

CANNA

Issue No. 6, Volume 2

Talk

Variety Mixing

A cocktail against diseases

Disasters Dissolved

Calcium Deficiency

Research

How plants communicate

What's New?

New Website



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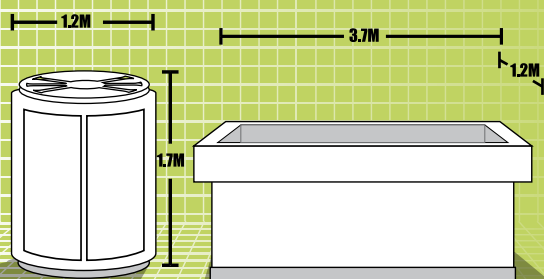


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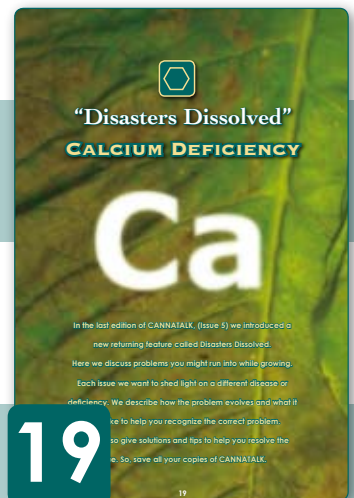
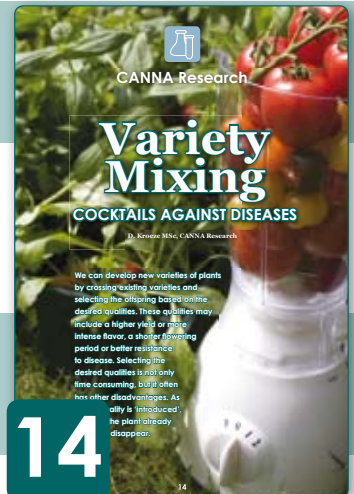
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HQ's Talk:

Summer is finally coming back and the good times as well. Some choose to spend winter months in Florida, others go ski the mountains; but personally I enjoy sun rather than snow. Sunshine heats me up much better than snow and the same goes for my mood.

This CANNATALK has more tools to get you in that 'right mood' too. What about another specific feed chart with the use of CANNA products? It is for basil this time! Next to the feed chart, we also added a tasty recipe for your fresh grown basil which you should really try. You will find more feed charts for various specific crops on our website and we will keep adding new ones so check out www.canna-hydroponics.com regularly. As of now, CANNATALK will shed a light on a different crop with an accompanying feed chart and refreshing recipe each issue.

The season for growing outside is upon us and we wish to explain the differences between growing organically and growing mineral (in soil). It also helps in clearing the confusing terms (inorganic, natural, mineral, organic etc.) that are so copiously used in this industry. However you choose to grow is up to you. The fact that BIOCANNA and CANNA can provide you with what you need for both ways of growing, organic or mineral, there is no reason for us to direct you one way or the other: something we rarely do anyways. We just want to hand out options and solutions: you are the one calling the shots!

What else do we have this issue? In this issue we introduce the long awaited (and requested) Q&A pages. We get all kinds of questions from our growers on a daily base. In CANNATALK, we want to highlight the FAQ's; both seasonally related questions and questions that can open your eyes and be beneficial for your future growing projects.

The cornerstone of our company, CANNA Research, is given some extra exposure this issue as they contributed two fascinating articles. Start reading page 14 to get some interesting insights in variety mixing. It informs us how we can prevent the spread of diseases by mixing different varieties of one crop in a growing area. Then on page 23, CANNA Research explains how plants communicate (no kidding, they really do!) and find out whether talking to your plants can truly make a difference or whether it is just a hoax. Last but not least, once again we grew four pages compared to last issue. So be aware, before you know it, you'll be having a grown-up magazine in your hands!

Enjoy this new edition and please do not forget to tell us what you think of CANNATALK. It is most appreciated and gives us the opportunity to optimize the content of the magazine and fulfill your needs. We are awaiting you at editor@cannatalk.com. Good reading!

Cheers,
Jeroen



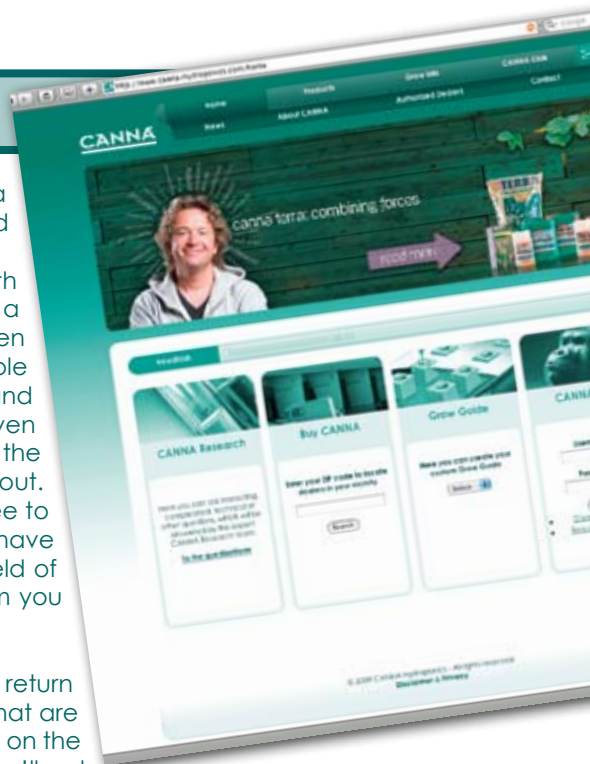
What's New?

New Website

The new CANNA website is finally online. It experienced a make-over, resulting in quite a different look. You'll still find the usual information on our company and products. There is interesting growing info, feed charts and a growth calculator to customize things to your situation. Looking for a CANNA dealer near you? You can find the nearest ones when you type in your zip. Some intriguing articles are available written by our own experts and research department and this will be extended further in future. In fact, you can even ask them questions! There's a link to the question form on the homepage that is sent to our researchers when you fill it out. They will try to help you out the best way they can. Feel free to ask questions, any question at all. They don't necessarily have to be CANNA related questions. They are experts in the field of growing and can probably help you out with any problem you are facing and are happy to do so.

Of course CANNA members are in our good book and in return they get several advantages and access to some pages that are off limits to non members. So go to the CANNA Club section on the website and become a member, sign in and make sure you'll get the most out of our website.

www.canna-hydroponics.com



New crop specific feed charts



Why are there so many different types of food around the world? And maybe even more different kinds of eating habits? Easy! We simply all have different needs. The same goes for plants. Some will agree to the same guide line more or less but you cannot put all of them in the same box. That is why we decided to customize feed charts

for different kinds of specific crops on several media. This is an

ongoing process so more and more specific Feed Charts will become available over time. You'll find them in CANNATALK regularly. On our website you can find out which ones are already available. Many more will follow in near future. If you cannot find the crop you are growing on the system/media you are using, please let us know (editor@cannatalk.com) so we can develop one and further build our directory to ultimately help our growers out with getting the absolute most from your favorite crop.



These flowers
are grown
100% Organically



In the Spotlight

Organic/Mineral, What's the Deal?

Geary Coogler, B.Sc. Horticulture

Organic, inorganic, mineral, natural, all natural..... What does this all mean and why are some of these terms bantered about so loosely? It is confusing and made more so by the complexities of our political systems and advertising agencies. That aside for now, let's look at the correct meaning of these terms and the implications it has for the grower and their choice of crop and system.



Let us start with some basic definitions:

1. Mineral: The inorganic salts, including sodium, potassium, calcium, chloride, phosphate, sulphate, etc. So called because they are (or originally were) obtained by mining¹. They are not necessarily natural.
2. Organic: Chemically, a substance containing carbon in the molecule (with the exception of carbonates and cyanide). Substances of animal and vegetable origin are organic². It can also mean many other things from body parts to growing styles including defining the most fundamental laws of a government. Loosely translated it means good (unless a body part is involved in which case it is a type disease, or the law if you violate it). They are also not necessarily natural.
3. Inorganic: Simple enough, it is not Organic. See mineral. They are also not necessarily natural.
4. Natural: Present in or produced by nature.³ Then the definition goes on for ten additional pages including talent and a color described as a yellowish gray to pale orange yellow (how can that be natural?). For us, it basically means that it was not made by man but was harvested or processed from nature. These should be necessarily natural but it really depends on whose definition we use.
5. Synthetic: Man made or, more precisely not natural: artificial or contrived.

Now that we are well versed in the definitions, let us look at each one as it relates to selecting parts and components for growing systems.

Plant roots can be selective in what elements they let through the cell membranes and into the plant itself. It is a system comprised of many components that work by allowing access for all elements smaller than a particular size by diffusion; actively moving very specific molecules such as nitrate or larger single elements; or other varied methods. Mineral elements are the ones that will break down and be available faster than anything else.

Since all elements, including those applied organically, must exist as a single element to cross into a cell (excluding specialty molecules), and organi-

cally applied components are still complex molecules waiting further breakdown into usable end products, Synthetic Inorganic minerals will react quicker with a plant and can be controlled more precisely. They are supplied in many combinations like Ammonium Nitrate, Calcium Nitrate, Potassium Sulphate, or Potassium Phosphate, ions that disassociate in solution and the plant can take them up. Unfortunately, when they are supplied with undesirable components such as Sodium Molybdate, or when the 'mined' material is not pure, these impurities or undesirable components cause problems. This is especially true where heavy metals are concerned. These undesirable elements can either be deposited into the medium causing salt and other toxicity problems, or pass into the plant to be deposited into the cell vacuoles where they remain until consumed by the end user or degrade into the soil.

Organic, as the term is used in the Green Industry, implies two basic concepts. One is material based as in the source of Nitrogen is an organic molecule, and contains Carbon as noted earlier, that has to be broken down to be available. It also refers to the end product, plant or fruit, harvested or used, for example; the lettuce is Organic which means everything done to the crop was done with all Natural and Organic programs for feeding, pest control, etc. Let us understand that a combination product like a fertilizer can have organic components with mineral elements combined and be either Organic or not, depending on both components.

Organic components are recognized as either synthetic or natural; they are either man made or not. When the subject is fertilizer, for instance, typically it is the Nitrogen that is worked with and everything else is incidental. Natural Organic Nitrogen is supplied by whole components of once living things from plant to animal; components such as manure, leaf mold, or blood meal. These require organisms to finish the breakdown so they, too, must be present and the Nitrogen becomes available slowly. Synthetic Organic Nitrogen includes compounds such as Urea, or Urea formaldehyde (UF) that release based on microbes, temperature, pH or other



conditions of the medium. This Nitrogen is available fairly rapidly although some breakdown must occur. There are advantages to any of these and disadvantages, the faster they are available, the less time they spend available to the plant and the greater the chance of burn. Also, to fit into the Organic Program, they have to be Natural Organic. The remaining component supplied elements are almost incidental in their presence in the fertilizer mix. Only by carefully selecting the most suitable feed stock for decomposition, selecting or designing the right microbes to break down the feed stock, and by engineering the pathway of decomposition can an organic fertilizer, such as BIOCANA Bio Vega and Bio Flores for example contain a specific and known nutrient value.

If the other main components of a fertilizer are needed to make it complete, then it has to be added to the Nitrogen mix, or added separately. Using a blend of plant and animal derived components will get close to all the required elements, but not for all. A grower that feeds 100 % organic components

will never maximize their crop. Certain components like Calcium are needed in large amounts but consumed in the degradation process. Bone meal can be added for the additional Phosphorous needed, but not for all organic consumers, some want no animal by-products to be used as well. The next best option is to supplement what is needed to get the ratios correct, with naturally available elements such as Calcium Carbonate (Lime) or Rock Phosphate. However, the material can no longer be described as 'Organic' but is now 'Natural and Organic'. As noted earlier, this same description, Natural and Organic, could apply to a Synthetic Organic Nitrogen and heavy metal contaminated Rock Phosphate. Confused yet?

So, as a review, we see that the term organic means many things and the same thing, so does natural, and yet both can be used at the same time to achieve better results. What to do? A grower needs to understand a few important points first:

Certain components exist in almost all natural mineral soils fit to grow in, why grow in pure organic? Important components like Calcium are supplied in lime, phosphorous exists in all soils too, either as bound or as free, phosphate is the oxidized form and occurs in all mineral soils (most is bound up in Calcium – Phosphate interactions and remains unavailable).

Using Natural Organic components requires the proper root environment containing the microbes necessary to break down the organic components, and the physical conditions of temperature, moisture and pH will affect the process and must be taken into account. Growing 'Organic' requires not just the proper fertilizer, but every component must meet the standards. Seed or cuttings used must be from 'Organic' stock, pest control has to be 100% Natural or naturally de-

“A grower that feeds 100 % organic components will never maximize their crop”



rived compounds from plants or animals. (This begs the question if growing under lights is Natural).

Materials used to produce components of Organic systems must be Organic as well. If plant extracts are used, for instance, then the plants must have been produced 'Naturally' and 'Organically' as well.

Growing Organically requires time, as the materials used for feed take some time to become broken down enough to supply a plants needs. It can be a long process with tens of processes required to take an organic component like a cell wall and turn it into an available single element or specialty molecule like nitrate.

With fertility, Natural Organic growing requires that a microcosm be established to deal with the organic component needing reduction. You can add all the manure, castings, and blood meal you want to the medium, but without the micro-life, it will sit there. It may breakdown some under reduction-oxidation pathways, but not enough to feed a crop. It takes organisms that feed the raw proteins or other components, then another organism to feed those waste products, and another until the compound is rendered to a plant usable form. It takes balance between organisms to get the nutrients correct: micro-flora, -fauna has to be present at the right time.

All this has to occur in the root zone in a medium that will support this; an organic base with storage sites, so our system is limited to soil or soilless organic based mediums, usually peat since the values will work with the organics. The best feed to use would be one that is as close to the final stage of breakdown as possible; this takes the variability and guess work out of it. Organic 'Teas' or liquid compost is an example of being closer to the end results, however, all are different and will tend to vary with the components being turned into tea and the seasonal changes in temperature (or any other external factor) of the 'brewing' facility. In a perfect world, giant fermentation tanks would take raw materials and render them to a liquid fertilizer by the careful addition of specific soil borne microbes that would

work on the first step only, and once they digested everything they could, they would be removed and replaced by the next step's microbes. This would be repeated by the same microbes engineered to produce very particular compounds, all the way to the final step, where it would be bottled and sold. Once applied this would be reduced immediately at the root surface to become available, with little delay, to the plant.

All the while, the materials and process would be 100% Natural and Organic and would include nothing added but the microbes (if they are even needed by this step): wishful thinking, perhaps, but one doable with future technologies. CANNA produces Bio soil/ soilless medium fertilizer that is produced in exactly this fashion. They are called Bio Vega and Bio Flores for respectively the growth and flowering stages.

Unfortunately, all the technologies in the world will do little to clarify the industries use of words like natural and organic. Fortunately, there have been laws that have been promulgated to limit what can be said on labels and advertising, and organizations were started to sanction components and processes as fitting into an Organic System or Organic program. This is done to insure the consumer gets what they think they are getting. Organizations like OMRI (Organic Materials Review Institute) and the European Control Union look at the materials being labeled Organic or Organic Produced and certify the materials and processes used. Not only do they review the types and origins of materials used, but govern the process from harvest to bottling. They also recognize the inability of pure organics to provide for all the required elements for a plant and allow certain components to be used that are natural and clean. These are paid services that guarantee the product and process. The government, on the other hand, should be providing controls on the use of these words on the product labels.

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OMRI™
List
CAN-4



Some governments regulate the design and content of labels for fertilizer and pesticide labels. Most will not let the word 'Organic' or 'Natural' be used on the label without meeting certain criteria. Some follow the review institutes' guidelines; some are much stricter allowing organic to be used when the only components of a product are plant or animal based. Registration is designed to protect the purchaser and consumers from illegitimate companies selling bad things with confusing or false claims and statements. The grower has to do the rest of the legwork to decide which route is best for them.

So, there is the problem in a nut shell. It is confusing; just remember, do the homework. Find out the metal contents, find out where the technology is coming from, use registered products, find out how it is produced, and use it correctly. How 'Organic' does this need to be? What crop am I growing (some species do not do as well on organic systems preferring waste type soils)? How will this be done? What can be reasonably anticipated from this method? If you want Organic then use OMRI or Control Union listed products, makes it really easy. These are all questions the grower must decide before deciding on how organic to grow, and what materials to use. Take some advice, keep it simple, and understand the way it works and the limitations it has, but enjoy the benefits of growing 'Organic'. Work within the limits, and keep an eye out for that perfect product.

Reference:

Food and Nutrition information about mineral salts on Answers.com. A Dictionary of Food and Nutrition Copyright © 1995, 2003, 2005 by Oxford University Press. Published by Oxford University Press.

Food and Nutrition information about Organic on Answers.com. A Dictionary of Food and Nutrition Copyright © 1995, 2003, 2005 by Oxford University Press. Published by Oxford University Press.

Dictionary definition of natural on Answers.com. The American Heritage® Dictionary of the English Language, Fourth Edition Copyright © 2004 by Houghton Mifflin Company. Published by Houghton Mifflin Company.

ECOSYSTEM, the #1 selling vertical garden in the world

The Ecosystem is essentially a cylinder that can hold between 20 to 140 plants grown in a bonsai style. Surprisingly, the Ecosystem measures a mere four feet in diameter (42 inches actually) and 5.5 feet in height. This means that it can easily fit into the smallest of spaces. The Ecosystem comes complete with rock wool holders, a pre-assembled pump and drip line system, two integrated 100cfm fans used to circulate air inside the Ecosystem and one 200cfm fan mounted in the center of the Ecosystem under the glass tube which houses two lights (for air cooling). Inside the Ecosystem, 20 rock wool slabs are hung vertically. Nutrient solution is periodically pumped from an internal 18-gallon reservoir into drippers positioned at the top of each slab. Gravity then pulls the nutrient solution through the length of the slab; any run off simply drips back into the internal reservoir below. The Ecosystem is designed to be clean, space and energy efficient, high yielding and perfect for any hobby gardener.

The Ecosystem's unique design gives it an advantage to gardeners who are concerned about energy conservation or have limited space for a garden. Although the footprint is less than 15 square feet the growing area is 48 square feet.

The space advantages are obvious but the

conservation of electricity is equally impressive. To adequately light 48 square feet most gardeners would use 3 lights at 600W minimum if not 3 lights at 1000W. The Ecosystem uses 2 bulbs; we recommend 2 lamps at 600W but 750W or 1000W work very well. Because of the Ecosystem's relatively small size, each plant receives the



benefit of both bulbs. The proximity of the bulbs also means very little of the bulbs' power is being lost. The risk of burning the plants with too much light is next to nothing. One reason for this is that no reflectors are used. This reduces hot spots and gives perfect light distribution. The other reason is the incredible air exchange rates that will not allow heat to build up in the Ecosystem. The intense light and massive air exchange rates create an environment that produces fruits and flowers of the highest quality, and yields per watt/time that will

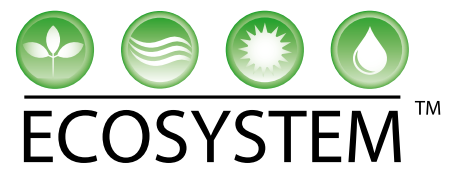
exceed even the best horizontal gardener.

Of course there are some things that should be taken into account when growing in such a small environment: First is plant variety: grow plants that naturally stay short. For example, do not try Beefsteak tomatoes, rather grow Cherry tomatoes.

Second is heat; plants stretch in hot environments. Try to keep the garden around 80 degrees F. Then there is vegetation; if you are growing plants that have specific vegetative and flowering cycles be careful not to over vegetate; five to six inches under vegetative light conditions and then change to flowering, would be best. Last is the nutrient solution: a nutrient specially designed for re-circulating systems, like Canna Aqua for example, is most suitable for use in the Ecosystem.

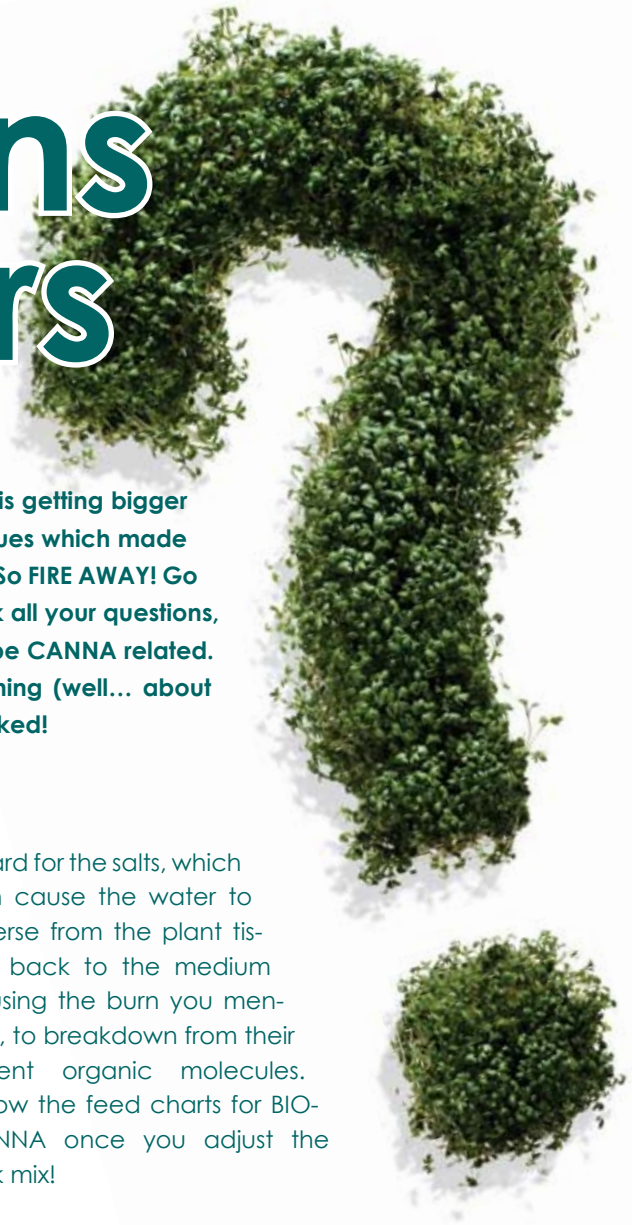
This Canna nutrient helps hold the pH steady and contributes to keeping the Ecosystem remarkably clean.

The Ecosystem has become the world's #1 selling vertical garden for a reason. It works and in the right hands it works very well.





Questions & Answers



The amount of questions we receive through our website is getting bigger every day. We notice many of you running into similar issues which made us decide to share some of them with you in CANNATALK. So FIRE AWAY! Go to the CANNA Club section of our website, sign in and ask all your questions, any question at all! There is no need for the questions to be CANNA related. Our engineers are there to help you out with truly anything (well... about growing that is). The only stupid question is the one not asked!

Question:

I was wondering which nutrient you would recommend for sunshine mix #4? I would like to do an experiment with a side by side of dirt (organic) and soilless (sunshine mix #4) with BIOCANNA nutes. Plus, what is a true feeding schedule that would realistically not burn my plants that feed at medium strength?

Answer:

The issue with Bio products made from decomposition of plant components (like BIOCANNA), is that Calcium tends to be totally used up. So, it is important that the right Calcium is added by the medium to help it work.

The 'Bulk' mixes most used in today's market lack pH controls, micro elements and such.

Both Bio Terra Plus and Terra Professional Plus are carefully adjusted to control pH longer and the Calcium supply remains strong. Any other bulk mix will not supply this. If you wish to use Sunshine, add bone meal and worm castings first then, it will work much better, but definitely not unless you do.

Organic fertilizers like BioCanna would have to be dumped on the plant to burn as organics work within a framework of feedback loops that make

it hard for the salts, which can cause the water to reverse from the plant tissue back to the medium causing the burn you mention, to breakdown from their parent organic molecules. Follow the feed charts for BIOCANNA once you adjust the bulk mix!

Ps. We would love to hear (and see, if you have pics) how the experiment turned out for you at editor@cannatalk.com

Question:

I use BIOCANNA nutes with Bio Terra Professional Plus as I like to grow as organic as possible but now my hydroponic store tells me Terra Professional Plus is new and would be a better choice... Why is it better? And can I still use the Bio nutes with it?



Questions & Answers

Answer:

CANNA Terra Professional Plus recently became available in North America. It depends on your needs and wishes what would be the better choice for you.

Terra Professional Plus was designed to work optimally with our TERRA nutrients. Mainly because they give best results on a pre-fertilized, pH adjusted mix, which most poor bulk mixes on the North American market are not. Both TPP and BTP are pre-fertilized, have a starter charge and are free of perlite. Than what is the difference???

Well, BTP has an organic based starter and pH control charge whereas TPP has mineral based ones. It turns out the Bio nutes work very well on TPP too but if true organic growing is that important to you, you would be better off using BIOCANNA, combining the bio nutes with the BTP and go for a 100% organic result!

Question:

I am using osmosis water. What can I use for water hardness value on the CANNA Feed Chart?

Answer:

Osmosis water has an EC near 0. So 0 would be the value to give your water. If you run into pH problems (instability all over the place) we recommend you add some of your tap water till you have an EC of 0.2 - 0.3 and then mix up your nutrient mix. Add 0.2 – 0.3 to the Feed Chart or enter it into the Grow Guide Calculator on our website.

Question:

I am using your AQUA nutrients for the first time. I was wondering if I should keep running my lights for 18 hours if I wish to increase the size of my plants before they start fruiting. I would prefer them to get a bit bigger first but I am not sure whether the 12 hour light cycle would bring on the flowering stage right away, before I could get them to grow a significant size. Could you help me out please?

Answer:

As long as you give your plants AQUA Vega and

keep your light at 18 hours your plants will keep on growing. Please keep in mind that just after switching the lights to 12 hours they do NOT stop growing. They will still get larger but the plant will put more effort into fruiting/flowering rather than growing. How much more they will grow in size after switching depends on the variety and species. Experience will teach you! The first time round it is better to switch quickly as you can't raise the ceiling and it would be a waste to have to harvest prematurely. If after the first cycle you have some vertical space left you can allow the plants some more time in the vegetative stage.

Question:

Could you explain the difference between CANNABOOST Accelerator and BIOCANNA BIOBOOST?

Answer:

In short, BIOBOOST is a 100% biologic product composed entirely of organic ingredients. CANNABOOST is not organic but it is designed to do a similar job as BIOBOOST and more over, suitable for use in automated drip feed systems. So, BIOBOOST is most suitable for organic growing and CANNABOOST for other systems.

If you didn't find the answer to your specific question, please go to the CANNA Club section on www.canna-hydroponics.com. Here you'll find a question form for you to fill out. You're not obligated to fill out the entire form. But the more info we have, the better our experts are able to help you out. The form is sent to our experts at CANNA Research automatically. They will always try to answer you as soon as possible. Maybe your question will be published in next CANNATALK!





CANNA Research

Variety Mixing

COCKTAILS AGAINST DISEASES

D. Kroeze MSc, CANNA Research

We can develop new varieties of plants by crossing existing varieties and selecting the offspring based on the desired qualities. These qualities may include a higher yield or more intense flavor, a shorter flowering period or better resistance to disease. Selecting the desired qualities is not only time consuming, but it often has other disadvantages. As a new quality is 'introduced', qualities the plant already had may disappear.



Variety Mixing - COCKTAILS AGAINST DISEASES

D. Kroeze MSc, CANNA Research

Example:

A new variety has a very special flavor, but is more sensitive to mildew. If one of these varieties becomes infected with mildew, it's most likely that it will produce less fruits and that the fruit it does yield will not taste as good as expected.

And that is a waste. Nevertheless, you can protect these plants without having to spray them.

The entry of monoculture

About 200 years ago agriculture in Europe underwent sweeping changes. This period is referred to as the agricultural revolution. At this time artificial fertilizers, cultivation machinery and new varieties were introduced. A new system of cultivation was applied to support these interventions. These days this is practically the only agricultural system that most people know about. And most home cultivators use this system too: monoculture cultivation. In a monoculture only one variety at a time is cultivated in a limited space indoors or an outdoor area. And often in indoor cultivation an extreme form of monoculture is applied. This is the case if all the plants are cuttings from the same parent plant: therefore in genetic terms you are growing a single plant. However, monoculture does have its assets. One advantage is that all the plants react in the same way to the nutrients and lighting conditions and that all plants are similar.



The entry of monoculture resulted in mechanization and crops were grown on a larger scale than ever before.

Illustrations courtesy of: <http://www.kvg-wieringermeer.nl>

The down side of monoculture

Unfortunately monoculture also has a downside. A monoculture can yield excellent results under ideal conditions, but conditions are not always ideal. One of the biggest disadvantages of monoculture is and will always be the increased loss of yield due to diseases and pests. This is because diseases can spread quickly through a crop if all the plants are (equally) susceptible. If problems are not recognized in a timely fashion or if nothing's done quickly, all plants will become damaged. In fact the ideal solution to this problem is simple: cultivate a variety that is not susceptible to the pest or disease.

Still there are situations in which such a solution is not feasible, for example:

1. There isn't a variety (sufficiently) resistant to the disease or pest plaguing the grower.
2. The grower is faced with more than one disease or plague, but there is no variety that is resistant to this combination.
3. The resistant variety has qualities that the grower does not want.
4. The pesticides are not sufficiently effective to counter the disease or plague.
5. It is not possible to use pesticides, for example in organic cultivation.

To find a potential solution to the last four situations listed above we will return to the situation prior to the advent of monoculture. For the first situation mentioned hygiene measures and (preventive) spraying may offer a satisfactory solution.

Different cultivation

Before the age of monoculture different crops were grown in between each other. And incidentally, this system is being reintroduced in many countries to keep plagues and diseases at bay. In China, for instance, wheat is grown on a large scale between rows of cotton plants to counter damage from insects. Growing different crops in between each other is also known as mixed cultivation.

This sounds good, but is a grower really willing to put in all the extra effort of growing sweet peppers in between lettuce? But there are other methods. There is another type of mixed cultivation, known as mixed variety cultivation. As you can guess, in this cultivation form different varieties of a crop are grown together. This is done on a large scale in the United States with grain. But mixed varieties are closer to home than you think. Whether it's a for a football pitch or for your garden lawn, grass is always a mixture of varieties. A mixture of varieties gives you the advantages of monoculture combined with the advantages of mixed cultivation, as long as you select the right combination of varieties.



Variety Mixing - COCKTAILS AGAINST DISEASES

D. Kroeze MSc, CANNA Research

Why mixing works

In this section we will examine one of the main advantages of mixed variety cultivation: that is to suppress disease. The principle of this method of suppressing disease is based on the fact that the varieties have differing susceptibility to disease. We can illustrate this with the following example. Two varieties are grown together and planted alternately. One of the two varieties is fully resistant to mildew, but the other variety is very sensitive.



Examples of mixed cultivation. Here we can see different varieties planted repeatedly in rows to prevent the spread of disease in the crop. The rows form a physical barrier or they have a deterrent effect on organisms that cause plagues. There are other forms of mixed cultivation and there are also other reasons than simply suppressing disease to use this form of cultivation.

As we can see in the figure on the right page, this mixture of plants suppresses the spread of disease in two ways as follows:

1. Plants of the susceptible variety are further apart from each other (thinning effect). A mildew spore that falls from an infected leaf will not reach another susceptible plant.
2. The non-susceptible plants of the resistant variety form a barrier between the susceptible plants. A mildew spore that in a monoculture would fall far enough from the infected leaf to land on another susceptible plant, will now land on a resistant plant.

Unfortunately, in practice the varieties are not fully resistant to a disease. But luckily, to perform in a mixture a variety does not have to be fully resistant. The principle relies on delaying the spread. The greater a plant's resistance the greater the delay in spreading the disease.

Misunderstandings about mixtures

People often think that in mixed cultivation with two varieties the occurrence of disease is halved, but this is a misconception. The degree of infection is the square of the disease spread. In other words

if you reduce the spread of the disease by half, the degree of infection is reduced by the square of the half. Just suppose that 64% of your plants are infected in a susceptible monoculture. That is 82. In a mixture with a non-susceptible variety this would then be the square of half of eight, therefore 42. That is 16%. Another frequently voiced reason not to mix varieties is that people think it will reduce the size of the crop. Still the average harvest from two monocultures is almost always lower than the harvest from a one to one mixture with the same two varieties. In addition, there is less pressure on the plants due to diseases and other factors that play a role too, such as more efficient use of light. Even though you can grow less of your favorite, but susceptible variety in a mixture, the yield per plant may be considerably higher.

The fact remains that you shouldn't start experimenting with a mixture if you think you can get a better yield from a monoculture.

Disadvantages of mixed variety culture

You shouldn't cultivate susceptible varieties in a mixture. This is absolutely pointless. Select the most resistant variety and grow this in monoculture. When Dutch farmers started mixing varieties of wheat towards the end of the 1970s to counter attacks of rust they were thoroughly unsuccessful, simply because there were no resistant varieties. You mix crops so that you can cultivate a susceptible variety because it has important characteristics. When selecting varieties to mix, you will have to consider the height of the plants. Varieties that differ greatly in length cannot be easily mixed, because the taller variety will take light away from the short variety. Varieties that grow to more or less the same height can be easily grown in between each other. They will usually grow to an average height.

Another aspect that you should consider is that mixing the plants to delay the spread of disease is only effective if there are sufficient plants in the mixture. So a good argument against mixing is that in a growing area there are insufficient plants anyway. Yet, a home grower could benefit from a mixture, even if it is only because your plants are often very close together. Remember that a mixture will only delay the spread of disease. If the infection in a crop is homogeneous and/or heavy, there will be little to no benefit from mixed cultivation.

Putting theory into practice

If you want to put together a mixture of varieties yourself, you will soon discover that generally speaking little is known about the resistance of the different varieties. And if a resistance is indicated, no degree of resistance will be stated. Unfortunately, this doesn't make it easy to create a good mixture. The sparse availability of resistant varieties almost



Variety Mixing - COCKTAILS AGAINST DISEASES

D. Kroeze MSc, CANNA Research

creates the impression that growers are not troubled by disease.

Once you have found a variety that is sufficiently resistant, there are different ways of mixing it. If you grow from seed, you can mix the seed in advance of sowing, for example in a cement mixer or you can plant the varieties in alternate rows. You can even mix more than two varieties.

If you are growing from cuttings, you can arrange the plants in different patterns. Good alternatives are fully mixed or in rows at right angles to your ventilation source. Remember that there is no point in planting a mixture if you are going to walk between the plants. In that case you will be the one spreading disease among your plants!

Returning to the problems we mentioned earlier:

The problem of more than one disease or plague, but that no single variety is resistant to that combination of diseases or plagues. One possible solution would be to mix a variety that is resistant to Botrytis (bud rot) with a variety that is resistant to mildew.

In the event the resistant variety doesn't have the particular properties you want to grow, you could consider growing your favorite variety with a great flavor but that is very sensitive to spider mite along side a variety that is resistant.

Even though growing a mixture of varieties can offer solace in certain situations, prevention is always better than cure. Then you can plant your favorite variety in monoculture and enjoy the fruits of your labor to the full.

1



In the susceptible plants mildew spores from the sick plant infect neighbouring plants, which in turn infect their neighbouring plants.

2



The thinning effect. Because the susceptible plants are further apart and are mixed among resistant plants, it is more difficult for spores from the sick plants to reach the other susceptible plants.

3



The barrier effect. Because non-susceptible plants are planted between the susceptible ones, these act as a barrier, most of the mildew spores cannot pass.



GROWERS-TALK

A word from a grower

I'm Scott and have been growing plants in soil my entire life. Not commercially or anything, just for my self. So I water them manually which is easy to do as I just have to take care of a few plants at the same time.

I live in the south of France near Marseille for almost three years now, but I was born and raised in Boston, MA. I still talk to my American family and friends frequently and so I found out CANNA's Terra Professional Plus is now finally available in the States and Canada. I can hardly believe CANNA waited so long to introduce it, especially with the common 'poor' soils in the US market.

When I lived in Boston, I used CANNA TERRA nutrients in combination with Foxfarm and it always worked well for me. When I moved to France I discovered that the standard is different here. Almost every European soil mix is pre-fertilized in order to give the plant a nice kick-start and avoid any deficiencies along the growth stage. This is different in North America where you hardly see these kinds of pre-fertilized or balanced potting soils (with the exception of FoxFarm). Over here I could not get any FoxFarm so I had to look for an alternative and switched to CANNA Terra Professional Plus. According to CANNA, their TERRA line is a complete growing concept where nutrients and medium are tuned to each other. My first thought on that was: yeah right. I fully expected it would probably be even less of a match than with the FoxFarm. I have to

say, now that I tried it, I agree, because the results are actually amazing. I would still like to do a side by side with FoxFarm and Terra Professional Plus once, but that will be hard because I can't buy FoxFarm over here.

After my first crop with TPP I bragged about it to my American friends but it turned out TPP was not available in the states, which made no sense as the TERRA nutrients (which are 1-part nutrients, easy) were. I don't know why it took CANNA so long to get it to the states but I am just happy they finally managed. My friends are just giving TPP a shot for the first time and so far they are cranked at what they see, more than I was the first time. Now when we chat, we can share our stories and experiences. We are planning on starting our next crop on the very same day to see who the better grower is.

So, happy growing to all fellow Americans and special thanks to CANNA for developing such a wonderful and easy product,

Later
Scott



“Disasters Dissolved”

CALCIUM DEFICIENCY

Ca

In the last edition of CANNATALK, (Issue 5) we introduced a new returning feature called Disasters Dissolved.

Here we discuss problems you might run into while growing.

Each issue we want to shed light on a different disease or deficiency. We describe how the problem evolves and what it looks like to help you recognize the correct problem.

We will also give solutions and tips to help you resolve the issue. So, save all your copies of CANNATALK.



“Disasters Dissolved: Calcium Deficiency:

Eventually you will build your own archive of possible problems. We will help you become knowledgeable in keeping your plants healthy and possibly just save your harvest (if you can't find the answer in here, go to the CANNA website so our experts can help you out). Nitrogen was subject of last issue's Disasters Dissolved; this time we put Calcium Deficiency in the spotlight.

About calcium

For plant as well as animal life, calcium is an essential element; it is found in many structures from bones and protective shells to eggshells and cellular membranes, just to name a few. Muscles and nerves do not function without calcium. The name calcium derives from the Latin *calx* or *calcis* meaning stone. In its pure form, it is a silver colored metal that is a little harder than lead but easy to bend. The metal ignites when heated and reacts very strongly to water and acids. Calcium is found everywhere in the world; 3.64% of the earth's crust consists of calcium. The degree of hardness of tap water is mainly determined by the quantity of dissolved calcium salts¹.

Calcium in the plant

Calcium occurs throughout the entire plant. It is used for many of the life processes in the plant; however, calcium is most important for the growth process. It has a regulating effect in the cells and contributes to the stability of the plant². Plants have two transportation systems at their disposal: the xylem (from roots to top) and the phloem (from leaf to other leaves and roots). Most nutrients can be transported through both systems; however, for calcium this is not possible. Since calcium can be transported almost exclusively through the xylem vessels, it is an element that possesses little mobility within the plant. It is, therefore, important that a sufficient amount of calcium is always available in the root environment, so that it will be continuously available for absorption by the plant.

A deficiency

Calcium is mainly transported through the plant by the up-ward flow of sap. In the case of a calcium deficiency, the older, larger leaves will show the first symptoms of deficiency. It often affects the leaves just above the bottommost leaves (just like with a magnesium deficiency). Beginning calcium issues show a distortion in the growth of the older leaves which will twist and curl in most plants. An advanced state of calcium deficiency is recognized by the occurrence of yellow/brown spots, which are often surrounded by a sharp brown outlined edge³. In addition, the growth is curbed and in serious cases the tops are smaller than normal and do not

close. The result of this is easy to predict: a greatly reduced yield.

Development of a deficiency

When a calcium shortage is the case, you will find your plant going through the next cycle:



I. The yellow/brown spots surrounded by a sharp, brown outlined edge that are found on the leaves, are characteristic of a calcium deficiency. The symptoms of a calcium deficiency often appear quickly; within one or two weeks of the first spots being visible on the older leaves. The spots usually start as small, light brown specks (edema or oedema) that increase in size over time.



II. After two weeks, the older leaves show ever increasing spots. The spots often appear at the edge of the leaves, as is the case with a potassium deficiency or with scorch symptoms. Nevertheless, the differences between a calcium deficiency and a potassium deficiency are in most cases well distinguishable; with a calcium deficiency the spots have a sharp outline and do not originate exclusively at the edge of the leaves. A lag in development is often already noticeable within a week.



“Disasters Dissolved: Calcium Deficiency:



III. Sometimes the growing points will wrinkle up and around the fruits you will find thin, small leaves that are not spotted.

IV. The older leaves die off slowly and yellowish cloudy spots may appear around the necrotic spots. The older the leaf, the more serious are the symptoms.

V. Flowering is also hindered and slowed: Fruits stay small.

Reasons for a deficiency

Several things can be the cause of a calcium deficiency, like:

- Insufficient or incorrect fertilization
- Culture on calcium fixing soil ⁴
- An excessive amount of ammonium, potassium, magnesium and/or sodium in the root environment. The absorption is curbed mostly by ammonium and least by sodium.
- Problems with the evaporation caused by an excessively high EC value or by excessively high or low relative humidity. ⁵
- An overall issue with irrigation and water transport within the plant.

Solutions to resolve a deficiency

- Go to your local shop for advice. They should have the expertise and right products available to help you overcome this problem. A correctly formulated fertilizer should contain sufficient calcium.
- If the EC value of the substrate or the soil is too high, it can be rinsed (leached) out easily with pure (and if necessary) acidified water.
- If the soil contains insufficient amounts of calcium, then it can be applied in the form of dolomite or hydrated lime, calcium sulfate, earth foam, potassium siliceous lime, magnesia siliceous lime, Thomas (basic) slag, triple super phosphate or lime nitrate. Be careful with fertilizers containing chloride, and be very careful with any of these mentioned products because only dolomitic

limestone offers less chance of burning the plants or applying additional nutrient elements that will change the overall fertility realm of the crop.

- Additional calcium can be applied through the nutrient solution by means of liquid lime fertilizers such as a calcium nitrate solution. With an excessively acidic soil, lime milk can be used to increase the pH, but be careful, it is a suspension of hydrated lime and reacts fast which could lead to burning of established crops.
- Use an appropriate soil that is not too acidic. Acidic soil often contains insufficient amounts of lime. Good pre fertilized potting soils/soilless mixes and Coco substrates are already limed or pH adjusted. ⁶

Footnotes

1. It concerns calcium carbonate, CaCO_3 , a white, sometimes colored rock or powder that is almost insoluble in water. Scale mostly contains a considerable amount of calcium carbonate. The degree of hardness of tap water is not only determined by the calcium concentration, but also by the magnesium concentration of the water. The degree of hardness can differ greatly from place to place.
2. Calcium is responsible for the stability and activity of the plant tissues and regulates (together with other substances) the inflow and outflow of substances in cells and tissues. One role of calcium is to stabilize the pectin of the middle lamellae in the cell wall. While stabilizing the structure of the cell wall, it also maintains the integrity of the membrane structure.
3. The yellow / brown spots are the result of an increased permeability of the cell membrane, which causes the release of pectinase (an enzyme) amongst other substances that can destroy the cell wall. The cells come loose from each other and burst open.
4. Calcium fixation can occur, for example with un-buffered coco and with humus or clay-rich soils. These soils tend to bond with lime and other bivalent cations.
5. An excessively high EC value in the root environment or a very low or very high humidity of the plant environment curb the evaporation. As a result of this, the upward flow of sap decreases and transport of calcium will be strongly reduced. A deficiency is often seen at the places with the lowest evaporation, such as the older leaves and the fruits.
6. Peat is often added to the soil to loosen the soil and aerate it. As this substance is acid, the pH of the soil is increased by adding a certain amount of lime.

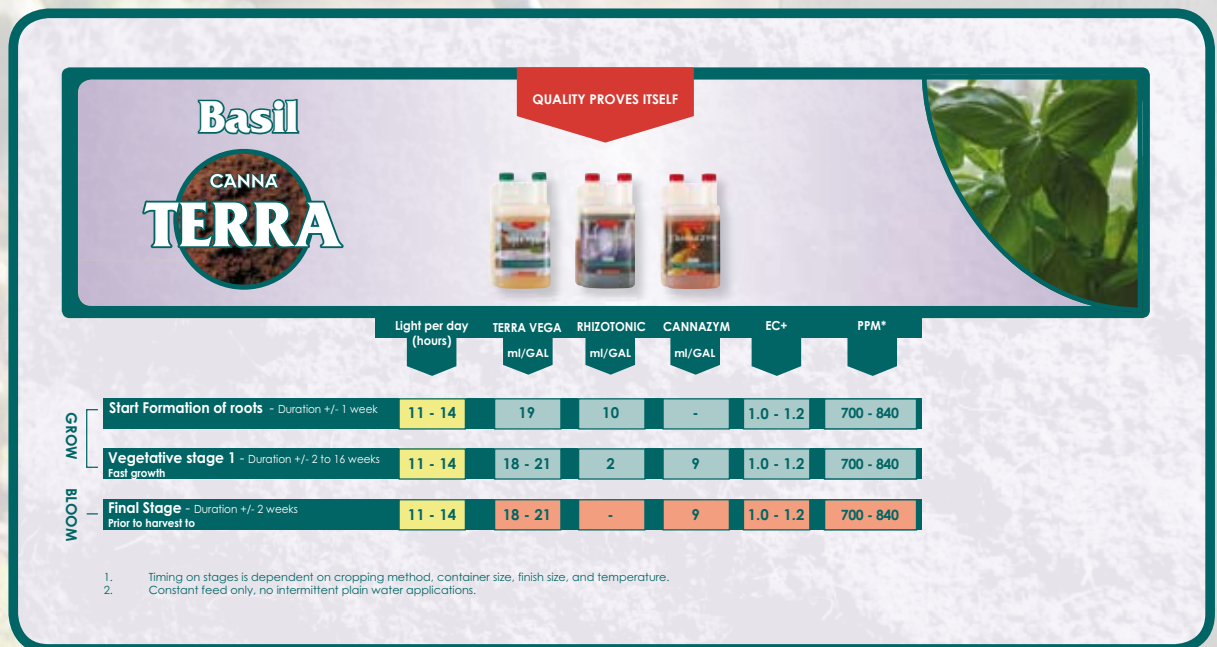


Grow it yourself: Basil

The economic slump makes everyone looking at ways to cut down on bills. Grocery bills for example! A lack of rain and changes in routing water to farmers caused a crippling drought on Californian fields. This will probably raise vegetable prices even further. All the more reason to get off your but and start growing yourself! Demand for allotments has gone crazy and even classes on gardening had to introduce waiting lists. So, if you don't want to be on a list, keep your eye on CANNATALK from now on. Each issue will share some information about a specific crop which can be grown yourself very easily. It will be accompanied by a Feed Chart designed for that specific crop and a nice, refreshing recipe so you can enjoy your proudly grown fruits, herbs or veggies right away. Keep an eye on the medium/system for which the Feed Chart was set up. If it is not the medium/system you are using, (or the crop you wish to grow) check out the CANNA website for more crops, whether you are growing in soil, coco in re-circulating system

or on rockwool, it is all there. If not, write us! Let us know which crop you are missing so we can help you and further build the Feed Chart archive. For this issue of GIY we shed a light on growing (and enjoying) Basil on a pre fertilized soilless mix like Terra Professional Plus.

Basil, *Ocimum basilicum*, is one of the most popular herbs grown in the home garden. An annual with over 160 varieties offered on the market today that come in a variety of shapes, textures, smell, and taste. It is originally from India but has found wide use in Italian and other cooking styles. It is fairly easy to grow, will produce in a variety of conditions, and will produce usually more than will be consumed. Basil is not only used for its culinary potential, but also for its form in the garden and ranges, based on variety, from a procumbent open structure, to a tight globe shape, and on to a taller upright loose form. All varieties flower prolifically, however, for cooking, it is important that flower spikes be pinched





GIY: Grow it yourself.....Basil

off when they form. This keeps the leaves and stems from developing an off taste and becoming both smaller and woodier.

The best production technique for Basil, any form, is from seed. Good seed, current year, exhibits high germination percentages and is usually big enough to handle. It is recommended that they be sown in open flats initially and later transplanted as individual plants to a small container like a cell pack in order to keep them as separate plants and not clumps since the form and growth pattern favors an individual plant. Transplant to the smaller cell when the plant just shows the first 'true' leaves after germination (5-10 days): this is usually within the first 7 – 10 days after the seedlings first appear. Keep the seedlings and transplants uniformly moist but do not overwater as they are very susceptible to Damping Off diseases as well as root rot. Once the root mass has reached the outside of the cell pack of small container, and developed about 50% of the

mass it could have in the small container, it can be successfully transplanted to its final home (usually about 8 weeks from seed). If you use a medium that has an initial fertility charge then it may not be necessary to do any additional fertilizing until and unless it will remain in the container past a 12 day window. Otherwise, fertilize new seedlings with half strength fertilizer (100 ppm N) first time then full strength after 2 weeks (150 – 200 ppm N).

Basil likes a middle pH range of 5.5 – 6.5 but can be grown from 5.1 – 8.5. Plants need to be set about 9 – 12 inches apart based on variety and form desired. Basil prefers full sun but can be grown in partial sun especially in warmer climates. Avoid any frost and the plants can be 'chill damaged' at temperatures below 50oF (10oC). Lighting needs to be 8 hours minimum per day of direct light. Major pests include whitefly, aphids, thrips, Fusarium, Rhizoctonia, and water molds. This can be a good addition to a butterfly garden.

Recipe: BASIL GRILLED CHICKEN

PREP TIME: 20 minutes
COOK TIME: 20 minutes
SERVES: 4 servings

INGREDIENTS

- ¾ teaspoon coarsely ground black pepper
- 4 skinned chicken breast halves
- ¼ cup freshly chopped basil leaves, plus 2 tablespoons freshly minced basil leaves
- 1/3 cup (5 tablespoons) butter, melted, plus ½ cup (1 stick) butter, at room temperature
- 1 tablespoon grated parmesan cheese
- ¼ teaspoon garlic powder
- 1/8 teaspoon salt
- 1/8 teaspoon pepper
- Fresh basil sprigs, optional

DIRECTIONS

Prepare charcoal grill for cooking

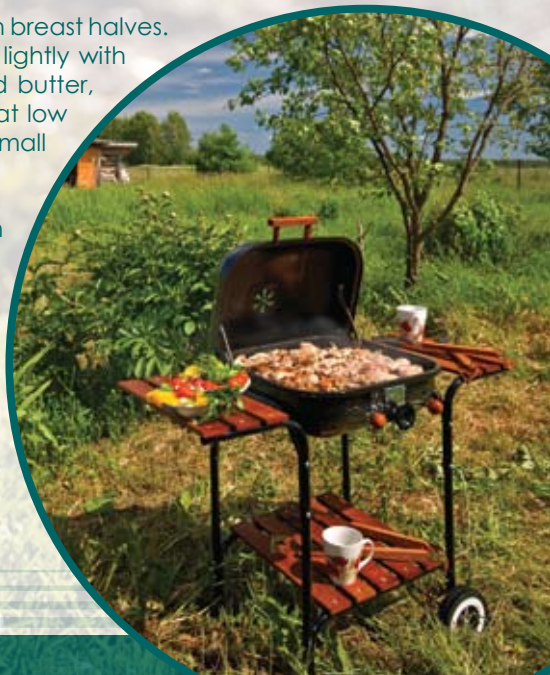
Press the coarsely ground pepper into the meaty side of the chicken breast halves. Stir the chopped basil into the melted butter. Brush the chicken lightly with this mixture and set aside. In a small bowl, combine the softened butter, minced basil, Parmesan, garlic powder, salt, and pepper. Beat at low speed with an electric mixer until smoothly blended. Transfer to a small serving bowl and set aside.

Grill the chicken over medium coals for 8 to 10 minutes on each side, basting frequently with the remaining melted butter mixture. Serve the grilled chicken with the basil butter mixture. Garnish with fresh basil sprigs, if desired.

Recipe courtesy Paula Dean 2007 from FoodNetwork.com

Good accompaniments :
Corn on the cob (use basil butter), and fresh garden salad.

Enjoy your self grown Basil!





CANNA Research

How plants communicate

D. Kroeze MSc, CANNA Research

**HOW PLANTS PERCEIVE THE WORLD AROUND THEM
AND HOW THEY COMMUNICATE**

Plants don't have the same senses as we have but are pretty good at forming a picture of the world around them. And they can even influence this and can communicate with each other and other creatures.



How plants communicate - D. Kroeze MSc, CANNA Research

Above or below?

Plants have many ways of interpreting their environment. Plants can tell the difference between above and below. You can imagine that it would be disastrous if a seed were to grow downwards into the soil. Plants that are in the dark have a bigger chance of finding light above rather than anywhere below. The contrary is the case for roots that need to grow downwards to find water. But how can a plant tell the difference between above and below?

Inside plant cells there are what we call organelles. Organelles are the cell's organs. Some of these organelles are granules. The best known example of such a granule is certainly the chloroplast granule that uses sunlight to make sugars. If these sugars are not needed immediately the plants stores them as another type of granule, in the form of starch; we call these starch granules. Starch granules can be found in the parts of the plant that grow, such as the growing points. But starch granules are more than just places for storing sugars. Because of gravity the sugars are always at the 'bottom' of the growing cells and that's how the plant knows which way is below and so in which direction it must grow.



A plant knows exactly what's above and what's below.

Source: <http://hortweb.cas.psu.edu/dept/arteca>

Seeing

Besides gravity, light also tells the plant which way it should grow. Plants grow toward light and, to be precise in the direction of where the light is most blue. The reason for this is that plants absorb large amounts of blue light. So the more blue light there is, the fewer other plants there are that want to use the light. Plants use what are called a photoreceptor to perceive the color blue. But blue is not in fact the only color that plants use to see each other. Plants are green because they mainly absorb the red part of the visible light spectrum. Plants can also use the quantity of red light (to be precise, the relationship between red and far red light) to determine if and where other plants are in the vicinity.

Seeds use this trick to decide when best to germinate. Growing plants will grow taller to get out of the shadow of plants that are around them, they may also grow in another direction. There's more to read on this subject in the article called "The influence of colors on plants" (ed. CANNA Talk no. 4)

Tasting with your feet

Plants taste and smell as well. They taste below ground, using their roots. Plants secrete substances below ground which allows them to absorb nutrients; other plants can use their roots to taste these. Based on what they taste they can tell how strong and how far away other plants are. A plant uses that information to decide whether or not to get into the underground contest for nutrients and water. They can also sense matter from the above ground parts of the plant that have been washed down by the rain into the ground.



Plants produce substances. Other plants can smell these substances so they know they're not alone. Plants can also transmit specific information using these odours.

Picture source: <http://www.bbc.co.uk>

Above ground plants smell each other. If plants smell ethylene they know other plants are nearby. Plants can in fact smell more types of substances but let's keep it to this for now. We'll also see whether it's true that your plants communicate with each other and how it is that plants grow better if you talk to them.

Odors

You could very probably get the impression that plants are each other's enemies and can only perceive things in order to compete for light and nutrients. This is only partly true. Plants warn each other for approaching danger such as foraging animals and insects.

If a plant is being eaten, it secretes a substance that makes it less tasty. In addition to this it also secretes other substances to warn plants in the neighbourhood of catastrophe. This can be secreted both above and below ground, but are

usually aromatic substances. This happens, say, when attacked by spider mites. Once warned, the plants around them also manufacture these aromatic substances and so pass on the warning in turn while they also make themselves less tasty for the insects. Unfortunately this strategy is less effective indoors. You can understand that spider mites have little choice when in a growing room and have to put up with a less tasty meal.

If you're thinking that plants start panicking and are going to send distress calls all over the place every time a leaf gets torn, you're mistaken. Plants know exactly when insects are eating them because they recognise their saliva. They even know which insect is eating them and pass that precise information on. It's not only plants that can interpret these signals. Predatory mites and other natural enemies respond to these signals too.

Evolution has arranged things in a way that they know that a tasty meal awaits them where the odour given off by these signals is the strongest.

Plants communicate underground with other organisms as well. They call on certain fungi and bacteria for help when there are not enough nutrients available. Plants do this by secreting very small quantities of certain substances. The micro-organisms release nutrients for the plant and get energy-rich sugars in return. Other advantages for the plant are an increased resistance against soil pathogens and improved resistance to dehydration.

Talking with your hands?

It's a well-known fact that there are people who say that plants do better when you talk to them. Although researchers have been working for a long time on the question of whether plants react positively to speech, no convincing research has been published to date. But there are also people who really have experienced the positive influence of speech on their plants.

One possible explanation is that they don't only talk to the plants but they also touch them. Plants do have a sense of touch. Researchers discovered this when doing a test involving plant hormones. It turned out that not only did the plants that were given the hormone stay smaller, but so did the plants that were given a substance that was entirely inactive. The reason for staying small appeared to lie in the plants being touched when the substance was applied and not in the hormone itself. So, plants stay smaller if touched. What has this got to do with the positive influence on a plant

if it's touched? In addition to being smaller the plant goes on flowering longer. These reports tend to concern plants that give flowers such as roses.

In addition to delayed flowering and staying small, plants that are touched frequently have smaller leaves, reduced photosynthesis and accelerated aging. How it is that a plant's development and growth can be influenced by being touched is not precisely known today, but if you touch your plants often you can be sure of a smaller harvest.

Listening

Although no organisms have been found on plants that allow them to perceive sounds, they do react to music and can distinguish this from 'conventional' sound. The influence of tones and music on plant growth and development is a relatively new area for science, but a lot of research is going on. There were some details on the subject in the article called "The influence of music on plants" which was published in CANNA Talk issue 4 and is still available on the CANNA website.

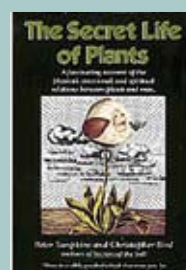
And anything else?

Could it be that plants have senses that we haven't the faintest idea about today? A book called 'The Secret Life of Plants' says yes. Although a bestseller, many researchers at the time concluded, despite high expectations, that the book was far from usable for science. But, over 35 years later, some of the claims don't seem quite so weird. Plants really do seem to communicate with each other and to react to music, but how they do that appears to be very different.

Like other living things plants do have senses. Just like us (but in a slightly different way) plants can smell, taste, see, hear and feel. And they know which way is up and which way is down. So plants have a pretty good idea of their environment and influence this in what is apparently a carefully thought-out way. If plants do have more senses, researchers will certainly discover them one day whether or not inspired by fantasy or the occult.

Ir. D. Kroeze, CannaResearch

'The Secret Life of Plants' initially sparked off expectations of a revolution in the area of plant science. Sadly the line separating myth from reality was very thin.





Growers Tip #6

Water Temperature

To ensure good root development, the feeding (irrigation) water must be at temperatures between 68 - 77°F (20-25°C).

At temperatures below 59°F (15°C) the roots capacity to absorb nutrients and water decrease rapidly. This, of course, will ultimately result in a smaller harvest.

Feeding solutions that are too warm, > 76°F (25°C) will show problems as well including creating an environment that can be ideal for many disease causing organisms. If the feeding solution is mixed using cold water then the pH will rise as the water is heated. In such conditions you can avoid high pH by setting the pH a little lower at the outset. Cold water mixing can also cause a momentary event with liquid nutrients where the elements may drop out of solution but can usually be readily mixed back into solution. Plant roots function best between 68 - 77°F (20-25°C) and will rapidly stress when the temperature is dropped or raised rapidly.



canna terra: combining forces

rhizotonic for rapid roots

from start to finish

i am in control

balanced

i reuse the medium

1+1=3

pk 13/14

designed by experts

synergy

terra flores

pure and natural

watching them grow

cannazym

proven quality

combining is the key

1 part nutrients

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it's so easy!

terra professional plus is free of perlite

my number one

terra vega

my first choice

stability

NEW



canna terra

The introduction of CANNA Terra Professional Plus medium in North America completes the CANNA TERRA range, making it a balanced growing program. All CANNA TERRA products are tuned to work with each other to create the best possible results. Precisely controlling the nutrient dosage is often challenging but made easy with CANNA TERRA. CANNA TERRA, the whole is greater than the sum of its parts!

For more information about CANNA TERRA or to download the CANNA TERRA InfoPaper, please check out www.canna-hydroponics.com

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The solution for growth and bloom