes are high end nutrients. Of course, any company would say that this is the problem and that I should use their nutrients. CANNA was no exception, but then this statement was followed by a long and clear explanation why. This explanation was full of scientific facts and technical information; clear data to both understand and accept this entire system.

The CANNA COCO A and B nutrient line is exactly tuned to the medium and therefore complete each other in such a way as could never be equaled by combining it with nutrients from competitors. The fact that it is only one nutrient from beginning to end yet you still have to buy both bottles (A + B), again is based on scientific fact and the proven effects of the (amount of) ingredients, instead of screwing us around and ripping us off. (read page 12 to find out the scientific reason of the two bottles, ed).

After deciding to give the company a shot at proving what they said, and because I had already used that current batch of CANNA COCO medium twice, I went and picked up the complete system including the nutes at my local shop. The reusable nature of the CANNA COCO has made life a little easier on my wallet so giving it a try was not a real issue. Actually, when you follow every nutrients feed chart you will find that, per finished gallon of solution, CANNA is actually midrange in price and that is the true bottom line. This is because everything a plant needs is in the few bottles that go with the program!

My first cycle with the complete CANNA COCO program is almost coming to an end and up till now it is going great. The astonishing results which I failed to see before, are definitely here now. My yield has never been this big. Combining the medium and the nutrient line does make a difference after all.

Jake (San Diego)

`when you follow every nutrients feed chart you will find that, per finished gallon of solution, CANNA is actually midrange in price`



CANNA Research:

THE INFLUENCE OF COLORS ON PLANTS

D. Kroeze MSc, CANNA Research

Light is essential for every plant. Chlorophyll allows plants to convert energy from light into sugars. Does light impact plants in ways other than just supplying them with energy? Do the colors within light even influence a plant's growth and development? Start reading here and find out for yourself.



THE INFLUENCE OF COLORS ON PLANTS - D. Kroeze MSc, CANNA Research

The primary colors

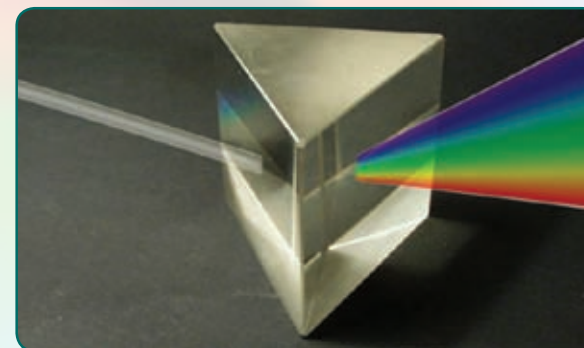
Researchers have traditionally distinguished seven colors. They are known as the colors of the rainbow, red, orange, yellow, green, blue, indigo and violet, often referred to as the primary and secondary colors. When put together, these primary colors create white light and only become visible when a ray of sunshine is split by a prism.

All objects can absorb the colors within the light, reflect them or allow them to pass through. Science tells us that an object usually adopts the color it isn't able to absorb itself. Because plants cannot absorb the color green, they must themselves be green. There are those who claim that light measurements show that plants themselves emit light particles in the dark and actively help create their own color. Just like we do, plants sense the light and colors surrounding them – but in a different way!

Red light

Plants are sensitive to the color red in the light spectrum, a sensitivity that arises from the plant having what is called a red light photoreceptor. The receptor is a blue-green pigment called a phytochrome present in the cells of a plant. You could compare phytochrome with an eye that only senses red light.

Red light impacts a plant in many ways. Plants that are grown in plenty of red light are often large, but in general also tall with many branches. If the photoreceptor picks up a large quantity of natural red light, for example in summer when there's plenty of natural red light, production of a plant hormone (meta-topolin) is increased. This hormone prevents the chlorophyll in the plant from being broken down, so that it stays green in spring and summer; advantageously, this is exactly the time that the plant needs its chlorophyll to convert energy coming from the sun into sugar. Red light also influences a plant's flowering and seed formation.



A prism refracts light into the primary colours
Source: www.physik.uni-stuttgart.de

By comparing the quantity of one frequency of red light to the amount of another, far-red, present in the light, makes the plant decide whether to start flowering or not. The non-flowering period can be extended by exposing the plant to red-containing light during the dark period. This will, as a result, also extend the period of time before harvesting, which, of course, most growers would like to prevent. This also explains why it is a bad idea to enter the growing area when it's dark for any time, even for a quick peek! The red color in light also influences flavor because it increases the concentration of special oils in plants.

Blue light

Plants see blue light as well as red light, using a photoreceptor that is called a cryptochrome. If there is plenty of blue light, as is the case in nature during autumn and winter, this receptor slows down the effect of a hormone called Auxin. This hormone is responsible for the plant's stem and root growth. Auxin is also responsible for what is referred to as 'apical dominance', the phenomenon which causes the central stem to be dominant over side stems. A branch off a main stem would be dominant over its' own side branches so it inhibits the development of axillary flowers. This causes the plant to create more side stems when exposed to bluish light and the plant stays shorter. This helps us to understand why plants exposed to bluish light are often short and bushy in appearance with a more robust structure. Experiments with blue light resulted in plants that are wider than usual. This can be explained by the fact that more branches sprout because of diminished apical dominance.

Plants use the quantity of blue light to determine how far to open their stomas. The more blue light, the wider they open their stomas, resulting in an acceleration of their metabolism. High levels of blue light will increase metabolism, and as a consequence accelerate plant growth and development. Blue light is also responsible for leaves growing towards the light. Blue light avoids the multiplication of leaves around the fruits. A shortage of blue light in the spectrum will quickly cause you to lose 20% of your harvest. Although opinions about this seem to differ, the optimum red to blue light ratio should be 5:1 in general.

Green light and the other colors

Plants are hardly sensitive to green light. As far as we know, they lack receptors for this color.



THE INFLUENCE OF COLORS ON PLANTS - D. Kroeze MSc, CANNA Research

This is probably the case because in practice plants do not absorb this color. Plants which are grown in green light only will be exceedingly weak and rarely grow old.

Clearly, plants only seem to sense those colors for which they have specific receptors. This is based on energy levels provided by each color. Plants are not blind but, up to a certain level, they are color blind. The way plants react to orange and yellow light is quite similar to the reaction on red light. This also accounts for indigo and violet which in reaction are similar to reactions on blue light.

'Invisible' light

Although plants are a bit color blind, they do sense colors, more appropriately energy levels, that are entirely invisible to us humans. For example, plants can perceive far-red light. Plants often utilize the

Anthocyanin goes up. Anthocyanins protect plants against UV radiation, but also against micro-organisms trying to get in. The formation of Anthocyanin can often be seen where flaws occur such as a lack of oxygen. UV light not only damages the plant's DNA and membranes, but immediately disrupts the process of photosynthesis. Therefore an excess of UV light is unhealthy for plants as well.

Light is seeing

As we have seen, light is not just essential for plants when it comes to supplying energy for photosynthesis. Although this article only reveals a small part of everything there is to know about light, the colors in it and the effects they have on plants, we did see how plants use colors to regulate many of their processes. Plants are capable of perceiving those



The plant on the left is taller because it received less red light in relation to far-red light. The plant on the right was exposed to the usual red/far-red light relationship.
Source: <http://www.le.ac.uk>



Centre and right: far-red light is reflected by plants and can thus be used to determine the presence of other plants in the immediate vicinity. Plants can perceive far-red light.

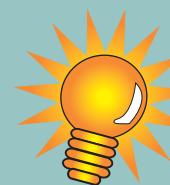


red to far-red relationship. A seed uses this relationship to determine whether to germinate or not. Plants also use that relationship to determine the number of other plants in the immediate surroundings. Because plants absorb large amounts of red light whilst reflecting far-red light, there will be less red light present in a plant's immediate surrounding if other plants are in the area too. Seeds will hold off germinating and the plants that are already in place will grow faster in order to emerge above the other plants to acquire sufficient light for their photosynthesis. The fact that far-red light has the exact the opposite effect to that of red light makes it unsuitable as a light for growing. The traditional light bulb is a rich source of far-red light.

Ultra violet light (UV) also influences plants. Like is the case with blue light, plants perceive this color using the cryptochrome photoreceptor. It is unclear whether other photoreceptors can perceive UV light. When increasing the quantity of UV light, the concentration of a purplish substance called

colors that matter to them. Those colors give the plant an indication of its general environment and its chances of survival and reproduction. If your plants are to develop, grow and flower well, the composition of the light is at least as important as its quantity. Do not forget that a plant perceives the composition of both direct and indirect light. Indirect light here refers to the light that is reflected onto a plant by other objects such as walls or other plants.

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CANNA Research



Growers Tip #4

Fifty-Fifty



When watering organic based mediums such as peat moss, mineral soils or coco, make sure you allow, on average, a 50% reduction in the amount of water applied previously before watering again. This 'drying down' of the medium fosters good root development and ensures the root system has adequate air infiltration. The same holds true with automated systems, water when 50% of the entire crop is 50% dry.



CANNA COCO DVD

A few years ago, CANNA produced a DVD about the use of Coco as a growing medium. It gives insight into the excellent results you can achieve with this tropical fiber medium. On it, you will find an introduction to our production methods, learn about the standards in coco, and you will learn why and how not all coco substrates are alike. There is also a step by

step user manual for the different kinds of coco substrates and we also advise how to use the different CANNA products to obtain the best results possible. It is a mini-course about cuttings, ways of energy saving and advanced growth methods. For the real techs there is also a part showing you how to take a substrate sample. Pick up your copy of this outstanding DVD at your local gardening store today!



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Challenged by knowledge,
Perfected through experience

NATURAL PLANT MEDIUM



CANNA COCO

15 Years ago CANNA was the first company ever to develop and introduce a research based coco medium. As a true pioneer, we welcomed you to a new level. Over the years we learned that experience makes a difference. It helped us in further refining an already high quality product into the excellent product it is today. A balanced program developed by CANNA Research. The COCO nutrient contains exactly what the COCO medium needs. They reinforce and complete each other in such a way results can never be equalled when they are not used together. CANNA COCO medium also contains the strengthening Trichoderma mould, it is very easy to use, RHP certified, 100% natural and reusable as well! For more information check out our website or get a copy of the CANNA COCO DVD at your favorite gardening store.

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