



CANNA

Issue No. 8, Volume 2

Talk

Florigen

The flowering hormone

Disasters Dissolved

Iron Deficiency

Research

Oidium & Mildew

What's New?

CANNAZYM New and Improved

Hi-LUX GRO™

made in Germany

USHIO Lighting—Edge Technologies

professional grade horticulture lamps



Opti-Red



Dual Core



Opti-Blue

USHIO
www.USHIO.com



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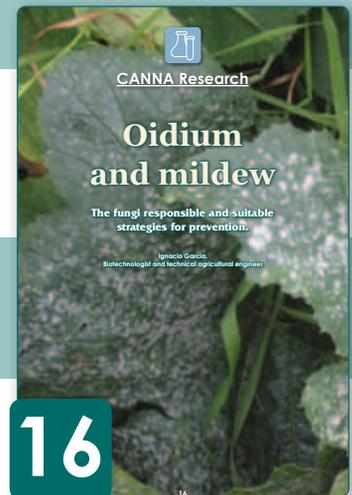
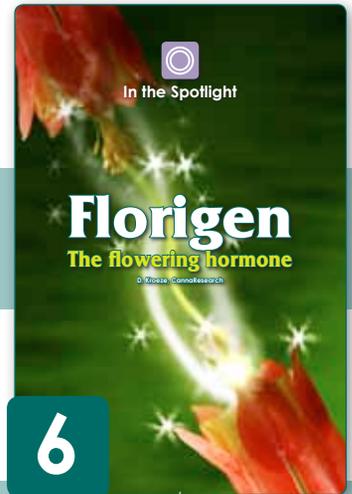
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HQ's Talk:

Do you believe in magic? We at CANNA would like to do so but we rather base our information on scientific fact. Although sometimes science seems to be like a fairy tale. The plant hormone Florigen is quite magical we believe. It is known for over a hundred years but it took quite a while to discover the secrets behind this mysterious hormone. It is able to trigger flowering without having to cut back on the plants lightning. The name Florigen is actually derived from Latin for 'Flower Former.' Read the article and also learn why night time visits to your grow room can be disastrous. And what will this hormone bring us in future? Will growers get under a Florigen spell? What do you think? Please share your vision with us; Editor@cannatalk.com

Unfortunately not all science is like a fairy tale. And not every powder is as magical as fairy dust. Mildew! Most growers get to face it sooner or later. It can really screw up your harvest. Mildew is a widely used term for all kinds of different fungi. If you wish to save, or better yet, prevent these types of fungi in your crop it is best to know which exact fungi you might be facing. One of CANNA Researches' biotechnologists wrote how to do this. You can start reading the first part on page 16. Because the article was written very thoroughly it became quite extensive and therefore you'll find part 2 in next issue of CANNATALK.

Which brings me to announce some exciting news! Well we think it is. We are very busy developing a brand new look for our CANNATALK magazine and it will appear starting next issue (# 9)! We will continue to bring you interesting, scientific articles from our Research department, testimonials and growers experiences, news, info on specific crops and growing problems and we'll keep helping you out with ANY question you might have. But the look will be totally different! If you don't want to miss the totally new CANNATALK than go take a preview peak on page 29 of this issue to discover the new CANNATALK logo.

We hope you'll enjoy this last "old look" CANNATALK and hope you look forward to the brand new issue as much as we do. Please write our editor if there's anything you wish to share. Or go to our website www.canna-hydroponics.com for more information or to submit your growing question to one of our engineers and horticulturists from CANNA Research. We can't wait to hear from you!

Cheers,
Jeroen



What's New!

CANNAZYM New & Improved

CANNAZYM has a new face and a whole new outlook on life. It continues to be the only enzyme product on the market today that specifically targets the food source and underlying cause of root binding, old cast off and dead root material. So what changed opposite to the old CANNAZYM?

Changes in the production process increased the activity of the enzymes on cellulose while decreasing the response interval for function. This is a technical way of saying the product simply works better for your plants. The improved CANNAZYM appears with a darker shade of color which will remain fairly stable throughout its shelf life where the old CANNAZYM could slowly turn pale as it got older. The improved CANNAZYM has a guaranteed prolonged shelf life of

24 months. Keeping CANNAZYM dark and close to between 48°F - 70°F (9°C - 21°C) will serve to extend the storage period. The Improved CANNAZYM is not influenced by extreme temperatures. You might notice a change in the product label as it is now listed as 0-2-1. Higher EC rates are possible with the new version which allows you to be cautious with the amounts you apply, so it's best to just follow the instructions on the label.



CANNATALK BRAND NEW LOOK

Next issue of CANNATALK will appear with a completely new and fresh look. Curious? We're raising the veil slightly on page 29. Take a sneak peak and be on the look-out for issue 9.

Win \$ 250 worth of nutrients*

CANNA wants to know all about your growing experience. To help you tell your story we've added a question form to our website to make this easy. As a member of the CANNA Club, you can fill it out and write a personal growing story. (non-members can sign up to become a CANNA member instantly). The best contributions will be published in upcoming editions of CANNATALK and on our CANNA website. Contributors whose stories are published will receive a special Thank You from CANNA worth \$250! So grab your digital pen fill and write yourself a prize!



* Represents nutrients and/or additives determined by CANNA to the value of approximately \$ 250. No exchange for other product or money. CANNA will contact you when you are a winner. For more information or questions please contact editor@cannatalk.com. Of course your personal information will always be handled with confidentiality and care.



In the Spotlight

Florigen

The flowering hormone

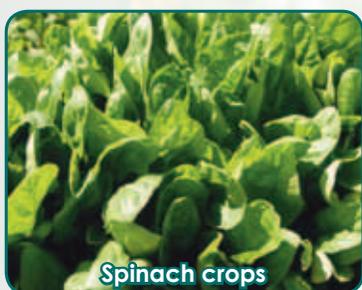
D. Kroeze, CannaResearch



Many plants are 'short-day' plants, meaning that the plant starts to bloom once the days shorten. This is why horticulturists cut the amount of light from eighteen hours a day to twelve when they want to start the flowering phase. It's actually a shame from the plant's perspective: six fewer hours of light a day is six fewer hours of photosynthesis, and thus less energy for your plants in the form of sugars. There is also a substance that can get your plants blooming without your having to cut down on their light.



Maize plants



Spinach crops

Differences in daylight:

Other short-day plants include maize, chrysanthemum and chicory. There are also long-day and day-neutral plants. Examples of long-day plants are spinach, lettuce and barley. One day-neutral plant is tobacco.

Short days

What really happens when the days get shorter or when you cut back to 12 hours a day? When the light goes down to 12 hours or less, the leaves start to manufacture a substance that triggers flowering, which gets transported to all over the plant. This substance is called florigen or flowering hormone. The term 'short-day plant' isn't completely accurate. It's not the fact that the days are getting shorter that makes the plant decide to flower, but that the nights are getting longer. Although the difference may seem trivial, it does explain why a night-time visit to your growing space will delay flowering for your plants. When you turn on the light, the plant's night is over; it has now become too short to stimulate flowering. The plant has to start over counting the hours of darkness from zero.

Julius and the discovery of florigen

In 1865 a German scientist named Julius von Sachs discovered that when he transferred sap from a flowering plant to a non-flowering plant, the non-flowering plant started to flower as well. This even happened when the two plants were from different species. Unfortunately, no matter what he tried, he never succeeded in isolating the substance responsible for flowering.

Many after him also have tried in vain to isolate florigen, which made it into something of a mystery. It got to a point where the question was not only what the substance actually was, but whether it even existed – at least until a few years ago. Now, one of the greatest mysteries of plant biology seems to have been solved.

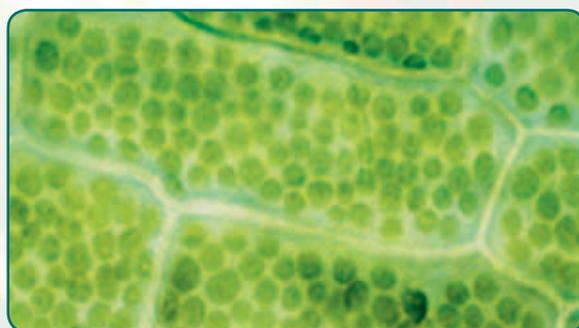
Julius von Sachs (pictured below) made other major discoveries besides the existence of florigen. For example, he discovered chloroplasts and the fact



that they produce sugar. He also discovered that glucose is stored in the form of starch in granules. In other words, the mystery of florigen was as old as much of the fundamental knowledge in plant biology.

The information superhighway

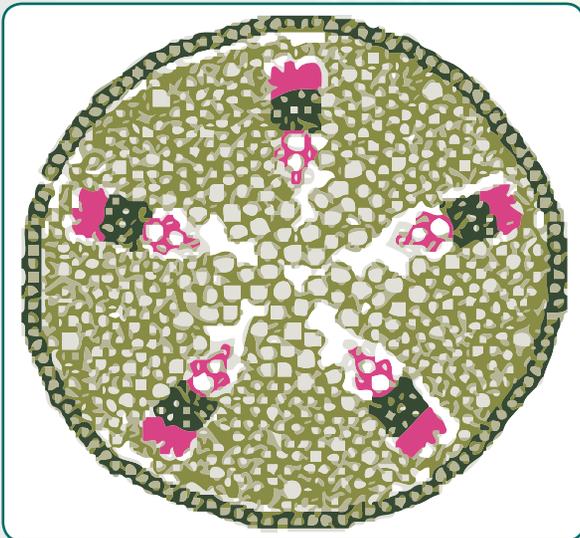
During the quest for florigen, it became clear that the sap flowing through the phloem (vessels) of the plant contained more than water and the sugars produced by photosynthesis in the leaves. As it turned out, many semiochemicals (substances that send signals to the plant) are dissolved in the phloem sap. These are mostly small molecules in



Chloroplasts



very low concentrations. The phloem transports information from one place in the plant to another, including the signal to flower, in the form of these substances. This is why the phloem is also known as 'the information superhighway'. Actually, florigen had been found a few years earlier, but its function had not been discovered until recently. You may wonder why it took so long to find florigen. Here's the reason: Once the night length has crossed a certain threshold, the leaves produce a signal to start manufacturing florigen. The substance is only made in the growing points of the plant; a different substance, which reacts with the substance from the leaves, occurs only in the cells of growing points. The two substances together are actually the real florigen. In addition, but no less important, is the fact that these are very tiny molecules, which were only discovered in the last few years. Until then, laboratory equipment was simply not advanced enough.



The phloem (red) is the living vascular tissue of the plant, through which mainly sugars and water are transported from the top down. Besides the phloem there is also xylem (pink), dead tissue that transports nutrients and water up from the roots.

The future is smiling?

After more than 140 years, the quest for florigen is finally over. A great mystery has been solved. This is fine for science, but what does it mean for your

average person? The answer is easy: a lot! Manipulating florigen has enormous potential.

Its discovery will bring about a revolution, in particular for conventional agriculture. Greenhouse horticulture will see increased yields from more hours of light. Scientists are especially thinking about growing crops in places where it was previously impossible, such as growing some tropical crops in Northern Europe. But a lot may change for tropical regions as well. The shortened growth time will mean that more crops can be grown in one growing season than is possible now. Besides this immediate effect on food production, there will also be a revolution for seed companies. For example, fruit trees could be made to flower in the first year and so can be crossed with each other within months instead of the usual years breeders spend waiting for the first flowers.

For hobbyists, it will of course be the higher yields that make the applications of florigen most interesting.

We should not get carried away. It will be many years before we can make practical use of florigen. One thing is certain: its discovery will change agriculture and plant breeding forever.

From Gentech to hunger

Why the question mark after 'the future is smiling?' because florigen can't simply be added to a plant. Biotechnology companies will have to provide crops with the information they need to make florigen themselves independent of day length, using genetic modification. Since this gene will initially be put into one or two crop varieties, these few varieties will quickly drive out local varieties (genetic erosion). This will mainly be a problem for developing countries where agricultural production is now less than optimum, and where these new crops could greatly improve food production. At first, these monocultures of just a few varieties on such a huge scale will produce lots of food, but in the long term will lead to enormous problems from diseases. And what are you going to eat when the food crops are gone? ***That's the next challenge!***

More about florigen, hormones and semiochemicals in next issue of CANNATALK.

members
only

Want to be part of the family?

Become a CANNA member

Become a CANNA family member today and profit from all the benefits CANNA can offer you! Members enjoy full access to our website where they can read all about the latest news, trends, inside information on research & development, and other gardening-related subjects. When you need any help, as a member, you'll go to the front of line! Sign up at our website today and become a part of our family.

www.canna-hydroponics.com

CANNA
The solution for growth and bloom

Mini Veggies

There are many kinds of 'fruit vegetables', crops of which only the fruits are harvested. The most popular of these are tomatoes, cucumbers, sweet peppers and chilli's. They come in both large and small sizes, and the miniature varieties are becoming increasingly popular, both as healthy snacks and as garnishes. We'll shed a light on one of them: sweet peppers.

Sweet peppers

The sweet pepper is an annual plant that can grow to 80 centimetres high. The fruits come in many colors: vivid green, bright orange, fiery red and golden yellow. They are high in fibre and almost exploding with vitamins A and C. Peppers promote regularity and are low in calories, so they're good for your figure too!



Peppers come in wide variety of colors

Origins

This plant originated in the tropical and subtropical areas of Central and South America. In 1492 Columbus was the first European to discover the pepper. It became better known in Europe during the 17th century, particularly in the southern countries of Eastern Europe. Peppers range in heat from sweet to fiery hot.

Sweet and hot (chilli) peppers

Both the sweet and chilli pepper belong to the same family and species, 'Capsicum annuum'. Sweet peppers and hot peppers are botanically the same, since they are both the same Capsicum



A sweet, mild orange bell pepper and a small flaming hot Habanero Pepper, both part of the Capsicum family.

species. The plant and leaves look similar but they are different cultivars. It's like a Chihuahua and a Great Dane, two different breeds but in the same genus and species, which is why we differentiate between sweet pepper and hot pepper. They're all peppers. But make no mistakes, you can burn your mouth pretty badly on a sweet pepper too!

Growing Peppers need lots of water and warmth. Within a few months the fruits are ready to harvest. They're ripe when they're nice and big, with a smooth shiny skin. When you pick them, make sure you get the stem too – they'll keep fresh longer in the veg drawer of your fridge that way.

Today there are many different kinds of peppers available: from pear-shaped to round like a toma-



Because of their size miniature vegetables are ideal for growing indoors

to, and everything in between. Mini peppers have the shape of a traditional sweet pepper, but are never more than eight centimetres long. The height of the plant makes the minis highly suitable for indoor growing, and their sweet fruits are ideal as a snack with your appies. They also make a colorful garnish for cold or hot dishes.

Fun facts

* Peppers stay fresh longer if they're not refrigerated. The reason is that peppers are sensitive to changes in temperature. At temperatures lower than 12°C their quality starts to deteriorate. The skins go dull and the calyx may come loose. This phenomenon also occurs with tomatoes, cucumbers and eggplants. Thus, it's best to store peppers at room temperature or in a cool shed, and not with other vegetables or fruits.

* The pepper plant is part of the nightshade family, Solanaceae, the angiosperms. This family has a number of toxic plants, such as the black nightshade, parts of which are sometimes used medicinally. Other well-known plants in this family are the potato, eggplant and tomato.

* Red sweet peppers contain twice as much vita-

min C as green ones.

* The most common colors for sweet peppers are red, green, orange and yellow but there are also black, purple, chocolate-brown and white varieties and sometimes even multi-colored ones!

* Eating peppers increases resistance to infections and helps protect you from cancer and cardiovascular disease. Peppers also contain vitamin PQQ, a rare B vitamin which plays an important part in fertility.

* All peppers start out green. So green peppers are actually unripe!

per 100 gram fruit	Sweet pepper			
	green	red	yellow	orange
kiloJoules	67	92	92	92
kilocal	16	22	22	22
protein (mg)	1	1	1	1
fat (g)	0	0	0	0
carbohydrates (g)	3	4.5	4.5	4.5
calcium (mg)	15	15	15	15
iron (mg)	0.5	0.5	0.5	0.5
sodium (mg)	5	6	6	6
vitamin A (mg)	100	120	120	160
vitamin B1 (µg)	30	30	30	30
vitamin B2 (µg)	70	70	70	70
vitamin C (mg)	70	165	175	180

Nutritive value of different colors of peppers



Duo Tone pepper

Facts about growing mini-peppers:

- Mini-peppers do not need pruning.
- Mini-peppers do not need to be thinned.
- Mini-peppers also do well outdoors, even in a variable summer.
- Mini-peppers are very strong plants, both outdoors and in greenhouses. They have almost no diseases. Aphids can be a problem in greenhouse cultivation.
- Mini-peppers grown outdoors grow to less than half the height of plants grown in greenhouses.
- Mini-peppers in the greenhouse produce abundant fruit. Plants grown outdoors are smaller and produce less.
- Mini-peppers grown outdoors may be even sweeter.
- Mini-peppers contain very few or no seeds.



Questions & Answers

It seems as if more and more growers are finding their way towards our “oracle” as we never received so many questions through our website before. We’ve made a selection of the most common and interesting questions. If you can’t find an answer to your own specific problem, please write us so we can help you out.

Question:

I feed my plants according your feeding schedule with CANNA Aqua Vega. This is not my first grow.

But until now I experienced this problem in every cycle. The stalks but also the stem are red. The leaves have a very nice color, but are not really shiny. The new leaves are very light coloured at first, but eventually turn green. The leaf veins appear a bit yellowish and the plant doesn't grow very well. Furthermore I have a bit of a problem setting the pH. In the course of time this decreases. I

live in an area where we have very soft water. (this should be good, shouldn't it?)

Total hardness is 5,2°dh, carbonate hardness is 3°dh. The measured carbonate hardness in a 3 days old solution is only 0,5° dh. Therefore I suspect that in that period the plants have absorbed all Calcium and

Magnesium. Would this be correct? Is it wise to add extra Ca or Mg?

Answer:

Red stalks can occur because of various reasons:

- 1: It is too cold for the plant
 - a: Night temperature is too low (below 18°C)
 - b: Shut down the ventilators at night, but only in the first week. The plant will cool down itself, as it evaporates a lot at night.
 - c: Cold air from outside, causes the plant to cool down. (divide the air better within the room)
- 2: pH value is too high
 - a: Because of the cold, the plant takes its nutrients in a different way, which can cause a higher pH in the roots.
 - b: pH is too high
 - c: pH increases in the roots because of nutrient uptake.

We suspect it to be the last. Because of your soft water, the pH in your system is not stable. That is why the pH value in the roots can rise until the 3rd week. (>6,2) This results in red stalks and matt to yellow leaves. After the 3rd week, the pH drops, probably because you switched to CANNA AQUA



Questions & Answers

Flores. Then it is logical that the plant takes up Potassium (this should also be the case) and because of the softness of the water, the water buffer can not fight the decreasing pH value. Solution: Empty a bag (1 KG in 1000 L Tank) chalk or lime (like a tea bag) in an extra feeding tank. Pump this water into your regular tank. In the first few weeks always correct the pH downwards. In this period you should add extra N27% for max. 2 weeks and set the EC 0,3 above your water. Then give the regular feeding. As of the 3rd week increase pH step by step. (max. 6.2) This can be done by adding a pH increasing product. N27% should not be in the solution anymore. You can control the pH in the root zone with the N27% (therefore no check in the tank). Then the chalk (bicarbonate) should stabilize the pH value after the 3rd week and keep it between 5,8 - 6,2

Question:

Somebody told me the chlorine in tap water will kill all or some of the good stuff in my CANNAZYM / coco medium. Is this true?

Answer:

Yes and no. It really depends on how the water is handled and what the source is; Chlorine or Chloramine. To begin, if the level of chlorine is really high then it could affect some soil micro-organisms, if not then no. It will not affect any of our products. It is worse for the crop itself. Filling the tank and allowing the tank to sit open for 24 hours, in areas where the tap water is high in chlorine will allow the Cl-ions to come out of the solution as a gas, its normal state. In areas where it has mid or low levels of chlorine, don't worry about it. If it is Chloramine, then it does not come out of the solution and can be a bigger problem, again, more for the plant. All plants require some chlorine, it is an important part of the process that breaks water down into O₂ and a proton (H). The plant, however, derives this from the air. Some Cl does nothing to the plant, higher amounts cause burning. So, see what your source is, and, with the range the water people will give as acceptable. If it is at the maximum end, fix the chlorine, if at the lower end, don't worry about it. Either way, it will not really do anything to our product line.

Question:

I have a question concerning the dosage of PK13/14: a long term Grower and garden master recommended me to dose at the start of the generative phase 1,5ml per 10 liter and to increase the dosage until the second last week to 6,5ml per 10 liter of water. This is extra contrary to your indication, namely 15 ml per 10 litre during only 1 week. Can you please explain me the difference between both directions?

Answer:

The difference is probably due to a difference in opinion. That's why we rather base on scientific fact than opinions only. Our research department is convinced, based on many test results and additional knowledge, that the plant can only absorb more P and K during 1 whole week, and this is about 3 weeks before harvest. That's the reason why we give these instructions. When a person holds another opinion, that's fine with us, but we are convinced and our research backs us in this, that we are right. Of course anyone is free to apply more but we just don't like people to spend more than is necessary for the best result.

Question:

I started using your Terra Nutrient program. What is the water cycle (Feed-Water-Feed-Water...) for the Terra Nutrients?

I use Sugar Additives (Sweet or SugarDaddy). Are there any issues with combined use of the TERRA program and Sweet/SugarDaddy? Information on the website and brochures itself are somewhat lacking...in my opinion. However, in the short time I have been using CANNA Terra, I am impressed.

Answer:

It is best to always feed the plants when you are watering the plants. Watering without nutrients is only useful when you made a mistake in the amount of nutrients (EC) applied last time. You can recognize it by brown burning leaf tips or even worse leaf borders. In general watering without any nutrients isn't preferable for the plants, But.... In general the plants will not take a lot of feeding anymore after week 5. Watering once a week with plain water will help to take the EC in the pot down...



Questions & Answers

You could choose to use Sugars together with our CANNA nutrients but we don't see the use of it. After week 5 Sugars can block your watering system because bacteria and fungi can live on these sugars. So most of the time you will have to flush this sugar away. A waste of time and money in our opinion. We hope this advice will help you to stay impressed.

Question:

I recently purchased a bunch of your nutrients and I saw on the label they should be kept away from frost. My nutrients came to me frozen solid and I was wondering if they are still 100%? Are they still good to use once thawed? I have CANNA Rhizotonic, CANNA Coco A+B, CANNABOOST, CANNA-ZYMAND PK13/14

Answer:

All the products you mention have been tested successfully to -40°C with no corresponding loss of function. It is generic on all our labels as we would prefer they did not sit on the back porch and go through cycles of freeze/ thaw or extremes of heat.

Question:

I am confused about 2 of your product lines; CANNA Aqua and CANNA Substra. Can Aqua Flores A&B be used in an Ebb & Flow system with plants grown in rock wool or do I rather use Substra Flores A&B?

Answer:

CANNA Aqua products are designed for re-circulating systems, CANNA Substra is for Run-To-Waste systems. If your ebb and flow system is a recirculating one, please use our CANNA Aqua products, if it is a run-to-waste system please use our CANNA Substra

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!





GROWERS-TALK

A word from a grower



Archi's Acres is a small-scale farm founded in 2007 by Karen and Colin Archipley. Back then, the property they bought contained 200 avocado trees. It was their first experience with growing ever. Soon they became very excited with growing and built a 30 x 60 ft. greenhouse, using fully sustainable and bio-organic growing methods. Now they successfully grow herbs, vegetables and fruit. Archi's Acres is located in Valley Center, California, very close to San Diego. We spoke Colin about testing the BIOCANNA line.

or more each! We couldn't believe the sugar content, the size and sweetness of them. We cut the tomatoes into pieces and let some farmer's market patrons try the tomatoes. The responds were unbelievable!

It led us to selling out of several hundred pounds of tomatoes in less than an hour! The very next week, we went to set up at the market at 6am. To our own astonishment a line was forming in front of our stand before the market opened at 7am! Again, maybe you'll already thought of it, we were sold out of all the BIOCANNA tomatoes in less than an hour."

"We from Archi's Acres decided to test the BIOCANNA line along with the Bio Terra Plus on 60 heirloom tomato plants in 25 gallon containers. We wanted to see what would be the difference between products

using BIOCANNA versus other 'organic' commercial nutrients. We tested the products on 'organic' quality, sugar production, weight and overall quality. Next to that it was also an opportunity to see if we would actually make a profit using the 'expensive' BIOCANNA line."

"The results were mouthwatering to say the least! We made more money on each tomato, selling them for \$5/pound. Each tomato was wonderfully juicy and some tomatoes weighing in at a pound

"Now we can tell the BIOCANNA test was of a great success. As told the quality, size and flavor were amazing. So this test proves that even at the premium cost of nutrients the sold product was able to make a real profit. Because of the fact that a lot of people were standing in line for our great tomatoes we were able to demand a higher asking price along with selling out each weekend! After these fine test results we're using the BIOCANNA line only to get maximum results."





CANNA Research

Oidium and mildew

**The fungi responsible and suitable
strategies for prevention.**

Ignacio Garcia.
Biotechnologist and technical agricultural engineer



The terms oidium and mildew refer to a group of phytopathogenic fungi that cause diseases in plants and have similar symptoms. Oidium is also known as “powdery mildew” and mildew as “downy mildew”. Fungi of this kind appear on the back of the leaves (abaxially). These fungi can usually be recognised because some whitish, grey or pink-hued marks appear on the leaves as if they have had ash sprinkled on them. Initially they look like traces of salt left on the leaves after the water has evaporated or like remains of powder, and they can therefore go unnoticed by the grower. However, as the disease advances, the leaves can end up being completely covered in this white layer and it can even colonize other plant parts, with subsequent losses in crop size and quality.

Recognition and prevention

Although the symptoms of these fungi are apparently quite similar, there are differences between them that will help you to tell which particular fungus is attacking your plants. The best treatment for this type of fungi is prevention; once they set in and develop they are very difficult to eradicate, sometimes even with chemical fungicides. Knowing which fungus you are fighting against will allow you to be certain of picking the best treatment and the one with the fewest side-effects, as well as knowing the best time to apply. If you want to use biological products to stop the fungus you need to bear in mind that the effect is not very long-lasting; so unless you get the timing right, all you’ll be doing is wasting time and money. Also, a product that is

effective against one type of Oidium may not work against another similar-looking mildew fungus.

For effective treatment, you need to know what conditions the fungus prefers to develop in and what other factors —such as weather conditions— affect it and in what way. That is why it is so important to determine which specific fungus is attacking your crops, since the optimum conditions for each one are different. For example, some fungi cannot germinate on wet leaves, while others actually need water to spread on the plant.

One of the differences in the symptoms that will help you identify the fungus responsible is the side of the leaf on which the marks appear. Symptoms on the upper side of the leaves are the most common cases. According to McPartland et al., the fungus responsible in tomatoes are:



Microscopic picture of Conidia and Mycelium of Sphaerotheca Macularis on achenes (seeds) on a strawberry.



Downy Mildew on a Hop spike

Sphaerotheca macularis

This is an oidium that attacks a broad range of hosts, so it is very likely to have a reservoir near your grow area. It is a serious problem of strawberry and hop plants.

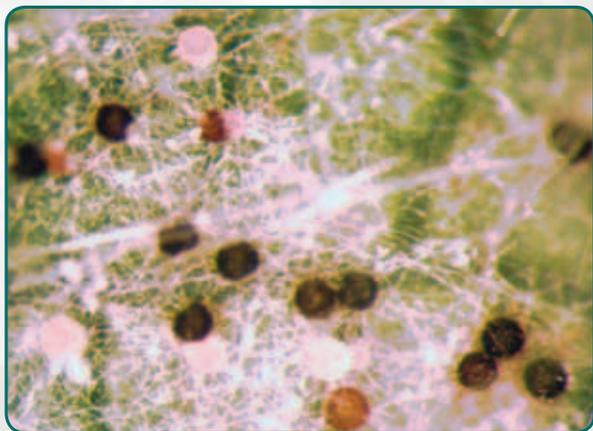
This fungus spends the winter in the form of asci (an ascus is a kind of bag, fruiting structure, containing a type of spore called ascospores) or mycelium on other wild or cultivated host plants (in parks and gardens, on verandas and terraces, etc.). Infected indoor and greenhouse crops also act as a good reservoir for the disease. This mycelium, which is harboured on other plants, releases conidia (a type of spore). These conidia, mostly carried by the wind, are what end up on the surface of your plant leaves; if the conditions are right, they then germinate and develop, forming new conidia, starting the cycle all over again and causing the fungus to



spread to the whole plant.

The higher the concentration of conidia in the atmosphere, the greater your plant's chances of suffering a serious attack by this fungus, and any preventative measures you take should therefore be targeted at creating conditions and applying treatments that prevent the conidia from taking hold on your plants.

This fungus develops on the surface (it does not penetrate deeper layers of the leaf). Another way of identifying it is by rubbing your finger across the leaf: the powder leaves a mark on your finger. That might fool you into thinking that it is easy to eradicate with fungicides. However, if you use biological products with a low systemic effect, the parts you haven't reached with the fungicide (or where it has not penetrated far enough), will continue to contain small parts of the fungus, which can grow back quickly under favourable conditions. That is why you must keep up the treatment even when you can no longer detect any oidium.



Microscopic picture of *Sphaerotheca Macularis* on a strawberry leaf.

Environmental factors

According to the studies we have consulted, the environmental factors involved in the establishment and development of the fungus on different hosts are as follows:

1. Average daily temperature:

Temperatures of over 15° C / 59°F favor the development of the fungus and the spread of the conidia. In general, production of conidia is reduced at temperatures below 15-20°C / 59-68°F or above 26° C / 79°F. According to studies conducted on

hops, exposure of around two hours to temperatures over 32°C / 90°F reduces the incidence of the disease.

2. Relative humidity:

The optimum range for germination of the conidia is between 75% and 98% humidity. At relatively low humidity rates, the fungus reacts by releasing a greater number of spores. This dispersion is also favoured by sudden fluctuations in humidity. The more the ambient humidity falls and the more abruptly it does so, the greater the number of spores released into the air. Although the environmental humidity is low, due to plant transpiration the leaf surface may be quite damp, facilitating germination of the conidia. In such cases, a digital temperature and humidity gauge with maximums and minimums is a must, since it will give you a precise idea of when these high-risk conditions arise.

3. Rain:

The rain washes away any spores floating in the air and the likelihood of infection on a rainy day is therefore low. A layer of water on the leaves can also prevent the spores from germinating and the conidia from developing and spreading.

The conidia need light to ripen, so the spores are scattered by day, roughly between 1 pm and 6 pm. The most critical time of day tends to come between 5 pm and 9 pm. Studies with hops show that spores that germinate in this time range are more likely to cause greater harm.

Strategies in outdoor crops

Based on the information above, one possible strategy you could adopt is as follows:

Growth phase: Until flowering begins, you can carry out preventative treatments using sulphur, repeating the treatment every 20 days or after rainfall (which washes the sulphur off the leaves). There are many ways of applying the sulphur. Ask in your usual grow shop. In any case, you should always follow the manufacturer's instructions and take great care with small plants.

There are some drawbacks to using sulphur, such as problems of toxicity at high temperatures. If you prefer not to use it, you should spray the plants with some biological fungicide (see Table 2) whenever two or more of the following factors occur:

- The average daily temperature is higher than 15° C (except if it has risen to 32°C or more at some point in the day)



- Low average relative humidity (below 70%, approx.)
- Sudden drop in relative humidity
- Prolonged drought

The more these factors occur at one time, the greater the chance of infection.

If the adverse conditions continue for a number of days, you should repeat the treatment every 2-3 days approximately (or as per the manufacturer's instructions). Always spray the plants in the evening at around 9 pm. If you have performed all the right treatments and are sure that your plant is free from Oidium, you can dispense with spraying on days when daytime temperatures are above 32°C / 90°F. Note that in plants already affected by Oidium (or which have had it in the past), and especially in larger plants, the ambient temperature may be considerably lower in inner and lower areas of the plant, where there is a greater concentration of leaves, lots of shade and poor ventilation. For this reason it is important to keep these parts of the plant clean, pruned and well ventilated since they can be an important reservoir of Oidium. This might be one of the reasons why the first leaves to be affected can be found in the dense, shaded and under-ventilated areas.

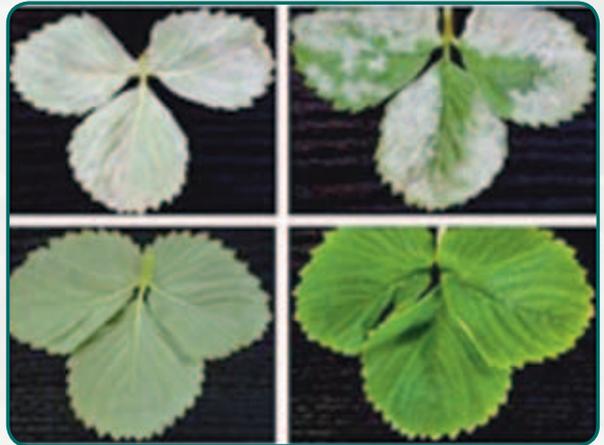
Flowering phase: Do not use sulphur when the plant is in flower as it leaves a residue. You should treat your plants with bio-fungicides such as bee glue (propolis), specific enzymes, horsetail, etc. (See Table 2). Potassium soap also tends to leave residue, and is therefore not recommended in advanced flowering. Like before, spray your plants when several of the environmental factors described above coincide (also shown in Table 1), repeating the treatment (frequency as per manufacturer's instructions) if the conditions remain unchanged and always around 9 o'clock in the evening.

Strategies in indoor crops

Infections in indoor plants are a result of conidia floating in from outdoors into the growing room, where they germinate and develop. Starting with a clean room, plants that are free from Oidium (cuttings are silent carriers) and a new growing medium should be your strategy to prevent spores from getting to your plants, and if any do manage to get through, make sure they can not take hold.

Preventing spores from getting into the room:

The number one way of how fungi get into the room is through the ventilation system. As you re-



The two pictures above show signs of *Sphaerotheca Macularis*, the lower pictures are healthy leaves.

move the air from your plants, it is replaced by the same volume of air from outside — which enters through the grille in the room and other apertures (e.g. beneath the door or through the bottom hole in the case of a cabinet), creating a current of air that goes all the way from outdoors to the interior of your growing room. The air that gets in through these grilles is not filtered, so that if the atmosphere is full of spores, you will be spreading them rapidly across your plants. It is very good practice to add air (positive pressure) to your crops instead of removing it (negative pressure), and to pre-filter the incoming air with a carbon filter or HEPA filter. The same volume of filtered air that you allow into the room will be released and forced out through the grilles or openings, creating a current of clean air going from inside the room to the exterior, further helping to prevent the entry of any spores (and insects), which would have to go against the flow to get in. This is the same principle used by laminar flow chambers (hoods). Clearly, spores can also get into the room on your clothes. It is a good idea to get into the habit of having a coat or dressing gown at hand, which you can put on before you go in.

Preventative treatments:

If these physical methods are not enough, you can also apply preventative treatments, especially at the most difficult times of year. Remember that you can use sulphur throughout growth until the day before the plants start flowering. However, when in flower, the plant will continue putting on new leaves for up to 15 days after the last treatment with sulphur. These new leaves are no longer



protected by the sulphur. If you want to be sure of having good protection (especially in plants with a long-flowering period or at times of year when the risk of oidium is highest) you will have to use other products. In order for the treatment to be as effective as possible, you must know when the concentration of spores outdoors is at its height. Following the same rules as for outdoor crops, the greatest concentration of spores will occur on days when several of the environmental risk factors described above coincide (see Table 1). When these outdoor conditions occur, you should take preventative action on your indoor plants. Always spray the plants for a few minutes before turning off the lights.

You should also keep the humidity levels constant; we recommend keeping humidity levels low (below 60%). Note that this humidity is good in cases in which there is no fungus on your plants and you want to prevent any spores that have gotten into the room from germinating. Using fans to keep the leaves in motion can prevent the spores from taking hold on the leaf. Many growers make the mistake of dramatically lowering the humidity when they discover that their plants have Oidium. However, this sends out a signal that stimulates the fungus already on the crops to scatter its spores with the result that the disease is propagated very quickly. If you have found this type of Oidium in your grow area and it is not at a very advanced stage, you should remove the most infected leaves, keep humidity constant at around 70% and treat your plants every 2-3 days with a bio-fungicide (or as per the manufacturer's instructions). Likewise, it is not advisable to keep the leaves moving with a fan if the Oidium has already taken hold; the only thing you will be doing is scattering the spores even further. Once the Oidium has been eradicated, you can lower the humidity and turn the fans on again to prevent it from growing back, but you should always repeat the fungicidal treatment whenever the atmospheric conditions described above arise.

To keep the relative humidity constant you can use a hygostat connected to an intensity regulator (a variable speed controller). The system connects the vent fans at maximum power (the fan operates at top speed) when the humidity rises above the programmed rate. When the humidity is at the right rate or lower, the hygostat runs the vent fan but through the regulator, which means that the fan operates at a lower speed, which can be regulated.

In all cases, stop applying the preventative or cura-

tive treatment one week before harvesting.

Table 1. Environmental factors related to ambient spore concentration of *S. macularis*

Environmental factor	Values
Average daily temperature	- Above 15° C*
Average daily relative humidity	- Sudden falls - Low humidity (approx. below 70%)
Rain	- Long periods of drought.

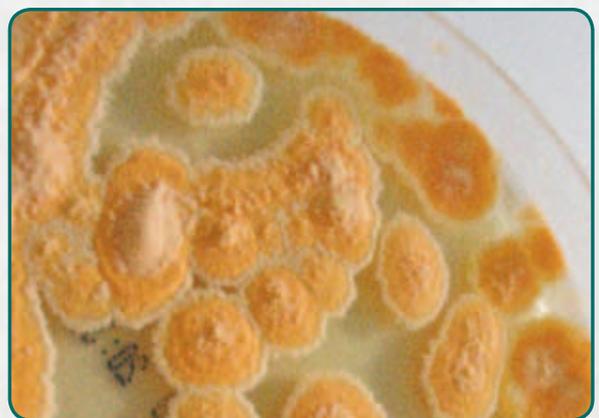
The greater the number of factors occurring simultaneously, the greater the risk of infection.

** If daytime temperatures rise above 32° C / 90°F, the risk of infection is reduced.*

Pink rot

This is the fungus *Trichothecium roseum*. Its symptoms are similar to those described above, but usually occur on the upper side of the leaf. What distinguishes this fungus from *S. macularis* is that during certain phases of its development it can take on a pink hue. However, in another of its stages, it has the same white or greyish colour as *S. macularis*, and is therefore easily mistaken for it. According to McPartland et al., another difference with *S. macularis* is that this fungus is usually limited to the leaves, whereas pink rot can colonise even the stems.

Unlike the previous case this fungus is a saprophyte (it also develops on dead matter) which means that there is always a reservoir of this fungus nearby. As a result, the fungus begins to develop on the plants helped by sticky remains of pests such as white fly, plant lice, wood lice, etc., or on remains of dust or pollen that may have been deposited on the leaves. Once it has developed and built up its strength on these remains it is in a better position to infect the living tissue. There are practically no references on the damage caused by this fungus or on its biology as a pathogen.



Culture of Trichothecium roseum.



Until more information is available, you can take the following precautions:

- Spray the growing plants regularly with potassium soap to clear off of possible remains of dust, pollen or sticky remains that might have been deposited there
- Keep the plants free from pests that might leave remains such as aphids, whitefly, etc
- Avoid using plants which are genetically susceptible to fungus
- This fungus prefers humidity to spread its spores in, and also warmth, so you should take preventative action in these conditions

Finally, note that the strategies outlined here have been drawn up on the basis of information from studies conducted with these fungi on tomato and other plants (strawberry and hops among others), and although they generally act similarly on all crops, research is needed on their specific behaviour in tomato in order to perfect these strategies or create new ones.



Microscopic Picture of Sphaerotheca Macularis on a infected strawberry leaf.

We'll finish our story here but there's so much more to explain. Please watch out for next issue of CANNATALK for the continuing story.

Product	Way of acting	Remarks
Neem oil	The components of neem oil have been clearly shown to be effective against oidium and other fungi.	
Bee glue for agricultural use	Bee glue (propolis) contains natural anti-fungal and anti-biotic substances. It also stimulates the production of defensive substances	Do not use on very young plants
Horsetail	Extract of the plant Equisetum arvense. Among other substances, it contains saponins that are toxic for the fungi and acid silicon which strengthens the tissues	Very useful during flowering
Potassium soap	Great cleaning effect and good preventative against these fungi	Not recommended in advanced flowering.
Verticillium lecanii	A parasitic fungus feeding on larvae of whitefly and —less effectively— trips and red spiders. Studies show that it is also an effective parasite of oidium-type fungi.	It is not very well known. It requires special storage conditions to remain viable.
Ampelomyces quisqualis	Like V. lecanii this is a parasite fungus feeding off oidium-type fungi.	
Specific enzymatic extracts and bacterial preparations	These are products fermented by certain bacteria. The effectiveness of applications such as Bacillus subtilis has also been shown as an antagonist to oidium-type fungi.	There are various preparations based on these ferments on the market.
Extract of citric seeds	Great cleaning effect. There are preparations combining potassium soap with citric extracts to improve the effectiveness of the two.	In advanced flowering it may be a bit aggressive for the flowers. Try it out first. Do not use compounds with potassium soap in advanced flowering.



Grow it yourself: Grapes (*Vitis spp.*):

Thoughts on Growing

Grapes are one of the oldest, if not the oldest, plants in continuous cultivation by mankind. Across recorded history, the contributions of this perennial vine parallel the development of human civilization; at least in those areas where the plant will finish a crop of berries.

The fruit can be harvested and consumed fresh, dried, juiced, pressed into oil, distilled into vinegar, or made into wine to be remembered for years to come. If wine is the goal then it takes two talents: an Enologist (wine maker) is only as good as the Viticulturist (grape cultivation specialist). While the Viticulturist makes it seem easy, there is actually some art to successful production.



GIY: Grow it yourself.....Grapes (*Vitis* spp.):

There are more than 25 species or hybrids of grape found throughout the world today. While most of these species are used, to some extent, locally, the two main commercial species that we will focus on are *V. labrusca* and *V. vinifera*. From these two species hail the vast majority of commercially produced grapes. *V. labrusca* is a native of North America and is used to make juices, jellies, and sometimes wine: Concord is probably the best known variety. *V. vinifera* is commonly known as the European wine grape species used throughout Europe and the world for wine production. The North American grape is best for North America, adopting to different pH levels in the root zone as well as handling climate differences as well as insect and diseases better in North America. This variety is also used as root stock to which the European varieties are grafted. Grafted European grapes handle North American soils much better as well as root insects and diseases prevalent in North America. *V. labrusca* handles pH ranges from 5.0 – 6.0 where European varieties prefer pH ranges around 6.5. Additional differences in environmental plant requirements are cultivar based.

All cultivars can have different physical needs as well. Cold hardiness may be important and growing season length as well. It takes, on average, 150 – 220 days for grapes to ripen fruit. Typically you really need a minimum of 180 days with no frost as a minimum. While the fruit may still be harvested, Ice Wine is a good example, however vines in full leaf trying to finish a crop are more apt to be damaged and killed. So cultivars are chosen for conditions as well as end use. Some very hardy cultivars can handle temperatures down to – 15° F (-26° C), some cannot handle below 0° F (-18° C).

Pruning is another giant consideration. In some areas, including the United States, grape vines are listed as a noxious or invasive weed because it has a sprawling habit and takes over other vegetation. Pruning and training the vines are not only critical for control, but production as well, with larger more evenly ripening fruit coming from well managed vines. There are many pruning styles and systems used for trellising. These are chosen for many reasons including cultivar vigor, growth habit, labor, field layout, harvesting methods, and so on. There are many books detailing the methods of pruning grapes. A grower must understand the methods and needs, and must match all the factors including plant selection. In colder climates, vines are usually maintained lower to the ground for freeze protection. Some vines are vigorous enough that multiple central leaders are chosen and serve as multiple plants with a single root system.

Grape vine starts are available from a wide variety of sources. Most starts tend to be from cuttings however some seedlings might be available. In most areas where there is a need, these starts are usually grafted, meaning a desirable cultivar is attached to and replaces the top portion of a cultivar that is better suited for the growing conditions found in that local area such as pH or disease resistance. These cuttings are the best way to assure true to type propagation especially with hybrid varieties. Starts are usually obtained in the early spring and planted with the graft union above the soil line. Non-grafted plants tend to be less picky for planting depth but the purpose of the graft is defeated if the plant above the graft throws roots, then the root stock is nullified.

Grapes are best grown in the ground, in full sun. They like available water but do better with drier tops. (Disease and insect issues) Grapes do not tolerate wet feet very well, but do not like droughts either. Irrigation is usually applied at 1 inch (2.54 cm) per week. They do not like having their roots tampered with. Grapes are deep rooted preferring a sandy soil with about a 10% organic component. (Good drainage and nutrient retention). Grapes have a difficult time growing in containers for these reasons. Grapes produce fruit on buds arising on 1 year old wood even though the plant itself might reach 50 years or more, so pruning requires attention to detail and methodical year-to-year training. Containers have to be re-soiled every 3-4 years resulting in root disturbance and loss of both production, and possibly the plant itself. Grapes are typically grown in containers only for the form and texture of the vines and leaves.





GIY: Grow it yourself.....Grapes (Vitis spp.):

Flowers form in clusters opposite leaves. If no flower forms then a tendril forms. Tendrils are specialized structures that anchor the stem as it grows upward, always seeking the light. Greenhouse grapes will probably require assistance with pollination, which has to occur for a grape to set. After fruit set, it is sometimes advisable to thin out both the fruit and the clusters in order to increase the size, yield, and taste of the ultimate harvest. Fertility applications have to be timed and monitored correctly at all times to insure a good harvest.

Grapes, like most perennial woody plants, have a different requirement in fertility than others. In a natural setting, grapes require fertilizer applications in the spring right at bud break. After this it is open to conjecture. Depending on organic sources present in the medium, some think a follow-up application shortly after fruit set is beneficial, others think not.

Certainly too much Nitrogen applied across this period will result in greener and prettier plants but with the loss production. Potassium has to be watched as too little will cause loss of berries and too much will cause taste/ textural issues in the fruit. Vineyards typically require from 30 – 100 lb N/acre

() with the typical rate being about 75 lb N/acre. This is usually applied ½ before bud break and ½ after, but liquid feedings will use a lower concentration, at varying rates, in successive irrigations to optimize availability. Excessive Nitrogen applied late in the season can affect cold tolerance and push the plant into being active at first frost.

Fruits develop across the growing season through veraison or the berries coloring up. This is a step in ripening but does not indicate ripeness. Berries must be allowed to finish ripening before harvest. Harvest is timed to correspond with certain times of the day because the levels of acids and sugars will fluctuate.

Mastering the art of grape growing is not difficult but is a challenge. By making the correct plant choice for the correct system, paying attention to detail, working the system, and having a little patience, success should be inevitable. There exists a wealth of information available on growing grapes. The prospective grower should understand their conditions, limitations, and abilities before jumping off into large production, but the rewards can sure be sweet.

QUALITY PROVES ITSELF

Grape







	Light per day (hours)	Terra Vega ml/GAL	Terra Flores ml/GAL	RHIZOTONIC ml/GAL	CANNAZYM ml/GAL	PK 13/14 ml/GAL	BOOST ml/GAL	EC+	PPM	
GROW	Start - Duration 1 week Bud Break	*	19	-	10	-	-	1.0 - 1.2	700 - 840	
	Vegetative stage 1 - Duration 1 to 2 weeks Fast growth	*	18 - 21	-	2	9	-	1.0 - 1.2	700 - 840	
BLOOM	Generative stage 1 - Duration 2 to 4 weeks First signs of flower/cluster formation	*	-	15 - 18	-	9	1	8	0.9 - 1.2	680 - 840
	Generative stage 2 - Duration 2 weeks Flowers and set fruit present	*	-	5 - 8	-	9	1	8	0.6 - 0.7	450 - 580
	Generative stage 3 - Duration 2 weeks to completion Last flower set to veraison (fruit coloring)	*	-	10 - 12	-	9	1	8	0.8 - 0.9	500 - 680
	Harvest to dormancy - Holding	*	-	-	-	9	-	-	-	-

1. Timing on stages is dependent on variety.
 2. * - Natural day length
 3. Calcium can be the limiting factor, add a liquid Calcium source when necessary. This can be progressively seen as the fruit ripens.
 4. Proper pH control is essential to develop the taste.
 5. This chart is for Peat based medium AND sandy loam mineral soils. In heavier clay soils use less fertilizer and more in sandy soils. Grower must make this adjustment based on crop response.
 6. Grapes like deep roots and sandy soils for heavy root systems. It is not advisable to grow in potting mediums composed of all soilless mix. Sandy soils with 10% minimum organic content is recommended. Grapes only begin producing well after several years of development; because it is impossible to avoid disturbing the root system periodically of container grown plants grown long term, it is not advisable to grow grapes in containers. It is still advisable to mix coco and peat fractions into existing soils in new plantings for the organic benefit.

Download the Feed Chart for Grapes on CANNA TERRA through the Grow Info section of the CANNA website.



GIY: Grow it yourself.....Grapes (*Vitis* spp.):

DOLMATHAKIA ME KIMA: Stuffed Grape Leaves with Meat & Rice



Recipe from: About.com

Cook Time: 60 minutes

Ingredients

- 1 jar of large grape leaves in brine (about 60-75 leaves) or about 180 small leaves
- 8 cups of water
- 2 pounds of lean ground beef
- 1 cup of uncooked short-grain rice
- 2 medium-large onions, finely chopped
- 5 tablespoons of olive oil
- 1 bunch of fresh dill, chopped
- 1 tablespoon of fresh mint, chopped
- juice of 3 lemons
- 1/4 teaspoon of pepper
- 1 teaspoon of sea salt
- 2 cups of water

Directions

Blanch the Grape Leaves

Bring 8 cups of water to a boil in a large pot, add juice of 1/2 lemon and the salt. Carefully unroll the leaves (do not separate them). Turn off the heat and place leaves in the hot water for 3 minutes. Remove leaves and place them in a bowl and cover with cold water. When cooled, drain in a colander. It is not unusual for many of the outer leaves in the jar or can to be damaged, or to tear while using. Set these aside to use later in the recipe.

Prepare the Filling

Soak the rice for 10 minutes in hot water and drain. (Alternatively, sauté the rice with the onion.) Sauté the onions in 1 tablespoon of olive oil until translucent, not browned. In a bowl, combine the onions, ground beef, rice, remaining olive oil, dill, mint, juice of 1 lemon, and pepper. Mix well by hand.

Filling and Rolling the Leaves gently separate one leaf and place it shiny side down on a work surface. Place a pinch (up to a teaspoon) of the filling on the leaf at the point where the stem joined the leaf. Fold up the bottom of the leaf over the filling, then each side inward in parallel folds, and roll up the leaf. Roll should be firm, not tight, as the filling will expand during cooking. Repeat until all the filling has been used.

Because the leaves on the bottom can burn while the filling cooks, put a plate or wooden souvlaki skewers in the bottom of a heavy-bottomed pot (see tip below). The plate should fit as closely as possible to the sides. If there are unused leaves, or leaves that were torn and not used during the filling process, put them on the plate or on top of the skewers. Place the dolmatakia on top, packing them closely together (not squashed), seam side down, so they don't unroll during cooking. Layer them until all are in the pot (2-3 layers is best, but no more than 4 layers). Place several unused leaves over the top. Take another plate and place it upside down on top of the dolmatakia, with something to weight it down (a second plate works well). Add 2 cups of water to the pot and cover. Bring the water to a gentle boil, add the remaining lemon juice, reduce heat to low and simmer for approximately 50-70 minutes. Check to see if done. If the rice has cooked, they are done. If not, continue cooking for another 10 minutes and check again. Cooking time depends both on the type of pot used and the particular stovetop element.

If preferred, use a pressure cooker. No plates needed, but do use the skewers in the bottom. Pack the dolmatakia into the pressure cooker, add the 2 cups of water, close and cook for 15-20 minutes at the first pressure mark.

Serving Individual servings of dolmatakia are 4-5 pieces on small plates as an appetizer; however they can also be used as a side or main dish. Serve dolmatakia warm, or at room temperature with avgolemono (egg and lemon sauce), lemon wedges, tzataiki, or unflavored yogurt on the side.

Storage These will keep well in the refrigerator for about 5 days. Return to room temperature before serving. Drizzle olive oil on top and cover to store. They can also be frozen. If you do freeze, reheat in the microwave or by steaming and serve warm. Don't just thaw and eat.

Tips:

1. If you don't have a plate that fits or skewers, line the bottom of the pan with unused or torn leaves.
2. Leftover filling can be used to make stuffed vegetables, like tomatoes, peppers, zucchini, and eggplant.
3. To make as a main course, use larger grape leaves and increase the amount of filling in each leaf to 1 tablespoon.
4. Recipe can be divided if fewer grape leaves are available.

For more original recipes with Grapes please visit the Grow Info section on the CANNA website and click "articles"



“Disasters Dissolved”

IRON DEFICIENCY



About iron in short

Iron is a vital element for plant and animal life. Iron has a number of important functions in the overall metabolism of the plant and is essential for the synthesis of chlorophyll. Iron is a relatively abundant element in the universe. It is found in the sun and in many types of stars in considerable quantity. By weight, the metal is the fourth most abundant element in the earth's crust.

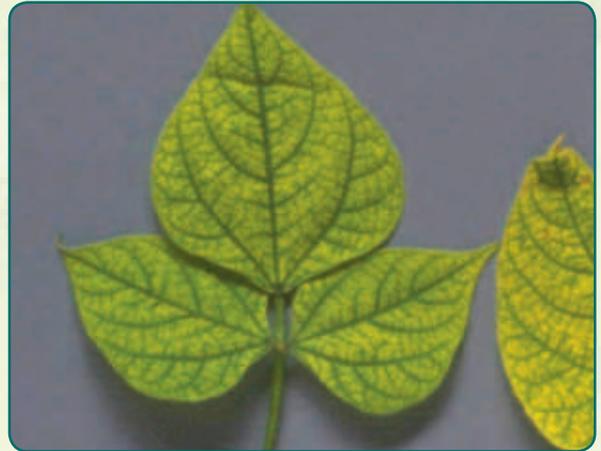
The brown and red color of rust is caused by iron. The use of iron predates recorded history, and still today, iron is the cheapest, most abundant, and important one of all metals. The pure metal is not often encountered commercially, because it is very chemically reactive and it corrodes rapidly, especially in moist air or at elevated temperatures. In general, iron is poorly absorbed by a plant. It can only be taken up sufficiently by the roots in certain forms and under proper conditions. Soil seldom contains too little iron, but it is possible that forms of iron that can be absorbed by the plant are lacking. The absorbency of iron is strongly dependent on the pH. Ordinarily, there is sufficient iron present in absorbable form in acidic soils.

Iron deficiency

Fast growing plants in general are pretty efficient with the absorption of iron¹, and under normal conditions, it has little trouble with iron deficiencies. Except during periods of heavy growth, or high plant stress, iron deficiency symptoms can temporarily appear that eventually go away by themselves. These symptoms are not detrimental to the harvest. An iron deficiency is characterized by a strong yellowing of the young leaves and the growth shoots between the veins. This occurs mainly because iron is not mobile in the plant. The young leaves can't draw any iron from the older leaves. With a serious iron shortage, the older leaves and the smaller veins in the leaf can also turn yellow.

Development of a shortage

- I. Green/yellow chlorosis, from inside to the outside in the younger leaves and in the growth shoots. The veins remain mostly green.
- II. Continued yellowing of the leaves to sometimes almost white. Also, large leaves turn yellow. This inhibits growth.
- III. In serious cases the leaves show necrosis, and the plant's growth and flowering are inhibited.



Stage 1



Stage 2



Stage 3

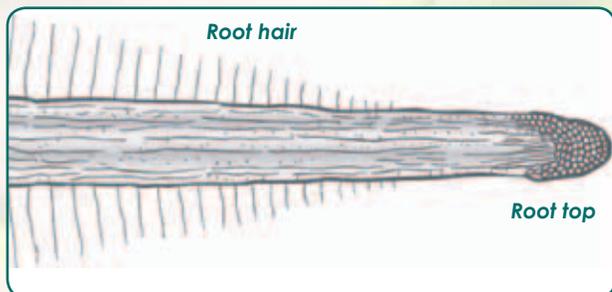


Reasons for a shortage

- The pH in the root environment is too high (pH > 6.5).
- The root environment contains a lot of zinc and/or manganese.
- The concentration of iron is too low in the root environment.
- The root temperature is low.
- The root medium is too wet, causing the oxygen supply in the roots to stagnate.
- The root system functions inefficiently² due to damaged, infected or dead roots.
- There is too much light on the nutrition tank; light promotes the growth of algae. Algae also use up the iron and break down iron chelates.



1. Plants that were grown on rock wool, with a nutrient solution with no iron added, but with a sufficiently low pH, showed no signs of a deficiency after seven weeks.



2. Iron intake by the plant takes place immediately after the root top. Roots with lots of root hairs, branches and root tops are therefore more effective with the uptake of iron than long straight roots with few branches. Plants in wet mediums, and plants in circulating water systems are more sensitive to an iron deficiency due to the root hairs.

Chelates

A chelate is an organic molecule which forms a bond with free electrically charged "metal particles" (ions). Chelates owe their name to the fact that they are attached like a claw around the metal ion (chelate is the Greek word for claw). Thanks to this property, they keep the metal ion dissolvable in water, and moreover, the metal ion will react less quickly with surrounding materials. Additionally, chelates insure that a metal ion, for example iron, is taken into the roots in a stable,

soluble form. For the most part, most chelates themselves can be easily absorbed via the roots as well as the leaves. Chelates, like humic acid and citric acid, appear naturally in the ground and in organic materials. Roots and bacteria also secrete natural chelates (exudates) in order to promote the uptake of iron. Chelates used in professional agriculture and gardening are factory made. The most-used chelates are DTPA, EDDHA and EDTA. Each one is active in a different pH area:

- DTPA iron chelate works especially with a pH lower than 6.5, and is used primarily for growing on substrate.
- EDDHA iron chelate works in a broader pH range than DTPA, and is even effective to a pH of 8.
- EDDHA chelate is more expensive and disintegrates faster at low pH values. EDDHA iron chelate is meant for application with rather high pH's, thus for iron deficiencies in lime rich soils.
- For leaf fertilization, another kind of iron chelate is often used, namely the EDTA chelate, because it doesn't cause leaf burn very quickly. Iron chelates decompose quickly in ultraviolet light and daylight. By exposure to this light, the iron chelate concentration can be diminished by half in a few days. Therefore, protect nutrient solutions and fertilizer packages from light.

Solutions to resolve a shortage

- Minor iron deficiency symptoms are rather easily reversible. Depending on the origin, a shortage can be corrected by various means. The pH can be lowered, excessive manganese or zinc fertilization can be avoided, iron chelates can be added to the substrate, drainage can be improved, or the ground temperature can be increased. A leaf nutrient with iron chelates could possibly be applied. If a good fertilizer is used with hydroponic growing, an iron deficiency is almost out of the question.
- Go to your shop for expert advice. They have the right products available. A correctly formulated fertilizer contains sufficient iron in a form that the plant can absorb.
- If a shortage becomes visible, the addition of iron chelates to the soil is less effective, and works slower than fertilizing the leaves. In order to get 1 kg of iron into the roots, 5 to 10 times as much iron chelates need to be applied. The iron chelates must be thoroughly mixed into the ground. This is because the daylight breaks down the chelates, and iron chelates are only effective around the roots.
- The best thing you can do is spray the plants with a watery solution of EDDHA - (max. 0.1 grams per litre) or EDTA chelates (max. 0.5 grams per litre)

CANNATAK

NNA

Talk

Announcing CANNATALK's
Brand New Look

CANNATALK

After 2 years of publishing CANNATALK it is time to lift CANNATALK to a higher level with a make-over. Starting next issue, CANNATALK will appear with a brand new look.

We'll continue to bring you news, tips, faq's, grower's experiences and scientific articles from our research department and laboratories. Maybe you'll find a new item here or there but in general we'll keep bringing you CANNATALK like you are used to but with a totally new design. Of course we're not going to raise the veil too much at this point but you can find the new CANNATALK logo above. Take a good look so you will recognize next issue's new design when you visit your gardening store.

Make sure not to miss it.

Editor@cannatalk.com



PUZZLE time

Are you in need of a break? Or you wanna set your mind to something different for a sec? Take the challenge and start cranking on one (or both) of the puzzles below. Good luck!

The Rules:

For a 9 x 9 grid:

Enter the numbers 1 to 9 in each row and column just once, as you would in a Sudoku puzzle. The main difference is the inequality signs, you must obey these < and > signs to solve the puzzle.

> means the number to the left of the sign should be higher than the number right of the sign.

< means the number to the left of the sign should be lower than the number right of the sign.

^ means the number below the sign should be higher than the number above the sign.

v means the number above the sign should be higher than the number below the sign.

For a 7 x 7 grid:

Same but you only have numbers 1 to 7.

Futoshiki 9x9 - Puzzle 5 of 5 - Very Hard

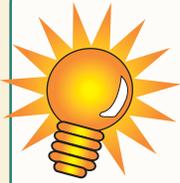
								>		
^			^	v		^				^
		<			>				>	
			<			1				
^		>								^
		5		>			>			v
^	v									1
	<	7			>					5
	<	^	^				v		v	
										v
			9		>					

www.sudoku-puzzles.net

Futoshiki 7x7 - Puzzle 1 of 5 - Easy

	3				>		
				v			
					7		
						>	2 5
		^					
			<				
							6
		<		<			6 4
	2						
		2		6	1	3	

www.sudoku-puzzles.net



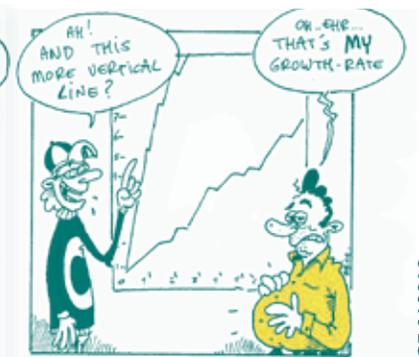
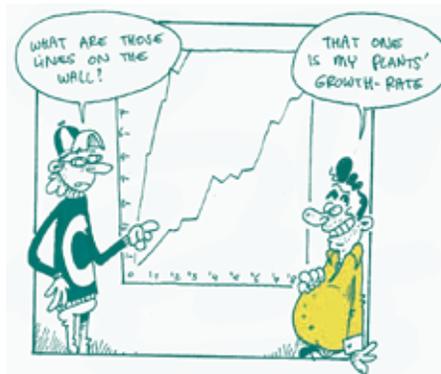
Growers Tip #8

Measuring the reservoir

Measuring the nutrient reservoir works as follows; take the EC value as starting point. Measure it and determine whether it should be higher or lower, based on the values indicated in the instructions. After all the nutrients and possible additives are mixed and the EC is spot on, only then you could start adjusting the pH by using a pH lowering, or pH raising product, if necessary. Some nutrients and additives might lower or raise the pH so always mix those in first before starting with pH adjusting products.

Always try to get the nutrient solution's pH value correct at the first attempt! Using too much pH lowering and raising products with each other disturbs the bicarbonate concentration and the water's buffering capacity. It affects the equilibrium between the different nutrient elements and deficiencies could arise.

Adding too much pH lowering and/or raising product can be prevented by first diluting the pH adjuster with water in a separate measuring jug and dose it bit by bit.



CANNA

The solution for growth and bloom

CANNAZYM

**NEW
FORMULA**



CANNAZYM NEW FORMULA

CANNAZYM has been improved! While it still continues to be the only enzyme product targeting the underlying cause of root binding, old cast-off and dead root material, the new formula made some major changes. New formula CANNAZYM increases the activity of enzymes on cellulose while decreasing the time it takes to work. CANNAZYM is now a darker shade of liquid from the increased concentration of enzymes. It now boasts a better resistance to temperature extremes, which prevents destruction of the enzymes.

Best of all, it now has an extended shelf life. All this means a better product all around. For more information, or to obtain the evidence of this products' effects, visit our website or your local gardening center and download or pickup the New CANNAZYM leaflet.

www.canna-hydroponics.com

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