CANNAtalk®

MAGAZINE FOR SERIOUS GROWERS

ISSUE 29 2015

PHOSPHORUS

A complicated story

WORLD WONDERS

Are there just 7?

LETTUCE

More than rabbit food

And more:

HQTalk:

Yesterday, I found myself in the park with a bunch of friends: just chatting, laughing and having a great time with the sun being our friendly companion after such a long winter, and enjoying lunch. Since most of my friends are vegetarians I created BLT's without the B but with my very own homegrown L; lettuce that is!

I have never really appreciated lettuce as anything but the green coloring in an otherwise plain sandwich, or the base for a small snack before dinner. For instance I never knew there was a link between sex and lettuce. In my humble opinion, lettuce is the most non-sexual thing I can think of. But I was wrong. For the Egyptians the lettuce was the sacred plant of Min, the God of male sexual potency. Think about that the next time you dig into the succulent leaves of lettuce.

In this issue, you can learn all you need to know, and more, about this versatile veggie. You can find out, while reading the issue, what the fuss is about with the New Seven Wonders of the World. And you can dig into the not so complicated story of phosphorus. Well, not complicated at least when you have consumed the article in this magazine. But, to get back to the Green, read about the lettuce!

Cheers,

Jeroen

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Figure 1: Sample of phosphorus (P). In elemental form it has several allotropes (forms): white, black, red and violet. This is the violet (purple) form. Phosphorus compounds are used in fertilizers, detergents, pesticides, nerve agents, and matches. It is also one of the elements found in many biological molecules that are essential for life.

WHAT IS ALL THE NOISE ABOUT PHOSPHORUS THESE DAYS, THIS IDEA THAT PLANTS DO NOT RECOMMENDED BY AGRONOMIST AND PLANT PHYSIOLOGIST ARE ACCURATE; THE PROBLEM COMES MINDS OF SELF-PURPORTING EXPERTS.

Geary Coogler, BSc Horticulture, CANNA Research

Nutrient recommendations and applications are made with numerous variables in mind which are based on medium composition, plant variety, pH, temperature, moisture, nutrient interactions, plant requirements, economics, and so forth, and not just pulled from the air; nor are they based on a lay persons understanding of karmic forces or scientific data.

Beginning look

The best place to begin understanding Phosphorous needs of a plant is to start with the basics, and the basics include many processes and as well as other nutritive elements. First, understand a few relationships that are basic steps in understanding the question and the answer.

Each element has its own weight different from all the others: one atom of Nitrogen weighs less than 1 atom of Oxygen which weighs less than one atom of Magnesium which weighs less than one atom of Phosphorous and so on. Molecules are combinations of atoms which are expressed in combined weights of all the elements in the molecule. Fertility components can be elemental (based on the pure form of the nutrient, such as Calcium) or molecular (based on a combination of atoms such as Nitrates, Sulfates, or Phosphates). This is how the plant takes up the nutrient components. This is can also be how it is measured on labels and reports. Few, if any, nutritional elements are taken up by the plant as applied and must either change form, change ionization properties, or disassociate. This is especially true of Phosphorous as it requires a special pathway (known as an **H^{+}-HPO_4^{2-} symporter**)that takes it up as a Phosphate ion after activation.

All applied nutritional components are under competition pressure in the root zone from not only the plant, but the environment as well including temperature, pH, interaction with other elements, and other life forms. Understanding how measurements and samples are taken determines how data sets should be interpreted. Most elements are more concentrated in certain areas of the plant based on the plant itself: for example, leaf tissue (mesophyll) will have as much Iron and Manganese as it does Sulfur and Magnesium. Phosphorous is present in larger amounts in root and flower tissues (especially seeds). The only way to have a complete picture of the composition of the plant is to analyze the entire plant: roots, stems, leaves, shoots, flowers and seeds

Important determinations can be made, however, based on specific tissue analysis. Individual metabolites are usually looked for in those areas where they concentrate. Even the way the components are gathered, time taken in storage or transport, extraction method used, or the machines used to analyze them will vary greatly with one method being superior to others for accuracy. Sample size is critical in the statistical analysis of the results; the more plants or repetitions in the data set, the more accurate the statements about those data sets will be. Accurate results in the data and the interpretation of the data depend on a clear understanding of all the elements involved in the assay; compare Granny Smith apples to Granny Smith apples, not Granny Smith apples to McIntosh apples. Know what you are looking for: looking for sharks in the desert may show a few leftovers from a time past when the dessert was a sea, but will not answer the question of how many sharks currently inhabit the planet.

Phosphorous is used by the plant in the formation of such compounds as sugar phosphates (stores and transfers energy), nucleic acids, nucleotides, coenzymes, phospholipids (membranes), phytic acid, and high energy phosphate bonds (ADP, ATP). The main entry point into assimilation pathways of Phosphate occurs during the formation of ATP (Adenosine triphosphate), which is the energy currency of the cell.

ATP is the energy for almost every process in the plant from the uptake of nutrients, to the conversion of nutrient complexes such as Nitrate to release the Nitrogen, and to the production of DNA and cell division. Photosynthesis is a well known general process which produces ATP through a process known as **Photophosphorylation**. Respiration is a process that produces ATP through an oxidative process known as **Oxidative Phosphorylation**. Power used in homes and industry is measured in Watts which gives a value for the amount of energy needed to make things work; ATP is used by Biochemists to indicate the energy needed to make biological processes occur.

The phosphate group is energy that, once incorporated into ATP, can be converted to energy or transferred by many different processes to form all the phosphorylated compounds in a plant. These groups may also form other energetic compounds that function the same basic way in specific processes. The entire pathway and its many routes are collectively known as **Phosphate Assimilation.**

Phosphate is required to transport most elements into the roots, through cell membranes, and to change the nutrient into usable forms; without it, the plant would starve, or, rather, not grow.

There are many different elements that make up plant tissues. Some elements like Sodium can be more specific to certain plants, like cacti and grasses, while others,

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like Nitrogen, Carbon, Phosphorous and Potassium, are required by all life forms. Concentrations of elements in plant tissues are expressed in terms of **'Adequate Levels'** which means that enough are present to insure availability when needed for the many processes and metabolites present in plants. There are levels that are considered high, especially in Nitrogen and the heavy metals, which can cause problems, sometimes to the plant but mostly to those animals and life forms feeding the plant tissues. Table 1 gives a fairly accurate yet general idea of those elements needed and the concentration levels they are used in. It is apparent by examining the table that while some elements are equal in percent composition, there are differences in the actual number of atoms which goes back to the first point made here that each atom has its own unique mass; it weighs different. Hydrogen, Carbon and Oxygen are considered critical nutrient elements for the plant but are obtained through water or the air and not applicable to this discussion of applied fertilizers.

Label discussion

The next critical aspect of this discussion concerns labels: how to interpret them and what do they mean. There are as many fertilizer label requirements as there are countries and, in the United States, as many states. Labels are used to represent to the grower the concentration of the nutritive elements and other constituents of a mixture, slurry, or homogenous blend of nutrient or nutrients. A general discussion of labels used around the world is not the goal of this article; North American markets will be used solely in this discussion. The reader must be aware of the differences across all markets and adapt this knowledge to that situation. In most cases, these labels are politically acceptable, not necessarily scientifically acceptable, and sometimes based on archaic methods of measuring and, in the case of Phosphorous, based on a by-product of burning the compound in enriched air. Science, unhindered by politics, deals with getting as close as possible to an accurate reflection of true contents. There are several ways to represent the content of these fertilizers, not one most accurate way, and several politically accepted ways. These are mass/mass (m/m) or mass/volume (m/v); in North America, and some other countries world-wide, this is done (m/m) as grams of element per kilogram of fertilizer. (The other is mass/volume or grams/liter)

On all North American labels that are registered, elements are given as a percent of composition, in terms of weight: for every kilogram (or pound) of fertilizer material there is X% by weight of the identified nutritive element. In general, the biggest or first three numbers that appear on the front or back or both, of the label, represent Nitrogen – Phosphorous – Potassium (N – P – K): for example 10 – 10 – 10. The additional elements may be listed under the Guaranteed Analysis section of the label ***IF*** the company wants to guarantee those elements, in the same percentage format. N – P – K elements are macronutrients and considered major elements, but **macronutrients** include other elements as well *(see Table 1)*.

Currently, nutritional elements are classified as either **macro** or **micro elements** based on the relative amount used by the plant of the measured component. The term component is used on purpose because it could be a molecule that is measured and not a single element; for example Phosphorous (P) is measured as Phosphate pentoxide (P_2O_5) or Potassium (K) is measured as Potassium oxide (K_2O). This means that the percent weight is not just for the element looked at but includes the additional elements, in this case Oxygen (O). Nitrogen (N), on the other hand, is given as only the N, but the Guaranteed Analysis section will state where the N is derived from and will state this as a percentage of the Nitrogen component as derived. Different forms of N act different and have different properties. So, while the percentages are correct on the label, not everything is that straight forward and must be calculated to arrive back at the actual amount being applied. When two or three parts are used, for example in some liquid fertilizers, add the similar element numbers together to get the correct concentration.

Here is an example for doing the calculations for determining actual concentrations of nutritive elements as taken from a North American label where percentages stated are mass/ mass.

A 50 pound pail of a liquid based fertilizer with N – P – K values given as 10 – 20 – 10 (a suspected 1:2:1 ratio)have in the Guaranteed analysis section the following additional information:

Total Nitrogen (N)..... 10%
10% Nitrate Nitrogen
Available Phosphate (P2O5).....20%
Soluble Potash (K2O).....10%

This means that 10% of 50 pounds, or 5 pounds, is elemental N since it is listed as N not a compound; 20% of 50 pounds, or 10 pounds is P_2O_5; and 10% of 50 pounds, or 5 pounds, is K_2O. These are the Commercial Percentages of the fertilizer package. For the elemental percentages, a conversion is required since both K and P weights include oxides. In this example, percent of actual P in the oxide form P_2O_5 is 44% and the percent K is 83%, so the actual weight of elemental P is 4.4 pounds (10 x 0.44) and K is 4.15 pounds (5 x 0.83). So the corrected numbers read 10% – 8.8% - 8.3%

The actual ratio in the fertilizer of single elements in this example is 1.0:0.88:0.83 N – P – K, not the 1:2:1 the label indicates. All other elements given, whether they are actually taken up as a complex like Sulfates or in elemental form, are expressed on the label as the elemental version like Nitrogen.

In different measures of mass/volume, the numbers would be different and are also based on specific gravities. An example would be a Root/ Flower additive fertilizer where the North American mass/ mass convention would show a 0 – 10 – 11 NPK value, might have a mass/ volume percentages expressed as 0 – 13 – 14 which would be dependent on the material from which it is derived. The ratio is what is truly important, how much of each element is provided; using higher or lower numbers is relevant to the amount that is applied as long as the ratio is close.

Each species or, sometimes, variety of plant has a ratio specific to its needs even though many plants have identical needs and are sometimes grouped according to these needs. Given 3 different fertilizers labeled 0 – 10 – 11, 0 – 20 – 22. And 0 – 30 – 33, the ratio stays close and only the amount applied needs to be adjusted based on the needs of the crop. This is because, in the end, the root zone needs to have a certain amount available for the plant across the time the plant requires to take it up and many variables can and will affect this as a nutrient moves from the bottle or bag to the utilization sites in the plant.

Limiting values

Limiting values are the speed limits of growth and development in a plant or any other life form. This is true whether it is Carbon Dioxide (CO_2) in the air, water in the soil, or a single element, any of these factors which become limited in availability will determine the potential for the plants development. These are known as Limiting Agents, perfect ratios and amounts of fertilizer can be applied to a plant, but if available Carbon (C) is limited by a lack of CO_2 in the air, the plant will not be able to utilize all the applied nutrients nor can structural elements and other processes be built or occur, and the plant fails: the limiter in this case is Carbon.

In any system, the goal is to insure that adequate levels of all the input components is maintained across time and adjusted when needed. A plant requires different

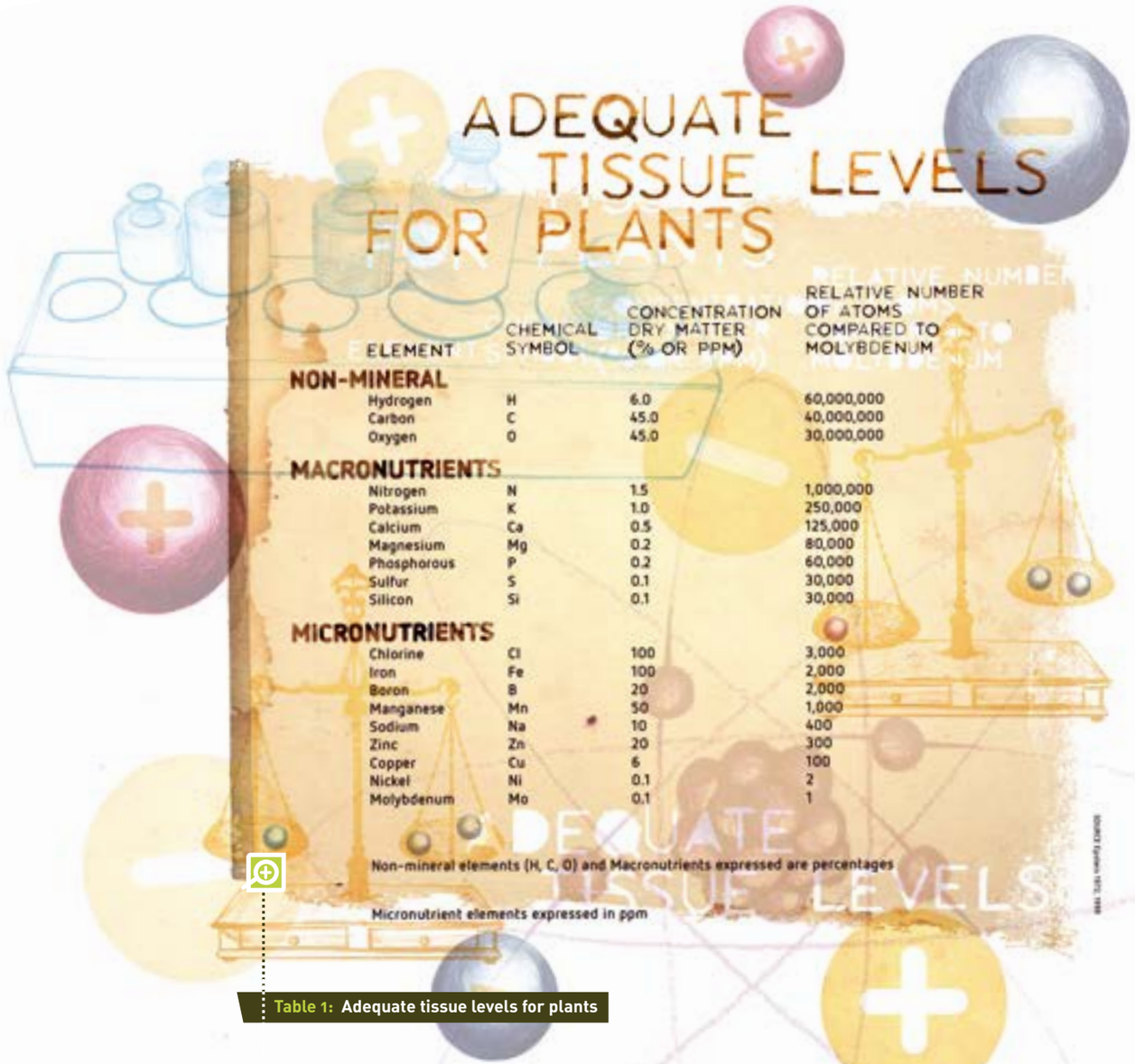

Table 1: Adequate tissue levels for plants

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levels of some elements at different times or stages in its development. Most nutritive elements, as mentioned earlier, should be kept close to the required levels because they tend to accumulate in the tissues of the plant where they can become toxic to both the plant and to the animal that consumes it. The ratio in the root zone closely matches overall plant tissue composition; it is the overall concentration that gets growers in trouble with salt burns. Other factors can greatly influence nutrient availability to the plant as well such as pH or substrate composition and nutrient formulation. It does no good to apply the correct ratio of NPK if the pH is out of bounds since these nutrients will be made less or more available to the plant and the plant will express this difference in tissue composition.

There are many ways or input ingredients that can be used to engineer a fertilizer; for instance Nitrogen can be applied as Ammonium nitrate, Potassium nitrate, Calcium nitrate, Urea, etc, but each is different and each brings other components to the table. Phosphorous can be applied as Superphosphate, Triple Superphosphate, Monopotassium phosphate, Ammonium phosphate, or Bone meal, to name a few. Each of these must be 'activated', broken down, or form shifted (ionization) in the root zone to be taken up in one of the three forms of phosphate that can be taken up by a plant. The pH of the environment will affect the form the Phosphates take and will limit the ultimate availability of the desired

Figure 2: A Scanning Electron Micrograph (SEM) of a single phosphate crystal. A phosphate is an inorganic substance and is a salt of phosphoric acid.

monovalent form H_2PO_4- at normal pH ranges between 5.2 and 7.2 by converting the phosphates into the unusable form H_3PO_4 or the less desired divalent form HPO_4^{2-}.
The phosphates will also bind other available elements as well as to substrate particles and become unavailable to the plant even while still showing in the system. Fertilizers must be designed not only to provide the right ratios of elements in the right amounts, but also for a dynamic environment of temperature/ pH fluctuations and across different substrates. •

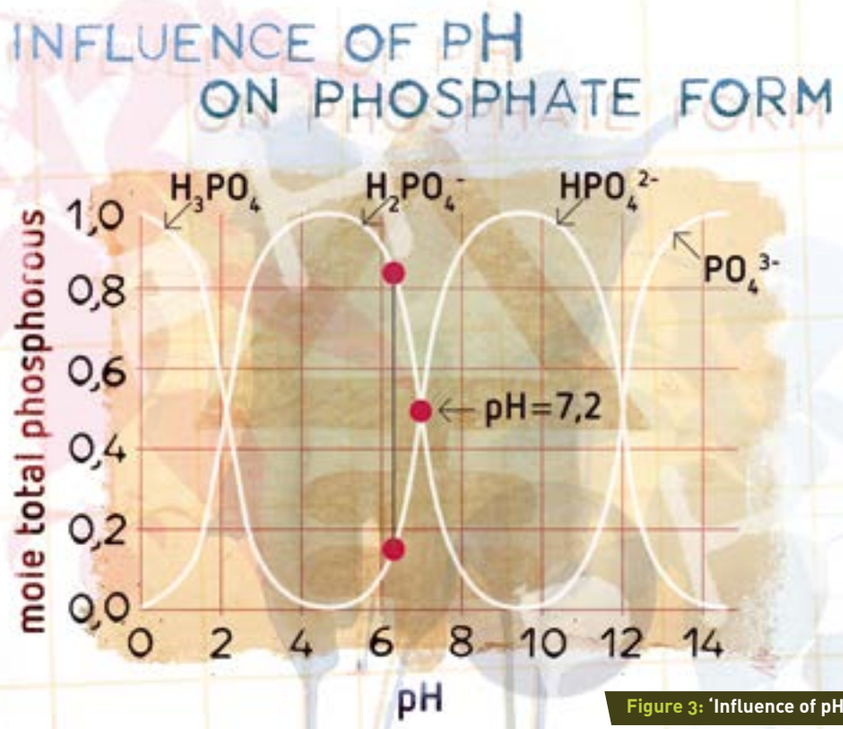


Figure 3: 'Influence of pH on Phosphate

LOVELY LUSCIOUS LETTUCE

SOME UNENLIGHTENED PEOPLE REFER TO OUR FRIEND THE LETTUCE AS RABBIT FOOD. LITTLE DO THEY KNOW...

THE ANCIENT EGYPTIANS MIGHT HAVE HAD A FUNNY WALK BUT THEY KNEW. OH, DID THEY KNOW. WITH 20% PROTEIN LOCKED INSIDE ITS SUCCULENT LEAVES, NO WONDER LETTUCE WAS THE SACRED PLANT OF MIN, THE GOD OF MALE SEXUAL POTENCY. PRAY TO YOUR LETTUCES.

By Marco Barneveld, www.braindrain.nu

Ah, nicknames. You have to love them. Lettuce has been called, besides rabbit food 'the perfect weight-loss food'. They might be right since there are very few calories in this plant. Lactuca Sativa is the scientific name for this salad crop. Lac meaning milk in Latin, which alludes to the white substance that oozes from the cut stems.

Sexual potency

That milky white substance might have been what triggered the overactive imagination of the ancient Egyptians, who started cultivating lettuce around 2800 years before they say Christ came into our world. The Egyptians started growing it to produce oil from its seeds. And they were so

smart that they bred it into a plant with edible leaves.
The milky substance that dripped from its stems when cut means that it came to be considered the sacred plant of the god of reproduction, Min. This god of male sexual potency was represented in many different forms but most often in male human form, shown with an erect penis, which he holds in his left hand. Min was honoured during the coronation rites of the New Kingdom, when the Pharaoh was expected to sow his seed and thus ensure the annual flooding of the Nile. I can just hear all you guys thinking 'seeds, Nile, flooding, milky stuff...' and you are entitled to those thoughts. The ancient Egyptians probably had the same thoughts.

Naked

At the beginning of the harvest season, his image was taken out of the temple and brought to the fields in the festival of the departure of Min, when they blessed the harvest and played naked games in his honour. And the most important game, I kid you not, was the climbing of a huge pole. And to finish our detour through ancient Egypt, our friend the lettuce was carried during Min's festivals and placed near his images. The plant was thought to help the god perform the sexual act untiringly.

Health and the lettuce

And when you consider all the health benefits of lovely green lettuce, they might have been right about that too. But first set some things straight. There are many types of lettuce. But the main ones are Romaine, Iceberg, Butterhead and Red and Green Leaf.
Choose Romaine lettuce if you can, rather than iceberg, because Romaine has one of the highest nutritional values in the lettuce family. Iceberg lettuce, on the other hand, has the lowest nutritional value. When we compare the two lettuces, Romaine and Iceberg, we find that Romaine has fewer sugars and sodium, twice the amount of protein, twice the calcium, three times the vitamin K, four times the iron, eight times the vitamin C and seventeen times the vitamin A, compared to Iceberg.

Good for losing weight

But in general, all lettuces have certain special health benefits. Lettuce has only 12 calories per one shredded cup. This is why it is so good for weight loss. It contains fibre and cellulose which stop you feeling hungry and fill you up, and the fibre improves your digestion. Improving your digestion may not sound like a good thing for losing weight, but it is actually essential for long-term weight control. Fibre also helps to remove bile salts from the body. When the body replaces these salts it breaks down cholesterol, which is why lettuce is also good for your heart. The vitamin C and beta-carotene in lettuce work together to prevent the oxidation of cholesterol, and this prevents the build-up of plaque.

Help with insomnia

The white fluid that you see when you break or cut lettuce leaves is called lactucarium. It actually has a soporific (relaxing and sleep-inducing) effect similar to opium, but without the strong side effects. Simply eat a few leaves or drink some lettuce juice for a great night's sleep.The minerals in lettuce help remove toxins from your body and keep your acid/alkaline balance in order. Once you are balanced at this level, there are a host of other benefits including higher energy levels, improved brain function, deeper and more restful sleep, and younger-looking skin.

Grow it yourself

Ready, steady, grow! All types of lettuce grow best in cool weather, so plan to add them to your garden in the spring or autumn, in soil that is kept constantly moist.

When to Plant

In spring, sow lettuce in cold frames or tunnels six weeks before the date of the last frost. Start more seeds indoors under lights at about the same time, and set them out when they are three weeks old. Lettuce seeds typically sprout in two to eight days. In autumn, sow all types of lettuce at two-week intervals starting eight weeks before your first autumn frost. One month before your first frost, sow only cold-tolerant Butterheads and Romaines.

FACTS

- Lettuce is part of the same plant family as the daisy and the thistle.
- Lettuce was served on the tables of the Persian kings in the 6th century B.C.
- The Greeks and Romans revered the leaf as a basic food and medicine.
- Emperor Caesar Augustus built a statue praising lettuce, since he believed eating it had cured him of an illness!
- The Chinese consider lettuce good luck and eat it on special occasions.
- None other than Christopher Columbus introduced lettuce to North America.
- Wild lettuce is common around the globe.

Figure 4: Make sure that the seedlings are hardend off for at least two to three days before transplanting.

Figure 5: The most well known lettuce varieties are Iceberg, Butterhead and Green and Purple leaved lettuce and romaine.

How to plant

Prepare your planting bed by loosening the soil to a depth of at least eleven inches. Mix in about an inch or so of good compost or well-rotted manure. Sow the lettuce seeds a quarter of an inch deep and half an inch apart in rows or squares, or simply cast them over the bed.
Indoors, sow lettuce seeds in flats or small containers kept under fluorescent lighting. Harden three-week-old seedlings for at least two or three days before transplanting. Use shade covers, such as pails or flowerpots, to protect transplants from the sun and wind during their first few days in the garden.

Pest and disease prevention tips

Slugs chew smooth-edged holes in the outer leaves. Collect them with a gloved hand during drizzly weather, or trap them in small pit traps baited with beer. You also can spray cold coffee on slug-infested plants to stop them feeding.

Tips for growing lettuce

As the seedlings grow, thin leaf lettuce to 6 inches apart, thin Romaines to fifteen centimetre and allow eighteen centimetre between heading varieties. After thinning, mulch between plants with grass clippings, chopped leaves or another organic mulch to deter weeds and retain soil moisture.
In late winter, grow lettuce inside a cold frame or plastic tunnel. Seedlings often survive temperatures below 20 degrees when they are protected with sheet plastic or glass. If your garden is small, try miniature lettuce varieties. Never allow the soil to dry out while lettuce is growing. In most soils, you'll need to water lettuce every other day between rains.

Harvesting and storage

Harvest lettuce in the morning, after the plants have had all night to plump up with water. Wilted lettuce picked on a hot day seldom revives, even when rushed into the refrigerator. Uproot (and eat) the younger plants until you get the spacing you want. Gather individual leaves or use scissors to harvest handfuls of baby lettuce. Rinse the lettuce thoroughly with cool water, shake or spin off excess moisture, and store it in plastic bags in the refrigerator. Lettuce often needs a second cleaning when being prepared for the table. So clean once again and take it to the kitchen.

Eat it yourself: Caesar Salad

Probably the best salad in the world. You'll need Romaine. And dressing. Enough said. •

RECIPE

CAESAR SALAD

Ingredients

- **3 garlic cloves**
- **3 anchovy filets**
- **Juice of 2 lemons**
- **1 egg yolk**
- **1 teaspoon Dijon mustard**
- **1 teaspoon dry mustard**
- **6 tablespoons freshly grated Parmesan cheese, cold**
- **Some olive oil, cold**
- **A bit of salt**
- **A dash of black pepper**

Directions

Place the garlic and anchovies in the mixing cup and mix them until they form a paste. Add the lemon juice and egg yolk and process them until they are well incorporated. While the machine is running, gradually add the oil, Parmesan cheese, salt and pepper. Use immediately on Romaine lettuce, garnished with croutons and Parmesan cheese. *Lettuce eat.*

Questions & Answers

We receive a lot of questions about growing. Of course, our researchers are more than happy to answer them! Just go to the contact page on our website, www.canna-hydroponics.com, to submit your question.

Question

Do I only add nutrients during the middle of the week? Or when I top off the water do I add nutrients also I have a basic Tri-Meter from Nutra. Which PPM am I using; Truncheon, Eutech, or Hanna for PPM type? The feeding schedule says to use canna boost 30.4-60.8. How do we determine how much to use?

Answer

A little but big question. The conversion I have no clue on for your meter. It is based on the tip and what element (Na, Ca, etc.) it uses as a marker. It should be listed in the paperwork that came with the meter. If not, ask the place that sold it to you. Hanna is a 0.5 conversion factor, Euteck is 0.64 and not found in NA often, Truncheon is 0.74 to get to the ppm conversion. You can always skip all this by working with EC since it is this number that is converted anyway. So I cannot answer all of the question for you. However, I am assuming you use CANNA AQUA, correct? If so, check daily, add water when the level gets low or the EC gets high. Refresh the nutes when the EC falls below nominal levels in a range of about 0.2 EC. You can do this anytime but allow a couple of hours for a new tank to stabilize first. It is always best to change tanks every 5-7 days. Some go longer, some shorter. Shorter is better, longer is asking for issues as the solution accumulates ions given off by the plants roots which ultimately show false higher readings for fertility and influence pH. As for Boost, that number is the number of ml added to your tank of solution. It is a range as different varieties and species have better results with different levels, however this is the range. Start in the middle and forget about the decimal place. Use 30 - 60 ml in the tank. Start middle (45 ml/tank) and decrease each crop to see where you find a drop in expectations. The actual rate is 8 - 16 ml/gal. The numbers you sent are based on the tank size you dialed in. Hope this helps,

Question

When using Rhizotonic as a foliar spray, should the pH be adjusted to within the normal pH range (5.2 to 6.2)?

Answer

Thank you for your enquiry. If you use CANNA RHIZOTONIC as a foliar spray your pH level should be between 6.0-6.5. Hopefully this answer helps you growing. Please do not hesitate to contact us again for any questions. For more information about CANNA please visit our website.

Question

I'm running a 30 liter flood and drain unit, got a bottle of PK 13/14 but confused how to use it, do i add 45 ml straight to my tank or mix it with water and top up to the right EC very confused , many thanks

Answer

You should add the CANNA PK 13/14 to the feeding liquid after you have add the feeding. The amount should be 15 ml/10 liter (so 45 in 30 liter is ok). The EC will rise a little (0.1-0.2) Now you can bring the pH to the right level. Let me make clear, you did it the right way! But be aware that the EC total is not too high for the plant. Hope this will answer your question, if not please do not hesitate to contact us or for more information.

Question

My EC is 1.9 and my plants are 22cm, 3rd week of veg and 2 days in flower now. The pot size is 6.5 liter. The light is 2ft above the top of the plant with new bulbs. The medium is CANNA COCO and the nutrients are CANNA COCO A & B. In the reservoir the EC is 1.9 pH 5.8 (background is 0.3) so really 1.6 when I check the run off its EC is 1.2 pH 6.0 my plants look bleached and pale yellow, however the roots are just starting to appear from the bottom which are nice fluffy and white. The plants reach for the light and look strong in every aspect but the signs look like magnesium deficiency or underfeeding with the veins of the plant dark green and the rest pale yellow....my main concern is why, when watering, the EC is 1.9 going in to the medium and then 1.2 with the run off? My pH is pretty stable...I have been growing 10 years and just can't understand this....I also feed twice a day until I see the start of run off please help and if you have any further questions please don't hesitate to email me thanks in advance and I hope you are prompt with your reply.

Answer

EC in 1.9 EC, out 1.2 the plant is taking more nutrients than given, or the coco is absorbing more Calcium and Magnesium than it should do. The coco will give Potassium (K) instead. I think it is the second option. CANNA COCO is already buffered. For some reason you took the buffer in the CANNA COCO away. Did you apply only water in the beginning? Or did you flush the coco before starting? Anyhow, we have to solve your problem and buffer the coco again. Because you have already started the growth, I would advise you to add either: A mixture of : Ca15% EC 1.0; MgO 8% EC 0.5 and 2 ml/liter Trace elements. You use this for 7 days. Total EC: Water 0.3 + Ca 1.0 +Mg 0.5 = 1.8 Other option is to add CANNA COGr Buffer Agent for 7 days. (Total EC 1.8) You may increase the EC temporarily (2 day's) tot 2.2, for a faster recovery of the coco. The plant can stand this, because it is still growing fluffy. Good Luck.

Question

The real issue is that I am using RO/DI water to mix my Nutrients in. This is due to a number of noxious chemicals being found in municipal water here in the states. Atrazine has not been banned here yet. I try not to even drink tap water here. I have been using Cal-Mag Plus at 250 PPM to make up for the missing micro nutes in the RO/DI water. But the problem is that all of the other Micro Nutrients are still missing. I have found no better substitute for the missing elements though today I did find a Micro Nutrient supplement at a nutrition store that is meant for human consumption. This is a possible solution though quiet expensive. I also have considered kelp extracts. Do you have a recommendation for those of us having to rely on RO/DI water? I am currently growing in 5" net pots but will be moving to 3.75" net pots on the next cycle so that I can water more frequently, as this was recommended by the local shop. I hand water now but would like to switch to drip. I water/feed waste to drain.

Answer

Well, let us start from the beginning. To begin, there is no micro nutrients missing from CANNA COCO A & B. CANNA's line is complete. What is happening is an imbalance of ratios brought on by the medium. The ONLY thing you need to add to the line if using RO water is Calcium to bring the hardness up a touch, roughly 0.2 EC mS/cm. You do not mention using CANNA COCO substrate, hopefully you are or this problem is really big. Never put plain water on our coco substrate, it washes away the buffer and takes a few weeks to re-establish. Now, when the balance is off, you get curling, yellowing and some tip burning. The lower EC you feed the worse this becomes. Watering too often will also cause these issues; coco holds more water than peat or other mediums. Coco does not hold nutrients so as long as it is moist, food is available. So, the fix is relatively easy, run the EC up to 1.2 of nutes added to the 0.2 source water for 1.4 total. I caution you however, since you flushed with plain water, this may take some time to re-establish because of the buffer I mentioned earlier. If you feel the need to flush, use 600 ppm nutes to flush with. Another note that will also contribute to the issue, if you are using CANNA RHIZOTONIC, stop the use of any other supplements containing vitamins, hormones, silicates, or amino acids. Rhizo has this and it is very possible to overdose the plants. The Super Thrive is repeating what you are using. Also do not add additional Kelp or and form of Marine algae, again Rhizo is this so you will be over doing it again. In this case a little bit goes a long way. Check out the Coco Infopaper available through our web site or the store you bought your product from, it will shed light on just this issue. Understand that more does not always mean better, and we provide everything in the nutrient program needed to grow and finish a crop. Hope this helps.

Don & Nicky

(PART 10)

Don and Nicky have moved back from Canada to their home country, the UK. Their search for the good life led them to France and they are now doing exactly what they wanted to do with their lives: growing. Don shares his experiences and will tell you everything about the good life in French Catalonia in this, and forthcoming editions.

DON IS A LITTLE TOO SUCCESSFUL GROWING *Chilli* PEPPERS

Help! I'm drowning in peppers! My four Tokyo Hot chilli plants are now in full production mode and it's just incredible! My plants are basking under a single 600W high-pressure sodium grow light. This incredibly efficient light source is beaming down vast amounts of PAR energy (photosynthetically active radiation) that's being gobbled up by a vast, trained and even canopy of hungry leaves transforming them into beautiful, classically-shaped, red hot chilli peppers! I'm giving them away to friends, neighbours—anybody who'll take them, literally stopping strangers in the street! It's actually more difficult than you might think as the French don't tend to have the pallet, even for these moderately hot and tasty peppers!

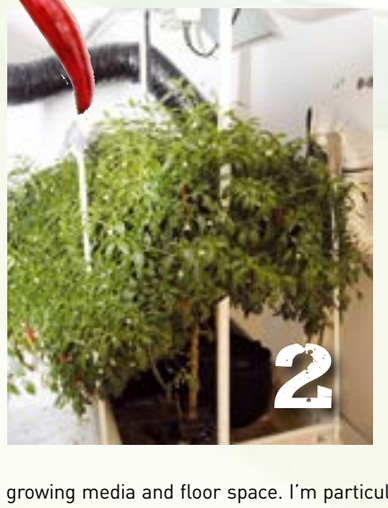
Here's another interesting observation. Three of the plants are in 20-litre fabric pots filled with a 50 / 50 mix of coco coir and chunky perlite. (I charged it up with some insect frass at 2% per volume to give them a hit of beneficial biology and a broad hit of fertility too). They're doing incredibly well. The fourth plant, however, is growing in less than half that amount of growing media—and it's arguably doing the best of all! What's its secret? Rockwool!

Now—if you're one of those growers who shuns rockwool then, well, my bet is you haven't actually tried it. If, on the other hand, you're willing to take a tip from the commercial growers (and doesn't that make sense?) then rockwool is a powerhouse for hobby indoor growers! It's clean, easy to work with, and—so long as you irrigate properly—it's possible to grow massively productive plants using a fraction of the growing media and floor space. I'm particularly impressed with Grodan's "Unislab" – a sort of mini rockwool slab designed to grow a single plant. They offer more stability than the larger grow blocks and, because they're not high off the ground, it's possible to irrigate them in a flood and drain table if top-feeding with drippers isn't your preference.

1 Another discovery I've made recently is ceramic metal halide – also known as 'light emitting ceramic' – a new type of grow lamp. I'm using an American fixture that houses the 315W lamp vertically, a little bit like those old-style parabolic reflectors.

2 Investing in a LightRail – an ingenious device that moves your grow light back and forth along a two-metre track – has helped me a lot with heat stress issues.

3 I have so many beautiful, classically-shaped, red hot chilli peppers, I'm even giving them



One day I noticed that some of the leaves looked a little dry and lack-lustre.

As it seemed to be affecting all the plants I made a guess that I needed to increase irrigations so I added a few more flood cycles on the timer. Turns out that this was a mistake. In hindsight I think I should have just given them all a simple foliar feed! With their root-zones permanently moist, thanks to the extra cycles, my peppers sprang back into vegetative mode and started sending out dozens of fresh shoots towards my grow light, causing me some difficulties with vertical space. It was amazing to see how I could "steer" my plants (albeit accidentally) through irrigation alone—basically I'd tricked them into thinking it was springtime (or rainy season) again!

I hacked back a huge amount of new foliage, reverted to my previous irrigation cycles to keep the plants' root zones drier, and invested in a LightRail—an ingenious device that's a longstanding favourite with energy-conscious indoor growers. It moves your grow light back and forth along a two metre track, increasing your footprint and helping to mitigate localized heat stress issues when plants inevitably venture too close to your lamps. It really is an ingenious device and has helped me squeeze even more efficiency out of my HPS grow lamp. I definitely recommend looking into these if you grow with the higher power (600 and 1000W) grow lamps.

Another discovery I've made recently is ceramic metal halide—also known as "light-emitting ceramic"—a new type of grow lamp. I'm using an American fixture that houses the 315W lamp vertically, a little bit like those old style parabolic reflectors. More or less all of the light received by the plants beneath is reflected—with very little radiant heat detectable directly beneath the lamp itself. This makes for a very "friendly" grow light for vegetative growth—ideal for powering fast, lush growth with minimal stretching without being too tough on young plants. I'm hugely impressed with this light (and it's a good deal cheaper than Light Emitting Plasma (LEP) too) and the PAR levels and coverage are amazing.

I have so much more to learn and dozens of species on my "grow next" list: turmeric, ginger, basil and more tomatoes, that's for sure. Nicky can't get enough of the Sub Arctic Plenty tomatoes which has helped her to partially forgive me for spending all our spare cash on hydroponics equipment! I concede it's time for me to consolidate what I've learned and enjoy my grow room at its current size before any further expansions occur! Four grow lights are enough to keep me very busy! •

FLY GEYSER

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

- Fly Geyser is located in the Black Rock Desert region about 20 miles north of Gerlach, Nevada in the USA. These hot springs are sited on Fly Ranch, which is private property.
- A collision of human error and natural geothermal pressure created this rainbow-colored geologic wonder in the 1960's. A geothermal company drilled a well, testing for a possible energy source. Since the water was not hot enough to suit the purpose, they abandoned the well. It is not quite certain whether they capped it and the cap started leaking or whether it was left uncapped. It has since built up a mineral cone several meters high with multiple water geysers constantly spewing over 74 acres.
- The Fly Geyser grown substantially in the last 40 years as minerals from the geothermal water pocket deposit on the desert surface. The geyser is covered with thermophilic algae, which flourishes in moist, hot environments, resulting in the multiple hues of green and red that add to its out-of-this-world appearance.
- The geyser looks like a small erupting volcano because water is continuously released about 1.5m in the air.
- The ponds are forming an ecosystem of their own. Small fish (introduced by some unknown human hand) breed in the ponds and they attract a number of birds such as swans, mergansers and mallards.
- The owners of Fly Ranch do not welcome sightseers, and do not want to sell the parcel on which the geyser sits. Therefore it will be unlikely that it will be open for the public any time soon.

What's HAPPENING

The world is full of wonders. But which wonders are the most wondrous, Bernard Weber wondered. So in 2000, he started a project called The New7Wonders Foundation, and got hundreds of millions of people to vote for different kinds of wonders – wonders in cities, wonders of nature and the new Seven Wonders of the World. We think it's just wonderful. By Marco Barneveld, www.braindrain.nu

Photo courtesy of SF Brit CC BY 2.0

THE WORLD IS FULL OF WONDERS

In ancient times there were the Seven Wonders of the World, including the Hanging Gardens of Babylon and the Great Pyramid of Giza. They were awe-inspiring wonders, of which only the Great Pyramid are still standing strong today.

Global democratic exercise

Swiss-Canadian Bernard Weber has started the New7Wonders of the World. "In 2000, I started New7Wonders as a millennium project," he explains. "For the first time in human history, a global democratic exercise, a worldwide voting campaign, was technically possible using the internet. The idea was simple and powerful: to ask the people of the world to choose and elect the new man-made seven wonders of the world, the rightful heirs of the ancient seven wonders. I called this simply the Official New 7 Wonders of the World – official because we wanted to recognize the ultimate authority and legitimacy granted to us by the people's free choice and democratic will."

Natural equilibrium

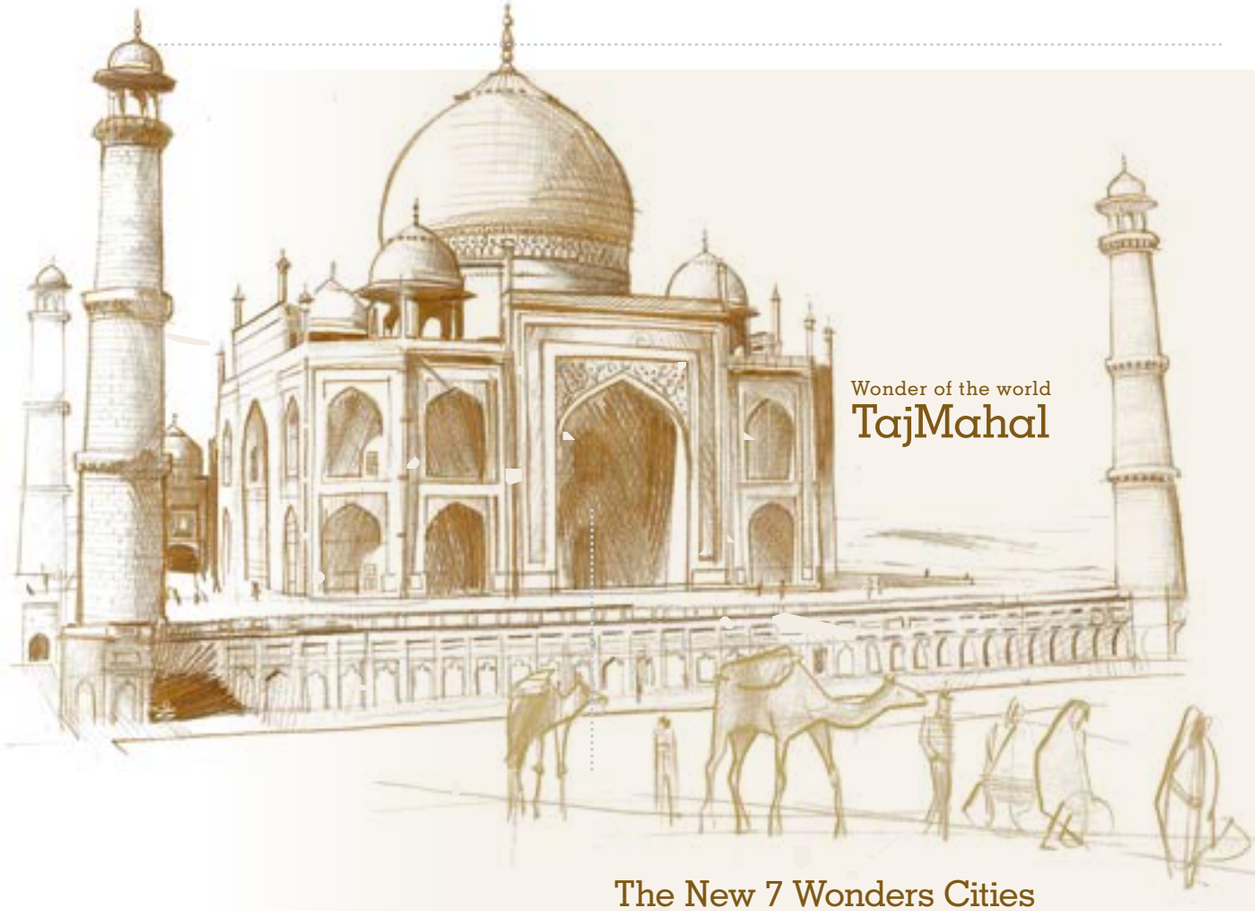
With a series of global voting campaigns, New7Wonders is inspiring and making people more aware of what we are leaving behind for our children and future generations. The first vote on the new Seven Wonders was a huge success, with more than one hundred million people choosing their favourite wonder. Because of this grand success Weber followed the up with a brand new vote to celebrate the beauty of our planet, thus fostering greater respect for the earth's fragile natural equilibrium.

New7Wonders Cities was the third global vote organised by New7Wonders. "New7Wonders Cities will be a forum for discussing everything from urban planning to metropolitan governance, from tourism to architecture," said Bernard Weber, launching the campaign in 2012.

1,200 nominees

"We began with more than 1,200 nominees from 220 different countries. For the first time in human history, more than half of our planet's population lives in cities and this election emphasises the dramatically challenging character of our changing world."

There are the great historic cities of Jerusalem, Venice and Kyoto, and the alpha world cities of London, New York, Mumbai and Shanghai. They have all enriched human civilisation immeasurably. Newer metropolitan areas, from Dubai to Seoul to Cape Town to São Paulo, have become magnets for millions of people, and new megacities, which most of the world is not yet even aware of, are springing up across Asia and Africa. For the first time in history, the majority of the world's population now lives in cities and New7Wonders Cities is the platform that enabled everyone to vote for the seven which they think are simply the best.



The New 7 Wonders Cities

- Vigan: Philippines
- Kuala Lumpur: Malaysia
- Durban: South Africa
- Doha: Qatar
- Havana: Cuba
- Beirut: Lebanon
- La Paz: Bolivia

The New 7 Wonders of Nature

- Amazon: South America
- Ha Long Bay: Vietnam
- Iguazu Falls: Argentina/Brazil
- Jeju Island: South Korea
- Komodo: Indonesia
- PP Underground River: Philippines
- Table Mountain: South Africa

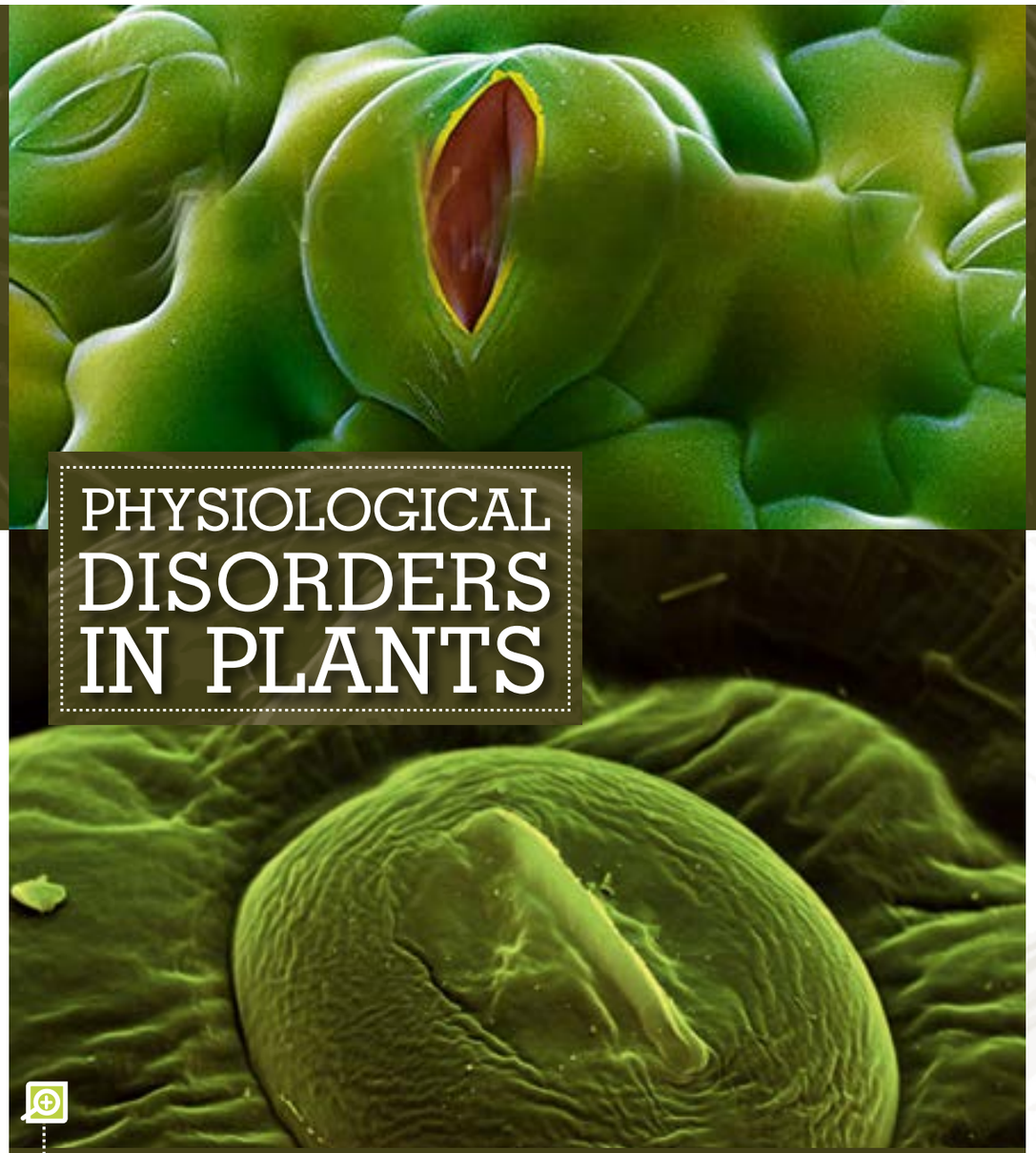
The New 7 Wonders of the World

- Christ Redeemer: Rio de Janeiro, Brazil
- Great Wall of China: China
- Machu Picchu: Peru
- Petra: Jordan
- Pyramid at Chichén Itzá: Yucatan Peninsula, Mexico
- Roman Colosseum: Rome, Italy
- Taj Mahal: Agra, India

This latest vote in the series of wonders ended in December 2014. And the building projects, nature reserves and cities chosen are gorgeous and remarkable. Were they your choice as well? Just something to ponder and wonder about, if you didn't vote.•

Pests & DISEASES

Plant physiological disorders are also known as abiotic disorders and are distinguished from other disorders by the fact that they are not caused by living organisms (such as viruses, bacteria, fungi, insects etc). By CANNA Research



PHYSIOLOGICAL DISORDERS IN PLANTS

Figure 6: A Scanning Electron Micrograph (SEM) of an open stoma on the surface of a tobacco leaf (above) and a closed stomato on the surface of a Sorrel leaf (down). Even moderate stress can cause the stomata on the leaves to begin to close, reducing photosynthetic production.

They are either the result of the environmental and cultural factors on plant development or genetic mutations. Physiological disorders are often caused by a shortage or excess of something that supports life. The effects of physiological disorders range from subtle symptoms, which may not be visibly apparent, to severely stunted and malformed growth. Unfortunately, physiological disorders are usually difficult to identify and most are irreversible.

Physiological disorders can affect plants in all stages of their life. They occur without the presence of infectious agents and therefore cannot be transmitted. Physiological disorders are serious in themselves, but they also often serve as an open door by which pathogens can enter. Dealing with physiological disorders often means dealing with the consequences of a past event.

Figure 7: This is a group of discoloured, bruised tomatoes that have been damaged by frost. The tomato plant (Lycopersicon esculentum) is a bushy annual native of South America. Unlike temperate species, it is unable to withstand the ravages of frost, which causes ice crystals to grow inside the plant and rupture the cell walls. The damaged tissue releases enzymes that further degrade the affected area, exposing the tissue to agents of decay.

Abiotic disorders are usually classified by the causal factor or symptoms. In this article we will give a short description of some environmental, cultural and genetic disorders.

Environmental stress

Plants can be subjected to numerous environmental stresses — drought, extreme temperatures, and excess light can all affect plant growth and quality. Environmental stress is very difficult to control when growing in the field. Greenhouse growing can make these environmental factors less severe but it cannot exclude them completely.

Flooding and drought

Water is essential for plants to take up nutrients from the soil and transport them throughout their system. A shortage of soil moisture can greatly inhibit plant growth. Even moderate stress can cause the stomata on the leaves to begin to close, reducing photosynthetic production. Wilting is the most common initial symptom of drought stress.

However, over-watering can kill a plant more quickly than lack of water. In waterlogged soil there is not enough oxygen for the roots. Without oxygen, anaerobic respiration will occur in the roots, producing toxic compounds in the plant. The symptoms of overwatering can include wilting, yellowing of leaves, root rot or stunted growth.

Cold injury and frost

Cold and frost are major causes of crop damage in tender plants, although hardy plants can also suffer if new growth is exposed to a hard frost following a period of warm weather. Symptoms will often appear overnight, and can affect many types of plants. Leaves and stems may turn black, and buds and flowers may become discoloured. Flowers that have been affected by frost may not produce fruit.

Heat stress and scorching

Extreme heat can damage plants directly, but usually heat damage occurs through increased water loss and plant moisture stress. Plants can also become sunburned when shaded foliage is exposed to sunlight during hot, dry periods. When temperatures are extremely high, plants need to bring water from the roots to the leaves and stems, which then exits the plant through the stomata as water vapour - a process known as transpiration. This cools the leaves and plant parts and prevents damage from heat stress. However, if there is not enough water for this process, the plant will sacrifice some of its leaf surface.

Cultural factors

Cultural factors are those that arise from growing a particular plant in a particular place for a particular purpose. Cultural practices are designed to promote and maintain plant growth and development. However, the same practices can at times be the cause of abiotic problems.

Nutrient deficiency or excess

Every plant reacts to extreme highs or lows in the level of nutrients available. Some reactions are very obvious, and others less so. Plants can be stunted, deformed or display leaf damage. Different nutrient imbalances will produce different reactions and an imbalance of one nutrient can make another nutrient unavailable.

Chemical damage

Any kind of chemical applied in the wrong dosage or at the wrong time is capable of physically damaging the plant. Most chemical damage comes from pesticides applied excessively, at the wrong time or during the heat of the day. Careless use of herbicides may also inadvertently damage or kill non-target plants. Spray drift is often the cause of unintentional damage to plants. Chemical damage may appear as red, yellow or brown spots on leaves, leaf tips turning brown, stunted or misshapen plants or widespread browning and death.

Mechanical stress or physical damage

Physical damage can be caused by people, machinery, wind, animals and so on. It can lead to tissue injury which can be a potential entry point for diseases. Differences in air movement, vibration or handling of plants can cause mechanical stress. Shaking or flexing a plant for only a few minutes each day can reduce stem elongation and the weight of the plant, both fresh and dry.

Genetic or hereditary disorders

Although this is an internal factor and not an external cause of damage, plants can do strange things when their genetic system goes wrong. The symptoms can range from variegated leaves, distorted stems, colour changes in seeds and flowers, dwarf growth etc. Some of these mutations have been exploited and selected to create new varieties but most of the commercially available variegated or otherwise different plants are not the result of a natural genetic defect but the result of the careful crossing and breeding of plants with the desired traits. •

PHOSPHORUS

A COMPLICATED STORY

PART 2

Figure 8: A Scanning Electron Micrograph (SEM) of a section through cells in leaf tissue from an Aconitum sp. plant. In the middle is a cell nucleus with it's nucleolus (red). The chloroplasts are green. The yellow structures are constituents of the vacuole

RATIOS ARE THE TRUE INDICATOR OF THE CORRECTNESS OF THE FERTILITY PROGRAM. WHEN DESIGNING A FERTILITY PROGRAM, IT IS CRITICAL TO KNOW ALL THE SOURCES OF NUTRITIVE ELEMENTS AVAILABLE TO A PLANT, AND WHAT THOSE RATIOS AND CONCENTRATIONS ARE. BY KNOWING THESE, THE REST OF THE QUESTION IS A MATH QUESTION.

Geary Coogler, BSc Horticulture, CANNA Research

Ratios

If the grower is using a medium that has a starting fertility ratio, of NPK, of 0 – 1 – 0.5, and the plant shows a total tissue ratio of 4 – 2 – 3, then they will have to add a ratio of 4 – 1 – 2.5 to get the correct fertilizer needed. It must be remembered, however, that these are at perfect values of pH, temperature, and across the growth cycle, and the values are seldom perfect.

Plants seldom take up nutrients equally and will influence the root zone to give up more of what it needs. Plants also change their needs slightly during development whereas tissue analysis is a slice of time, so tissue taken at the end of the crop cycle will show the cumulative value of these stages and not reflect how a plant takes these nutrients up over time. Juvenile plants take up a different ratio than flowering plants do; where a plant anticipates seed, it will begin to accumulate phosphates.

Where the nutritive elements are all correct except for one of them which is low, then the low element will be the limiter. When this is a minor (micro) element used only in a few processes, say sodium, then the effect, while present, is minimal. In the situation that a major element is the limiter, say Phosphorous, than the effect can be dramatic because those compounds made from Phosphorous will not be complete, and those processes dependent on P will not occur such as nutrient uptake, transport, and conversions. By applying sufficient concentrations of these elements in the correct ratio, along with the proper environment, the plant never sees a limiting agent and growth will proceed at the maximum genetic possibility.

It is important to apply sufficient concentrations of these elements, but caution must be observed in not applying too much; both high concentrations and incorrect ratios can play a hand. Just because one nutrient is limited does not mean the plant will avoid taking up all the other needed elements. These unused elements usually find their way to the vacuole of the cell and there they remain. Vacuoles not only provide water storage and structure support, they also serve as garbage dumps. Heavy metals like Copper, Boron, Molybdenum, and Manganese cause issues in animals that consume these. Plants will also accumulate non-nutritive elements such as lead and uranium if present in the available or free form in the root zone. Where not enough ATP is available to totally convert Nitrates to usable N, then Nitrites can accumulate. Excess ammonium shunted to the vacuole converts to Nitrites and Nitrosamines, a cancer causing agent. Keeping these ratios close, while avoiding limiting values, is the ultimate goal of a fertility program, and the best way to keep consumers consuming.

Plant needs

So what does a plant need in the way of Phosphorous, how do we provide this, and what can we expect over time and development? The best way to know a plant's needs is to know what makes up the plant and the ratio of these elements to each other. Once this is known, and what exists in the substrate is known, it is fairly easy to apply the balance by using several known fertilizing materials. It is equally important, however, to know what these values are at the different growth stages of the plant and adjust at each stage.

The other way is to use a product that was designed, based on the plant itself, from research done correctly by the company that produces the fertilizer (a complete fertilizer), based on the substrate involved. Care must to be taken by the grower to get all the variables correct, such as pH and temperature, or at least to give the company what it asks for. It is equally important to use the substrate for which it was designed, as these will cause the ratios discussed earlier to change. The grower must be sure to follow the guidelines of the company closely, taking care not to substitute products as most will provide different levels of the components or in a different format.

Equally important, from the balance point of view, is to provide the ratio that the plant wants when it wants it. A plant's need for Phosphorous goes up during the earlier stages of flowering then falls back to completion, but still the need has been escalating across the plant's development all along. This is known as the Phosphorous Utilization Curve, a modified bell curve in appearance on a graph. The only additional Phosphorous a grower needs to apply is the additional amount the plant requires that the main fertilizer does not contain, and that will vary over time; the ratio game again. The plant will change the environment around the root surface to influence the activation of phosphates to bring them into the plant. The total need for Phosphorous in the root zone will ultimately be based not only the need of the plant, but also with the level of activity the environment will have on ultimate Phosphate availability.

Special Considerations

The Phosphorous Pathway in the plant is wide and all encompassing. Phosphorous starts out in the seeds at

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high levels to ensure the plant has enough to start all the metabolic processes it will require for the first few days. ATP is used to build structure, chemical compounds, and uptake the other elements needed for these processes. More Phosphorous is found in root tissues because much is needed to move nutrients into the plant and into the transport pathways. It comes into the plant and is turned into ATP for use locally or transported to all the other cells to be transformed into ATP or used as ATP (assimilated). Once it is the form of ATP or one of the other energy components, it is released as energy by way of many activities and then is free to be used in the formation of other phosphorylated compounds. It can also be converted back to ATP. More Phosphates are also found in the flowers themselves because of the decrease in produced ATP locally and because the plant is accumulating Phosphorous for the seeds and other energy draining requirements of the flower tissues such as pollen.

In some substrates, such as mineral soils, roughly 50% of the Phosphates applied are rendered immobile and become permanently fixed in the medium. As a result, more has to be added to accommodate this capture, so while the amount added is higher, the amount realized is lower. Plant mediums that have active micro-life will also see a depletion of available Phosphorous that is used by the micro-life since ATP serves all life forms in equal roles. The pH of the soil solution will affect available Phosphorous as will temperature and overall concentrations of other elements such as Potassium, a synergistic effect which is also a ratio issue. The grower has to be aware of all these variables in designing a fertility program for their crop. Most nutrient lines are designed with the system of production in mind: in other words, the ratio, composition, source, and application rate of each component product adds to the final ratio of every nutrient that would be required by the plant.

The marketing effect

The noise level about Phosphorous is just that, noise. Numbers on fertilizers are legitimate in most incidents, especially where regulated: these are not wrong. They do nothing but indicate the concentration of the constituent elements. The type or source of these elements can be determining in final availability based on the overall system. The grower is the final determining factor of how much to use. Complete fertilizers are designed to provide the correct ratio of the elements required once the entire line is mixed according to instructions; concentration is affected by application rates.

The problem with Phosphorous is knowledge and old laws that dictate how to measure and report the element. When viewed correctly, Phosphorous should be in the correct range as adjusted for the root zone environment. Knowing how to read and accept both labels and reported findings, and interpret the data, is critical in determining the truth behind the advertizing and statements made about products and results.

In the end, all this noise is about marketing. Some companies will produce products with little thought in composition or how it actually fits, while selling them as beyond what they are, fertilizer. Some companies will take advantage of a confusing situation and general lack of knowledge to promote a myth that does not exist in order to tout a weaker product. Other companies actually do the work or research, they know what the standards are for which they are designing, they understand the relationships that influence nutrient availability, and they actually design a product line that works together.

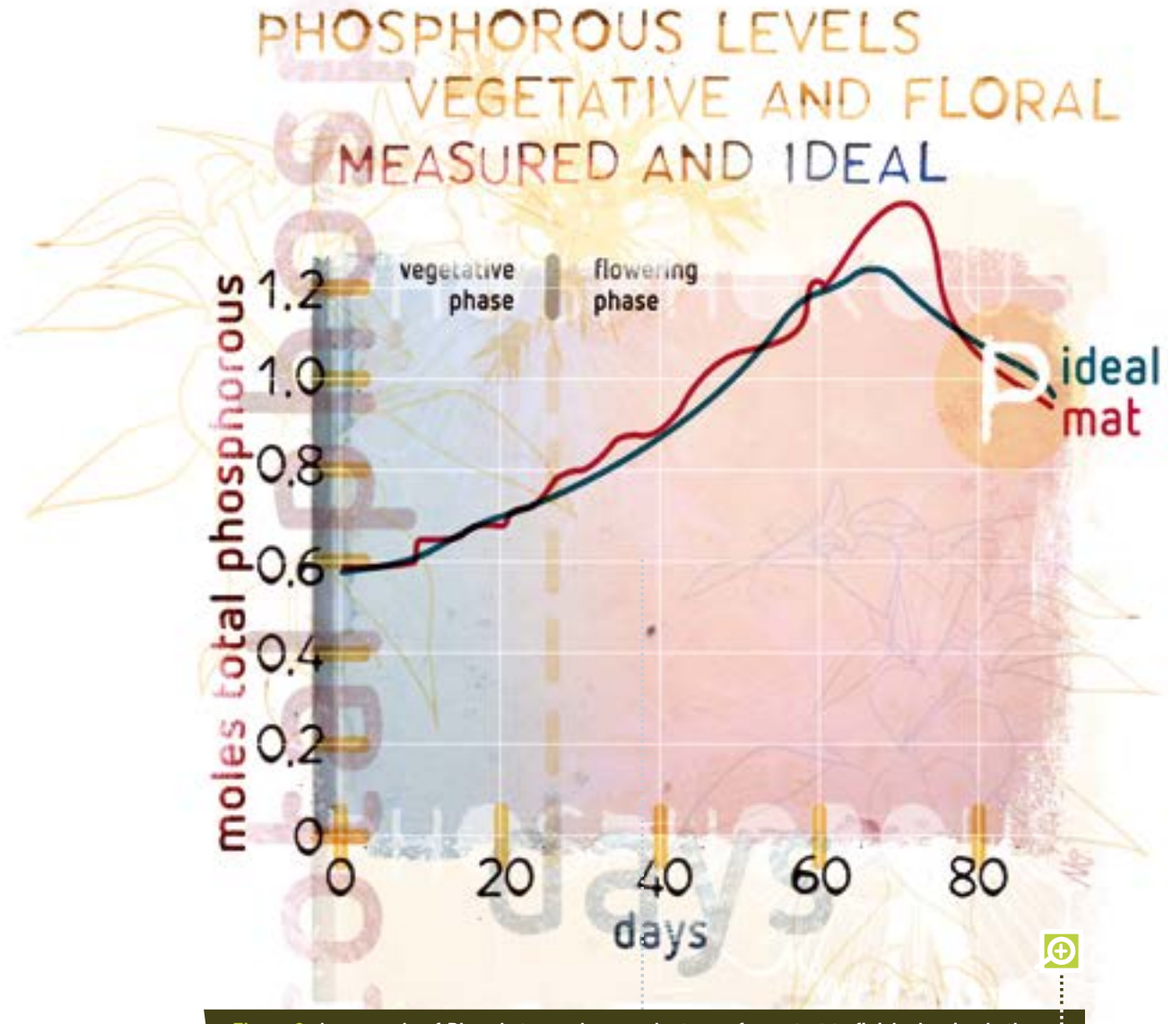

Figure 9: An example of Phosphate needs on a plant crop from start to finish showing both Observed (P mat) and the correct level to provide (P ideal)

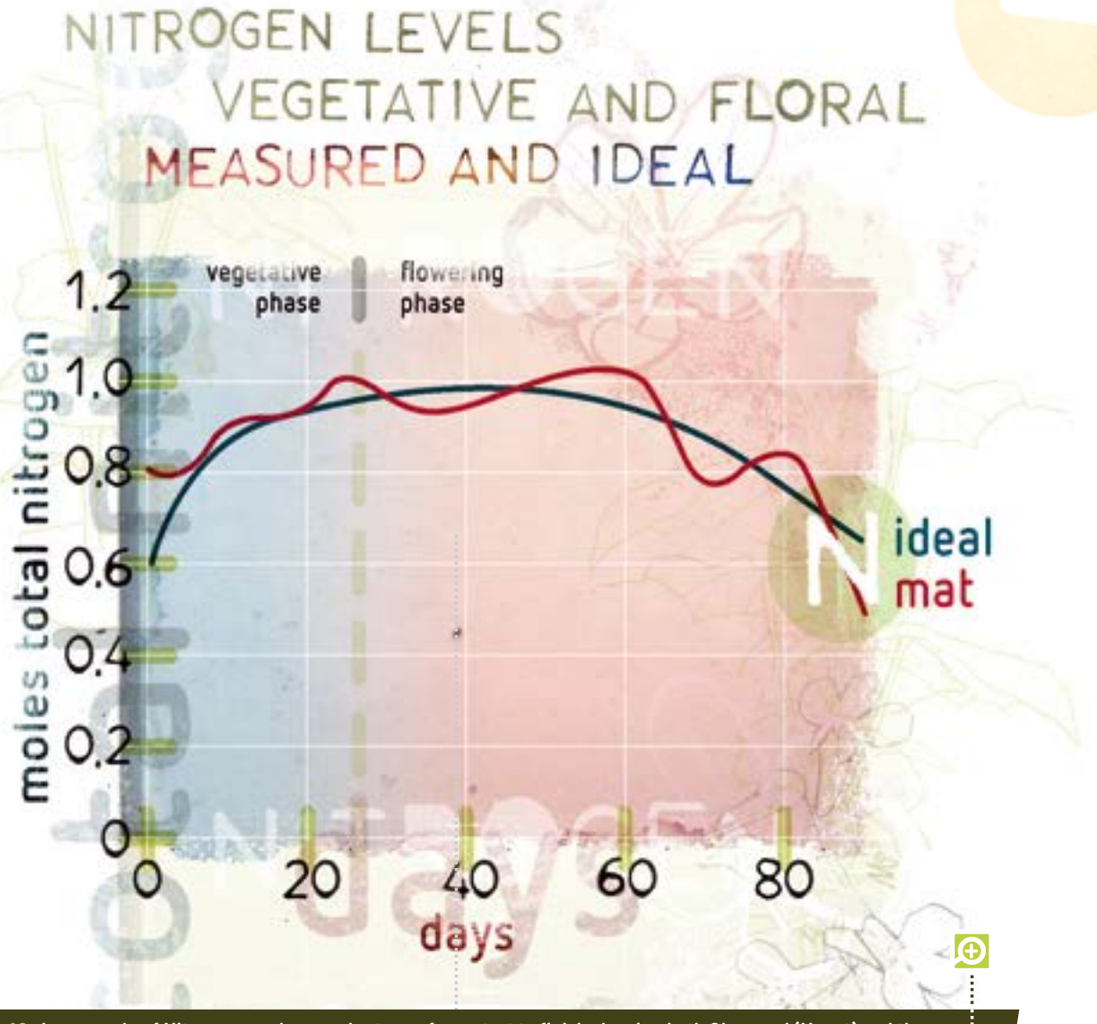

Figure 10: An example of Nitrogen needs on a plant crop from start to finish showing both Observed (N mat) and the correct level to provide (N ideal).

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What to look for

What should the Grower be looking for? First a grower must decide if they are going to use an off-the-shelf version of a complete fertilizer or build their own. Off the shelf must be designed for their plant/ crop and the methods they will use to grow them. Building a fertilizer takes some extensive knowledge of chemistry and horticulture; this is generally not the best method for growers of smaller commercial operations or hobbyist.

Phosphorous can be applied in many formulations based on the base mineral it is derived from. Base minerals have other elements associated with them, some good, and some not-so-good. For example, monopotassium phosphate with an NPK analysis of 0 – 10 -11 commercial and 0 – 4.4 – 9.13 elemental so it applies Potassium (good) as well. Or sodium nitrate with and NPK of 15 – 0 – 0, with 15% N elemental, but it also includes Sodium (not so good).

The bigger the Phosphorous number the less will be applied, so make sure that it is small enough to not make costly mistakes when applying smaller measured amounts. Bigger numbers may or may not decrease unit cost of Phosphorous as it is based on a different mineral which sometimes has costly other materials attached. Diammonium phosphate has an NPK of 21 – 53 – 0; the nitrate is expensive and the composition of the product is going to require some balancing with other components and care in application as it is very acid forming. Using an off-the-shelf version will probably offset most of these issues and make for an easier application process.

The grower should be aware of two issues: the first is nutrient contamination and the second is the fact that nutrient sources will vary in characteristics and availability. Some nutrient constituents become contaminated with other elements either through the mining or the manufacturing process. Contaminants such as lead or other heavy metals can accumulate in the plant to injure the plant or the consumer. Some nutrient constituents can have adverse effects on pH, be less soluble and therefore less available, or can be in a less than desired form. The ammonium ion, while an acceptable source of Nitrogen, becomes less acceptable as the concentration increases to the point of becoming toxic. So, the grower should look for nutrients that are high quality, clean, and designed correctly. Find or request the heavy metal analysis for the nutrient line before using, this will tell how clean they are.

For complete fertilizers, the grower should be dealing with a quality company that has their success in mind, one that does the research, in a legitimate manor, and maintains high quality standards. This holds true for both ways of fertilizing. This is especially true for complete fertilizers or fertilizer lines and it goes further. The company should understand all the relationships that affect delivering nutrients to the plant and should never, never attempt to sell their products based on the shortcomings of their market's (consumer's) knowledge levels.

A good company will educate the market and hold true to the science: a market oriented company will sell the glitz and make the science fit its ends. •

Photo courtesy to Scot Nelson by CC BY 2.0

Figure 11: Phosphourus holds a key position in both cell processes and total energy transfer of the plant. It's also an essential building block for cell walls and DNA. This plant has a phosphourus deficiency, recognizable by the purple/black necrotic leaf parts. The leaves are becoming malformed and shrivelled.

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Grower's TIP #29

By your friend SEZ

PHOSPHO-BOOM!

Years ago, I read an article named "The unending abuse of phosphorus to enhance flowering" and even back then the article was already dead on! Growers were under the spell of an unstoppable frenzy. Only one thing in mind: how many types of phosphorus can we get our hands on and how soon can we start...? Nutrient manufacturers and their marketing people quickly caught on...

Sadly, things have not changed much since. Maybe it is marketing propaganda, which shamelessly portrays phosphorus not only as a way to boost yields, but also simply as the gasoline, the nitro, the rocket fuel of your success. Or perhaps just an antedote to a general lack of horticultural knowledge?

Truth is, plants do require phosphorus in large quantities, but it is not used in the same way that our bodies use sugars. Phosphorus is not a 'fuel' to be 'burned', but it actually gets recycled inside the plant. So giving your plant more does not provide a bigger 'boost', because a plant can only use a certain amount of it in relation to its size and constitution. And in any case, base fertilisers usually supply plenty of it. CANNA nutrients certainly do.

It's not all propaganda though. It is completely true that certain crops may require more phosphorus at certain points in their production cycle, usually when they are in mid bloom. As the amount of plant material increases in quantity, a little extra must be applied, since more phosphorus is required for all the different biological processes to happen in as efficiently as possible throughout the whole plant.

However, when too much unneeded phosphorus is applied, many things may happen - namely:

- growers waste their money;
- salts build up in the growing medium, leading to many other problems;
- other essential nutrients like calcium become less available;
- crop quality goes down;
- phosphorous gets leached out into the environment.

That last point should have all you phosphorus addicts concerned, because we are seeing more and more lakes and waterways being 'off limits' and fresh water supplies being shut down because of cyanobacterial blooms (also known as blue green algae). Now, those algae really are phosphorous addicts and they can never get enough of your Phospho-Booms. And we all need fresh water. So think well, use well.

Good luck and happy gardening.*

*Author unknown. This article has been shamelessly recopied all over the web with several people claiming to be the original author. Well, whoever the real author is, kudos, because way back then you already saw this issue with clarity. Cheers from your friend SEZ.•

Puzzle&WIN

Here's a brand new Soduko for you guys, and it's not too difficult! So you can probably claim your prize already! If you are lucky enough to be picked, of course. But if you don't try your luck, you will never win. So make yourself a cup of tea and get your brain in gear.

WIN A 1-LITRE BOTTLE OF CANNA RHIZOTONIC

6				2		5		
	8	4		3				
			5		9	1		
	7		6				9	
2	9	8				7	6	5
	5				2		1	
		2	7		6			
				1		2	7	
		7		8				9

PRIZES PRIZES

Never done a Sudoku before?
Here's what to do: each row, column and 3 x 3 grid must contain all the numbers between one and nine, with each number occurring once only.
Let us know what your solution is (sending the middle part of the puzzle is enough for us to check) and you could be the lucky winner of a 1-litre bottle of CANNA RHIZOTONIC.

Winner puzzle#27

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

Congratulations on your CANNA Coco Brick. We will contact you as soon as possible to organize the dispatch of your prize.

Facts

PASSIVE SMOKING PLANTS

Passive smoking isn't only something that people have to cope with, but plants too. This is because some plants are actually able to take up nicotine from cigarette smoke, while others that grow in contaminated soil absorb it via the roots as well. This might explain why high concentrations of nicotine are often found in spices, herbal teas and medicinal plants, despite the fact that this alkaloid is no longer permitted in insecticides. Surprisingly, a large number of food crops and plant-derived products still contain very high levels of nicotine. A German team of researchers wanted to find out whether there are other reasons at play than the possible illegal use of nicotine-containing insecticides. They used peppermint plants, which contain minimal traces of nicotine, in a series of mulching and fumigation experiments. Tremendously elevated nicotine levels were detected after fumigation with cigarette smoke

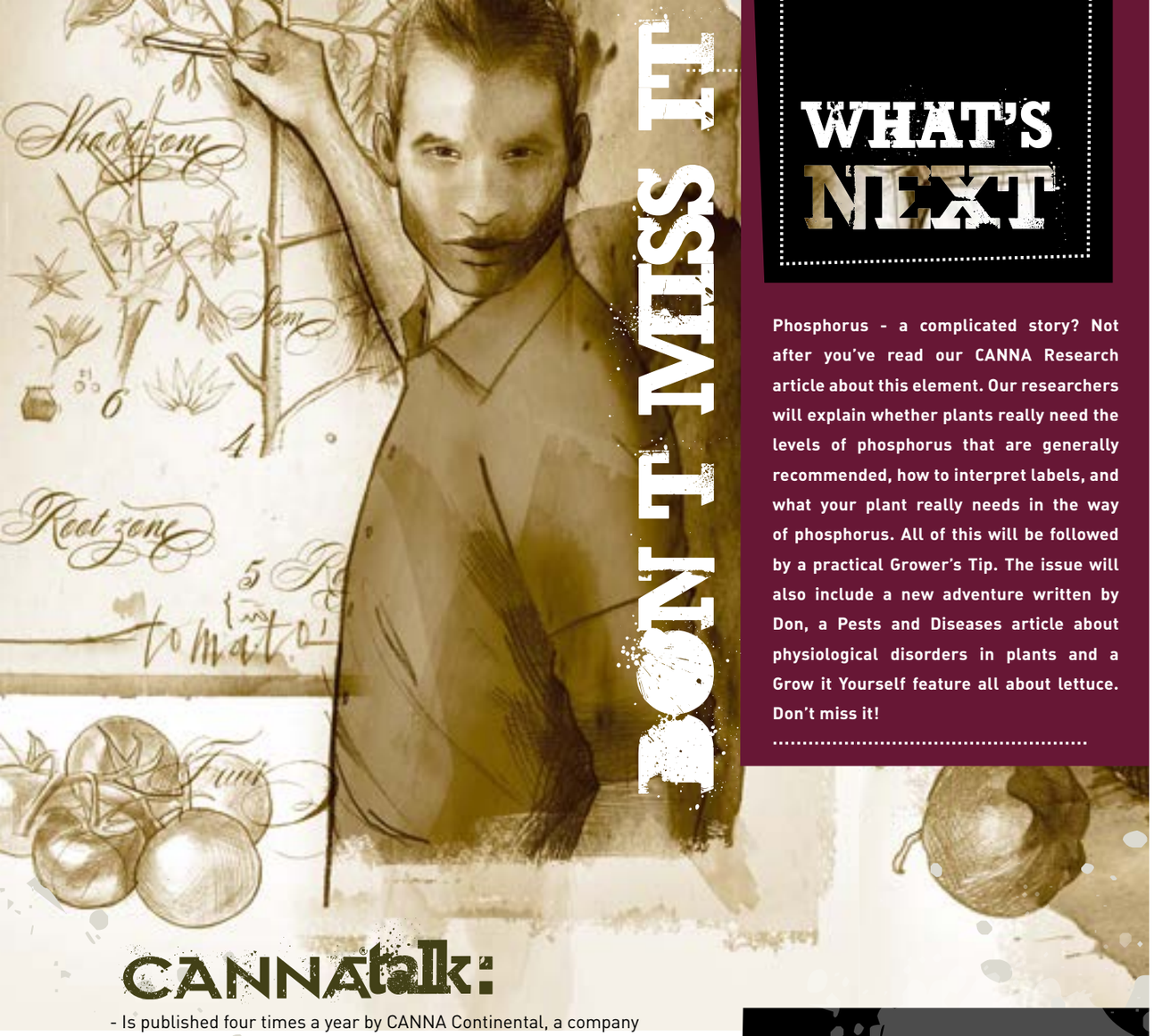
NITROGEN-EATING BACTERIA

How can nitrogen be safely and sustainably transferred into the soil? Nitrogen-eating bacteria may be the answer researchers found. An international team of researchers, including scientists from the U.S. Department of Energy's Brookhaven National Laboratory, has tracked nitrogen as soil bacteria pull it from the air and release it as plant-friendly ammonium. This process is called biological nitrogen fixation or BNF and is found to substantially promote growth in certain grass crops, offering new strategies for eco-friendly farming. The scientists measured the effects of two BNF soil bacteria, Azospirillum brasilense and Herbaspirillum seropedicae, on growth of the grass Setaria viridis. The study shows the first direct evidence of BNF by tracking the presence of a nitrogen radiotracer as it was absorbed first by the bacteria and then moved through the plant. The results revealed substantial increases in height, weight, and root length.

EARLY BUDS OF SPRING

Scientists at the John Innes Centre have discovered why the first buds of spring come increasingly earlier as the climate changes. Dr. Steven Penfield at the JIC found that plants have an ideal temperature for seed set and flower at a particular time of year to make sure their seed develops just as the weather has warmed to this 'sweet spot' temperature. This sweet spot for the model plant Arabidposis thaliana is between 14-15°C. Seeds that develop in temperatures lower than 14°C will almost always remain dormant and fail to germinate. This allows the mother plant to produce seeds with different growth strategies, increasing the chances that some of her progeny will successfully complete another generation. As the climate changes the sweet spot for seeds comes earlier in the year, so first flowers bloom correspondingly earlier too. That's why it feels like spring comes earlier in the year.

Photo courtesy to: Jürgen Berger / Max Planck Institute for Developmental Biology



DON'T MISS IT

WHAT'S NEXT

Phosphorus - a complicated story? Not after you've read our CANNA Research article about this element. Our researchers will explain whether plants really need the levels of phosphorus that are generally recommended, how to interpret labels, and what your plant really needs in the way of phosphorus. All of this will be followed by a practical Grower's Tip. The issue will also include a new adventure written by Don, a Pests and Diseases article about physiological disorders in plants and a Grow it Yourself feature all about lettuce. Don't miss it!

CANNAtalk:

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

Editor: Ilona Hufkens
Email: editor@cannatalk.com
Co-editor: Marleen van Merode
Printed by: Koninklijke Drukkerij E.M. De Jong

Contributors issue 29:
CANNA Research, Marco Barneveld, Mirjam Smit, My friend SEZ, Don and Nicky, Toby Adams.

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

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The CANNA COCO quality in a brick

2 x 10 Liter

Washed and buffered

RHP certified

Easy storage and transportation

Expands extremely fast

Re-usable

Multi functional packaging

CANNA COCO

The high quality, buffered coco that CANNA is known for is now available in a brick. One that makes a real difference! It has a specially designed hole which makes it expand faster than you have ever seen before. The packaging functions as a bag in which the brick is designed to be soaked. And its grip handles make it even easier for you. Want to see the hole difference? Check out the CANNA website.

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