


pH Manifesto

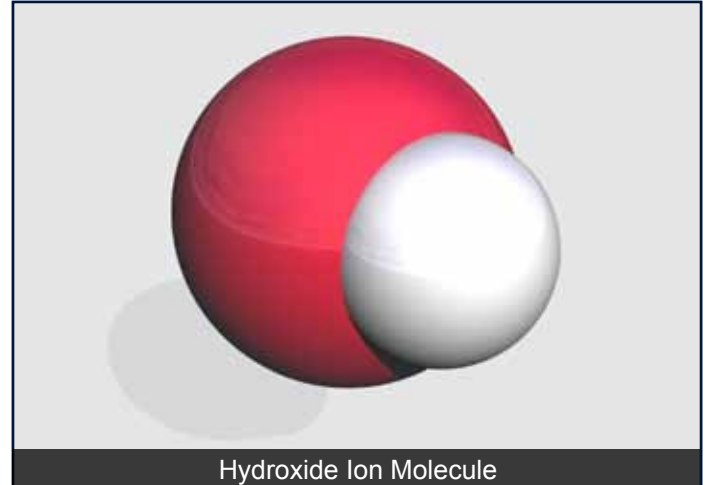
Your Buried Treasure of Growing Secrets

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- **If you want bigger buds and yields, you MUST control your pH in this one spot ... because ... it's the most important link in the growing chain! ... Page 9**
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 - **A perfect growing medium? It sounds outrageous, but this one combination is easy-to-use, inexpensive, pH friendly, charged with NPK, a wetting agent, and gives excellent aeration—it makes getting bigger yields almost automatic! ... Page 14!**
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pH Manifesto

Your Buried Treasure of pH Growing Secrets

One of the biggest misconceptions in hydroponics growing is that the pH in your nutrient reservoir is the single biggest thing having to do with pH that affects the outcome of your crops.



Well, it's simply not true. **It's actually the pH and alkalinity of three things:**

1. **YOUR WATER.**
2. **GROWING MEDIUM.**
3. **NUTRIENTS.**

Unfortunately, this circle of big bud getting power isn't talked about, and it's responsible for more growers silently losing loads of buds and quality they weren't even aware of.

Let me explain...we're going to have to get a little technical here, but not too much. So let's take a journey and uncover the really important points about pH so that we can leverage it to get you bigger yields.

First Things First

OK, pH stands for potential hydrogen and is actually a measurement of hydrogen and hydroxide ions, and is measured on a scale from pH 0 to pH 14.0 with pH 7.0 being neutral, aha, so we're interested in those pesky little hydrogen and hydroxide ions. They're the culprits? Yes they are. Here's how.

When your water, growing medium or nutrient solution is acidic (below a pH of 7.0) it contains more hydrogen ions than hydroxide ions. And when your water, growing medium or nutrient solution is alkaline, also referred to as base or basic (above a pH of 7.0) it contains more hydroxide ions than hydrogen ions.



Almost all the world champion growers who I've talked to have powerfully harnessed and utilized the synergistic punch that the circle of big bud getting power delivers to their prize winning crops. This report will show you how to start putting it to work for you immediately.

And these hydrogen and hydroxide ions interact with each other and perform a balancing act of sorts that determines the pH in your water, growing medium and nutrients.

Don't Sweat It

Wow that's a lot of stuff, but it's important you understand all this because it's one of the keys to you getting bigger and better yields.

Anyway, these hydrogen and hydroxide ions are also in the elements that make up our macro and micro nutrients of the nutrient solutions we use to grow our plants with.

And because of this the elements that make up our macro and micro nutrients are classified into two distinct groups. One group of elements are called cations and contains more hydrogen ions. The other group of elements are called anions and contain more hydroxide ions.

Also our growing medium pH is dramatically affected by these cations and anions contained in the macro, micro and secondary nutrient elements we use. Remember this because it's important and we'll be referring back to this in the growing medium and nutrients sections.

Mastering The Subtleties Of The Balance

The macro, micro and secondary elements that are cations are urea and ammonium (both are forms of nitrogen), potassium, calcium, magnesium, iron zinc, manganese copper and cobalt.

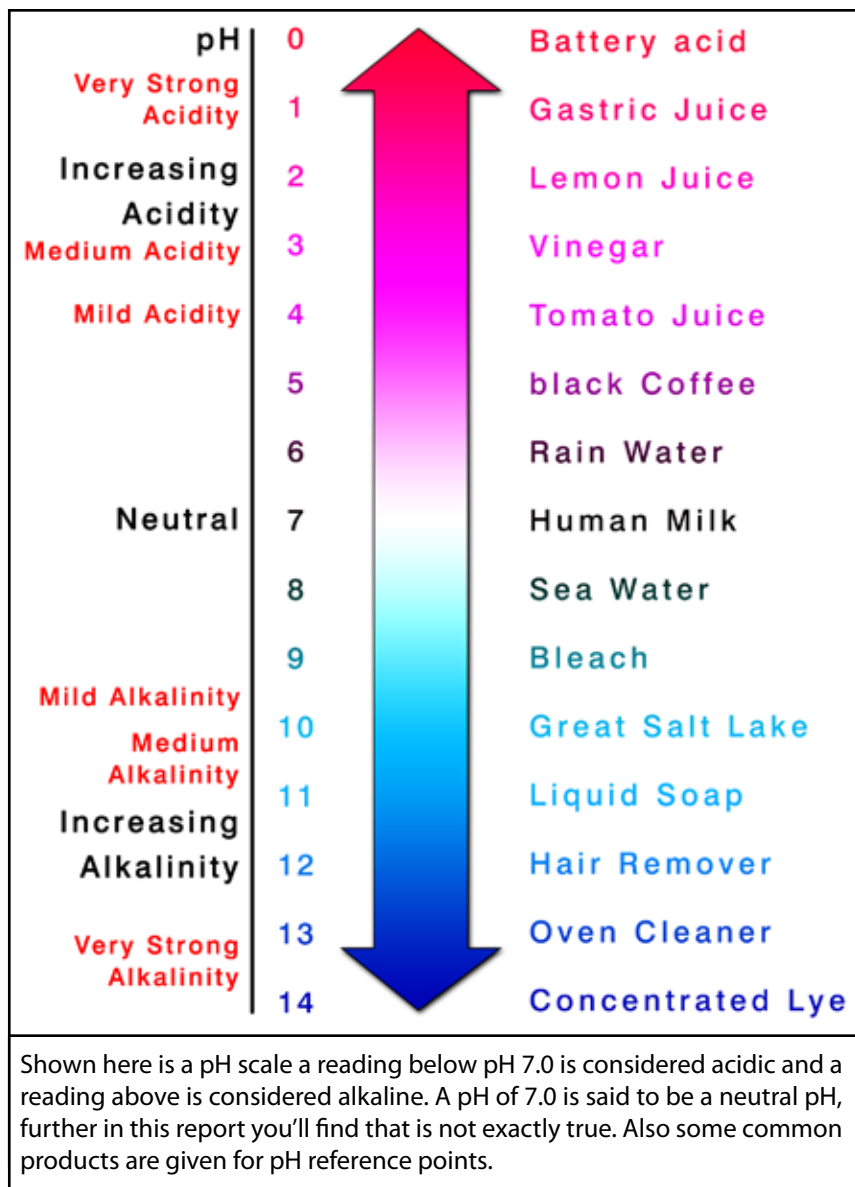
And the elements that are anions are nitrates (another form of nitrogen), phosphates (phosphorus) sulfates, carbonates and bicarbonates. This list covers the most common cations and anions. This topic will be covered more in the nutrient section.

So what does all this stuff have to do with you getting bigger yields? Well a whole lot. We're almost there.

These three things, your water, growing medium and nutrients powerfully form a circle that when kept in balance with each other truly hold the keys to the buried treasure that is commonly overlooked and waiting to be unlocked in a grower's garden.

And the best part, it will absolutely give you bigger more consistent and higher quality yields when fully understood and implemented.

So let's explore this circle of power a little deeper...



Your Water

Misconceptions About Your Nutrient Solutions pH

Like I mentioned earlier, the most common misconception is that the pH of your nutrients is the most important factor that will drive your plants ability to give you bigger yields.

You would think that your biggest concern would be about the pH in your reservoir. This is just not true.

You should be more concerned with your water's alkalinity. This is one of the major culprits that will affect your yields. In fact, one of the biggest problems with water is its alkalinity.

This is something that must be taken care of if you really want to easily manage the pH of your nutrients and growing medium and get those bigger crops.

The Simple Truth Of "Alkalinity"

And what is this "alkalinity", anyway?

Your water is not just water. There is a lot of other stuff in it. The alkalinity of water is the concentration of all sorts of ions in it, like calcium, magnesium, sodium, potassium, both come in the forms of carbonates



Field Crop Pumping Station — Here's one of the critical steps farmers — who grow field crops that are irrigated — take to ensure they get the best harvests possible. To do this they inject acid directly into irrigation lines to neutralize their source waters alkalinity. Then depending on the desired pH of their growing soil they will use a cation rich fertilizer to bring the soil's pH down or a anion rich fertilizer to raise their soil's pH. The field pumping station above also filters the source water.



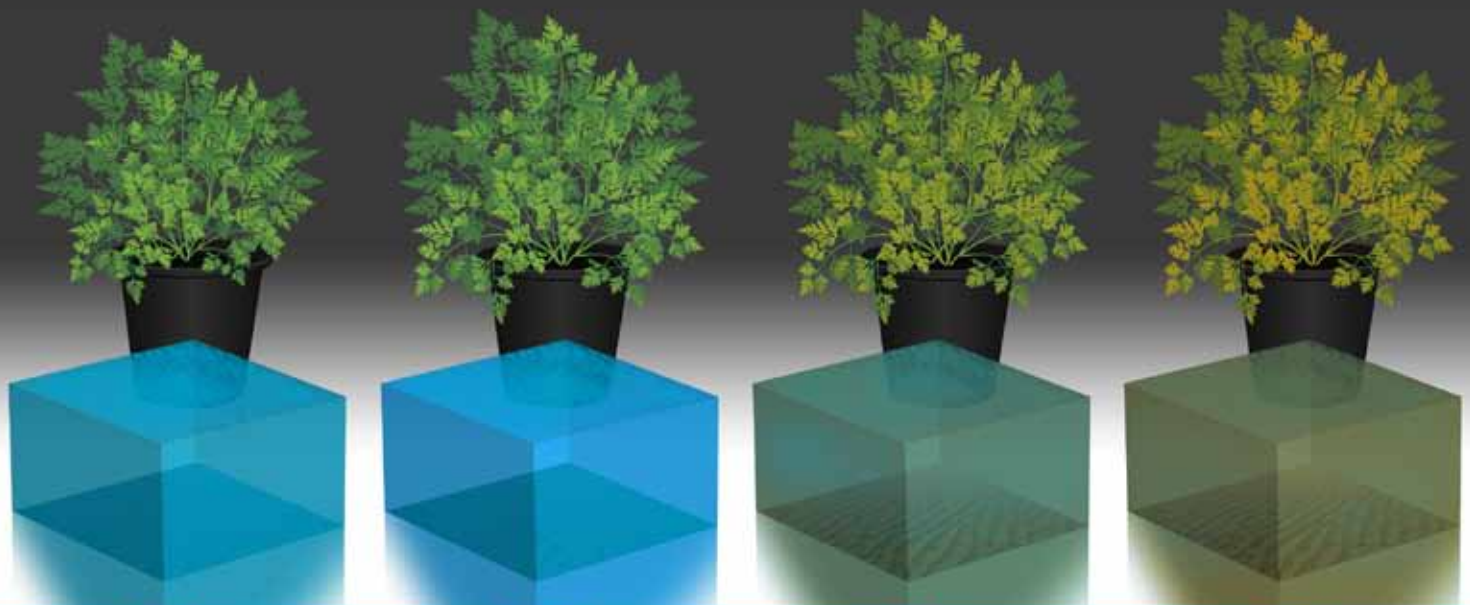
Unfortunately, more growers' money goes down the drain every single day — and its not your fault — because of the lack of information that has been given to us. Oh sure the PhD's know this stuff but they're not putting it out to us in plain English. And no hydro books have covered all this in great depth. And quite frankly I find that puzzling. Because the importance of water, nutrients and growing mediums all working together will absolutely give all of us bigger yields.

and bicarbonates. And bicarbonates are the worst offenders of the two.

Making matters worse, alkalinity insidiously accumulates in your growing medium in a vicious cycle that will cause your growing medium pH to climb faster than a speeding bullet and give you pH stability problems in your reservoir and growing medium, substantially decreasing your yields.

Vicious Cycle of Alkalinity

High Alkalinity Water Will Decrease Your Yields Even With Your Nutrient Solution at pH 5.6. Here's How...



Week 1
Nutrient solution pH 5.6
mixed with high alkalinity
water. Healthy plant.
Growing Medium pH 5.6

WEEK 2
Nutrient solution pH 5.6
mixed with high alkalinity
water. Healthy plant.
Growing Medium pH 6.2

Week 3
Nutrient solution pH 5.6
mixed with high alkalinity
water. Plant is compromised.
Growing Medium pH 7.0

Week 4
Nutrient solution pH 5.6 as
alkalinity accumulates.
Plant health deteriorating.
Growing Medium pH 8.5

When the amount of alkalinity in your source water hasn't been measured and is then used to mix your nutrient solution - even with a properly pH balanced nutrient reservoir - your plants can suffer from a continuous build up of alkalinity that will silently sneak up on you and quickly raise your growing mediums pH, locking out your plants vital elements, and hijacking you from your crops true harvest potential.

In fact, farmers who have to irrigate their field crops and have alkalinity in their water supply have to continuously inject different types of acids - depending on what the farmer is trying accomplish with the crop and soil - into their irrigation lines to counter balance their alkalinity. An easy way to think of alkalinity is pH up. Unfortunately a very bad form of pH up. Once alkalinity is neutralized, fertilizer is then injected into the lines.

Here's something to think about, depending on what crop is being grown, the fertilizer being injected will be balanced with the correct cation to anion ratios for that crop's soil pH requirement. If they need to lower their soil's pH they'll use a fertilizer that has more cations than anions. And if they need to raise the soil's pH they will use a fertilizer with more anions than cations. We'll go over this more in the nutrient section.

And then there's the subject of water hardness. Shouldn't you be concerned about that? Well, It's important not to confuse water hardness with the alkalinity of water. These are two different things.

Here's The Difference:

"Hardness" is the measure of the combined concentration of insoluble calcium and magnesium in the water, not the presence of the carbonates or bicarbonates mentioned earlier.

Using a water softener to handle the hardness will only displace the calcium and magnesium ions and leave the carbonates and bicarbonates behind, which doesn't change the alkalinity at all. So this is not the thing to do. And a BIG WARNING, using a water softener will add unwanted sodium to your water severely decreasing your yields.

If you're using well water it is almost guaranteed you will have alkalinity problems. In fact most municipalities have water that is poor quality and has alkalinity. I have personally seen municipal water that's 900 PPM and chocked full of alkalinity.



Magnified Calcium Carbonate

Here's the thing, if your water is 30 PPM or below you're safe. And I've seen city water that has less than 10 PPM, Vancouver, Canada being one of them. Anything over 30 PPM and you should invest in a reverse osmosis system

Let's Explore How To Measure And Manage All This

So now the question arises, "how do we measure alkalinity?" Well, the way that alkalinity is measured is how much carbonate and bicarbonate is in the water.

Alright, so now we have to test the water. But how do we do that? Well, there are several ways to test water alkalinity. One way is with an alkalinity meter (which measures it in PPM) which is quite different than an EC meter.



Potassium Carbonate

Calcium and Potassium Carbonate are a major contributor to alkalinity that will steadily raise your pH in your growing medium.

As an aside you can use an EC meter to do a quick check but it is not the same measurement. And the least expensive way to check your alkalinity is with a test kit where you add dilute acid until a color change occurs at a specific pH.



Hach Alkalinity Meter- Shown here is the Hach digital alkalinity meter it's used to check for the harvest robbing alkalinity of your source water. It costs a couple hundred dollars, for the same price you can go out and buy a reverse osmosis system and not have to worry about your waters alkalinity.

Now, you can get a digital meter for about \$200 at www.hach.com. But if you want to go easier on the pocketbook, there are kits as cheap as \$30 to \$40. And you should get one that uses titration which is actually the most accurate method of testing.

Here's Something Interesting About pH Readings

OK, so that seems simple enough, but now I'm going to add just a little variance into the subject to make it more interesting. Taking pH readings during the light cycle will give you a different result than when you take pH readings at night.

The reason for this is, during the dark periods, both microbes and the plants are resting and give off alkaline molecules and the pH tends to go up a bit. During the day the plant and microbes are active and they give off acid molecules which make the pH go down some.

If you're running a recirculation system this is important to consider, especially because your tank should be outside your grow room. And you might be taking your readings when your plants are in their dark cycle.

The Best Way To Measure PPM

One way people have measured the PPM is with TDS (total dissolved solids) but I would not advise this because TDS was intended for determining the acceptability of drinking water, not nutrient solutions.

Instead use a meter that measures EC (Electrical Conductivity) this type of meter was made specifically for measuring nutrient solutions.



An assortment of different manufacturers EC meters- EC meters are made to measure fertilizer solutions. TDS meters measure total dissolved solids and were originally designed to check drinking water not nutrients.



RO System Wall Mount And Commercial Units- Pictured on the left is a typical wall mount unit that will produce around 25-50 gallons per day. On the right is a commercial system that produces 200 to 500 gallons per day. WARNING: When you get your RO system DO NOT get a water softener with them, because they will put unwanted sodium into your nutrient solution and substantially cut down on your yields.

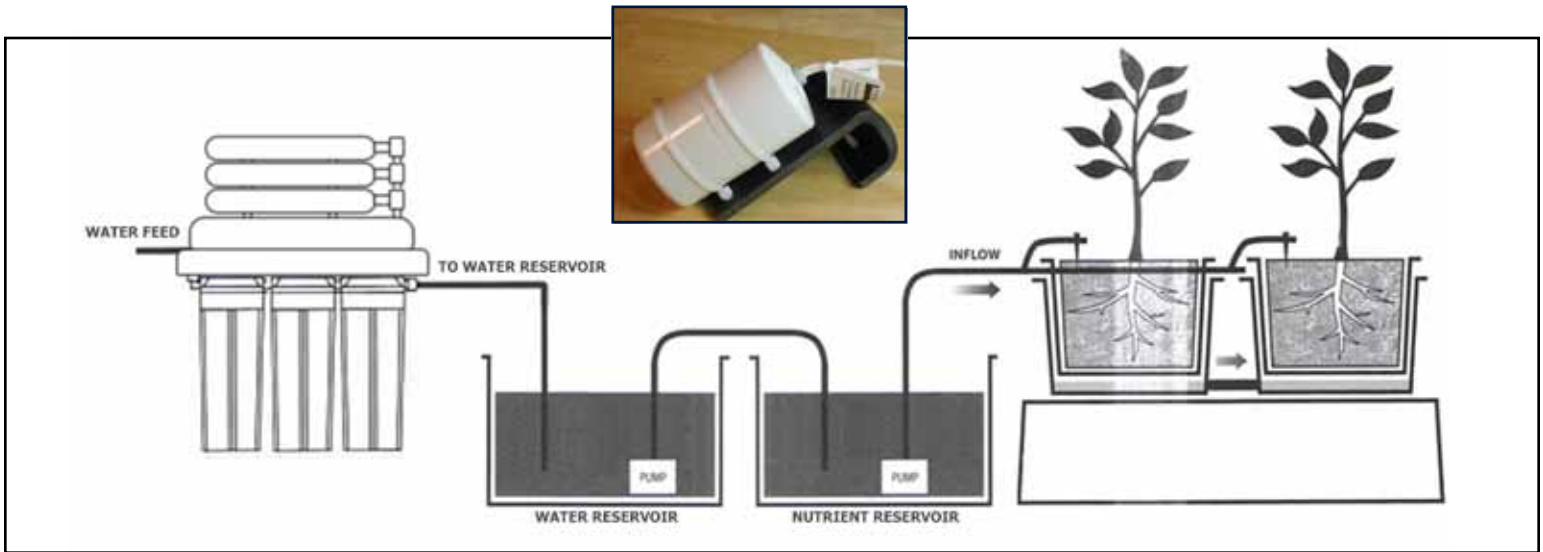
Here is one of the biggest secrets the best growers in the world figured out along time ago: if you want a world class crop you have to use really great water.

And a very simple way to ensure that is get a reverse osmosis water system. It's an absolute must for bigger yields.

You May Want To Read That Last Line Again...

Think about it, you spent all that time and hard work building your grow room and in the final hour you skimp on the water, it just doesn't make sense, you really should invest in a reverse osmosis system.

They aren't that expensive these day, prices start for under \$100. A reverse osmosis system will take the alkalinity out of your water and give you bigger yields. And obviously alkalinity is one of our limiting factors we want to get rid of, isn't it?



Float Valve System Diagram Of RO Storage And Reservoir — Pictured above: is a tank mount float valve shut off set up. Reverse osmosis systems are priced and rated by how many gallons or liters of water they produce in a 24 hour period. Because of this a lot of growers run theirs 24 hours a day into a separate reservoir. So to avoid over flowing your reverse osmosis water reservoir a float valve shut off should be installed.

When You Invest In RO Remember These Tips

One word of advice: you should have a tank mounted shut off float valve installed on your R.O water storage tank and nutrient reservoir that shuts off automatically when the tank is full, and you should keep your nutrient tank topped off because, as water level lowers, the pH will be magnified as either acidic or alkaline. You can get one at: www.autotopoff.com/products

One Last Thing About Your Water

Now here is the last thing I will say about the water you use and then we'll take a look at the growing medium. There is one more thing to pay attention to when it comes to your water. The temperature is important as well.

Cooler water holds more oxygen as well as affects your pH level, but if it is too cold, it will cause your pH to rise, and if too warm, it will cause it to go down.

Here's a little known fact, excessively high water temperatures above 79°F or 26 °C start to negatively impact your plants ability to absorb macro nutrients.

High temperatures also encourage fungal and bacterial diseases, and you don't want that either. In fact, it is best to maintain a nutrient reservoir temperature of 65°F or 18°C to 69°F or 20°C. And colder water holds a lot more oxygen.

And here's another fact, scientists who study our oceans consider warm tropic waters to be the "deserts" of the oceans because they contain way less life than the colder waters of the Arctic and Antarctic oceans, that are teeming with life because of the colder water temperatures holding more oxygen.

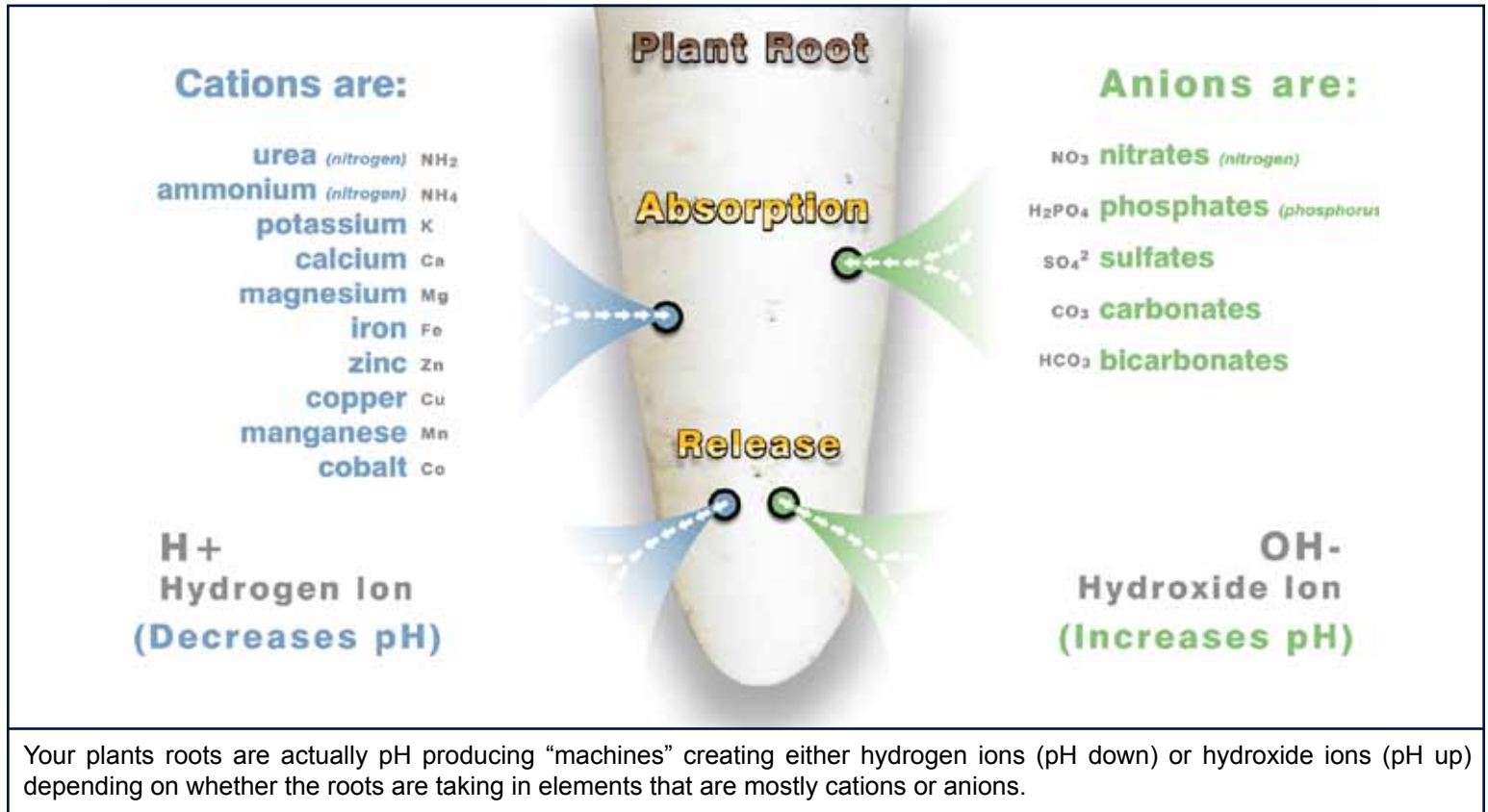
In the end if you want bigger yields go out and buy a reverse osmosis system it will be some of the best money you'll ever invest in your grow room.

All my labs grow rooms use reverse osmosis water. In fact it's so important all Advanced Nutrients products are made with ultra pure zero PPM and zero alkalinity reverse osmosis water.

Your Growing Medium

The Secret Beneath Your Plants

OK, let's explore your growing medium – A lot has been said about measuring pH in the nutrient solution, but where the real money is being won or lost by the buckets full, is in the actual growing medium itself.



Here's why... your plants' root system is actually a pH excreting machine that manufactures and pumps hydrogen ions (pH down) or hydroxide ions (pH up) directly into your growing medium and will directly change the pH of the growing medium depending on the elemental composition of your nutrients make up.

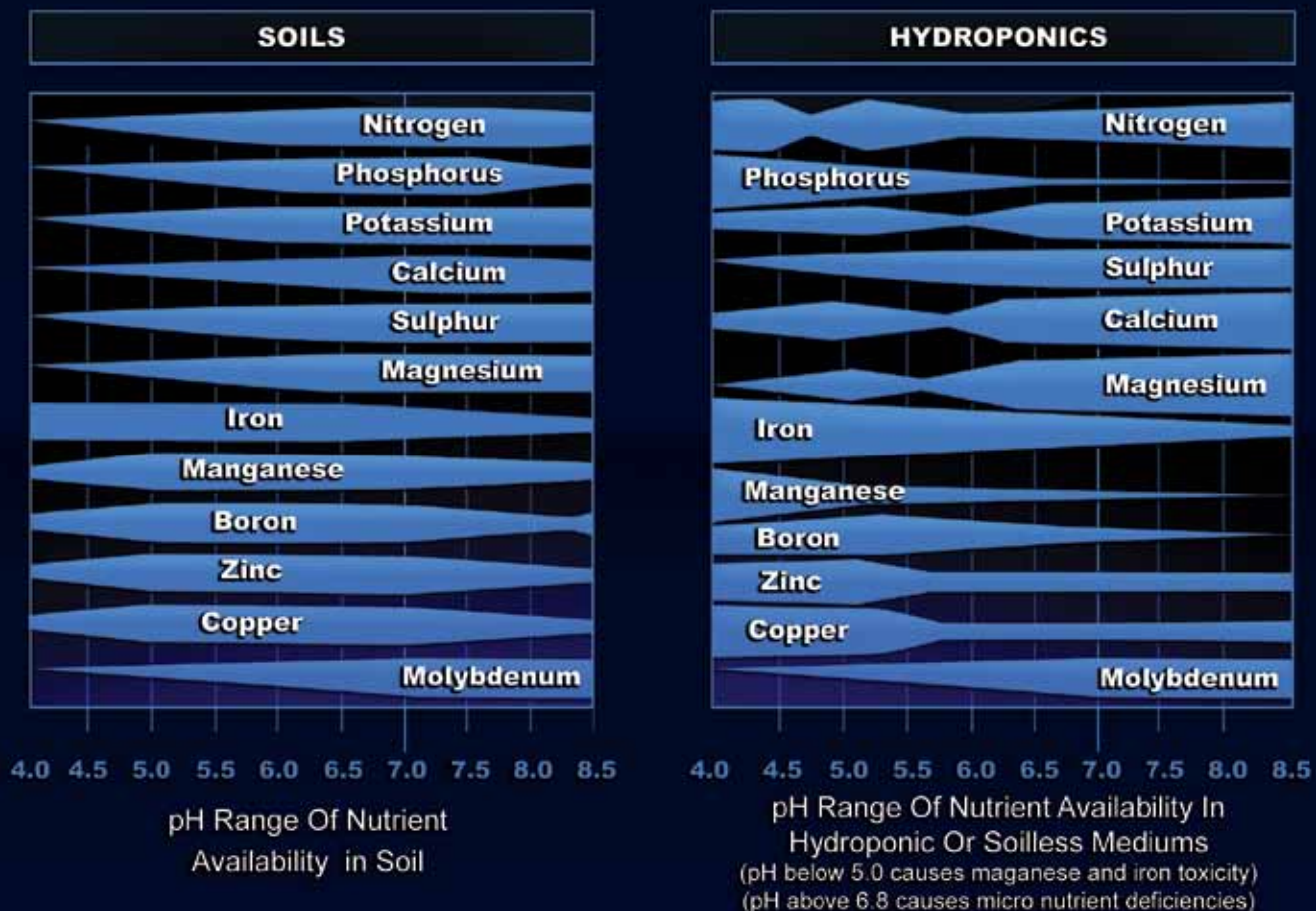
And you can imagine how having a thorough understanding of this is going to give you even more control over your plants that will lead to bigger yields, right?

The Most Important Link In The Chain

Out of the circle of big bud getting power, it's your growing medium that you need to be most concerned about. Because if you want a really great crop, your plants must have an acidic pH growing medium. In most cases your pH will be climbing and your challenge will be to keep your pH from going up.



How pH Affects Non Chelated Plant Nutrient Uptake & Availability



Here's the typical pH absorption range of non chelated elements in soil and hydroponics.

Sure, the water, the growing medium, and the nutrients should all have to work in perfect harmony with each other, but it's the roots in the growing medium that drives the pH chemical reactions that is the most overlooked by growers and it's not your fault it's just most books out there don't go into great depth about it.

And naturally this is very important because, the pH in the root zone is going to determine the availability of nutrients and your plants ability to produce world class buds. And we all want to grow kick ass buds, don't we?

It's This Sort Of Knowledge That Leads To Real Mastery In Growing

You just got another gem that's not even talked about or even considered by most growers, except by growers who have a very deep understanding of plants. And this is where your big money is going to be made or lost.



So you see, it's going to be essential then if you want big consistent yields, you should check your growing medium pH every week.

An Important Lesson To Nutrient Company Owners

I have extensively tested the competitors hydroponics nutrients, and unfortunately the vast majority of them don't work with the plants root system to even remotely come close to maintaining a stable or ideal pH in the growing medium. Because they use too much nitrates as there source of nitrogen .

Here's the straight goods... and an education for a lot of the nutrient manufacturers out there, to balance a growing mediums pH, nutrient manufacturers must be using the correct balance of cations to anions to guarantee you the right pH in your growing medium.

And...One more thing, the right balance of elements (cations to anions) that will give you a stable and ideal growing medium pH is different from plant species to plant species.

And by not being aware and acting on this vitally critical piece of knowledge is exactly like growing with one foot on the gas and the other foot on the brake at the same time.

Why Would Anybody Work Against Themselves Like This?

So why are nutrient companies not building there products with this in mind?

Well, I will give you two reasons for that. One is the high expense and the other is the amount of research and knowledge needed to prepare the nutrients for a specific type of plant.

I admit it... I go on the forums every once in a while, and it always amazes me when I see people making statements like, "all base nutrients are the same and salts are just salts".

Think about it... is there a difference in the foods you eat. Are your sources and quality of proteins, carbohydrates and fats you eat, all the same? Absolutely not, some proteins are assimilated and utilized by your body faster and more completely than others.

And some carbohydrates release quickly and spike your insulin while others are a slow burn and give you sustained energy.

What about fats? Some are actually good for you like Omega-3 and others will slowly clog your arteries and eventually give you a heart attack. Obviously it all makes a difference. And in the nutrient section we'll take a look at this in depth.



What are you really feeding your plants? Your plants macro, micro and secondary nutrients are really a lot like the foods you eat. Think about it, are all sources of protein, carbohydrates and fats you eat the same? No they're not. And its exactly the same for your plants food it eats. Your plants are what they eat.

What's Your Favorite Growing Medium?

Now if you've looked lately, you probably noticed that there is a variety of growing mediums to choose from.

You have sphagnum moss – that stuff from bogs. And there is coco coir, the fiber that comes from the coconut's outer



Rock Wool



Pete Bog Sphagnum Moss Harvest



Sunshine #4 Mix



Coco Coir



Sphagnum Moss



Coco Coir

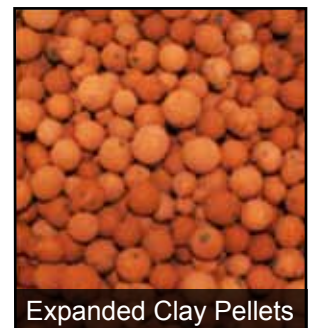
husk. And let's not forget about the special mixes and all the other hydroponic growing mediums.

Now you might want to keep it simple so what I recommend is that you use Sunshine #4 mix. This is a mix that is pretty close to ideal and will save you a lot of work. We'll talk a bit more about that later.

You might even choose coco coir since it is also a good growing medium and has a special line of compatible fertilizers. The thing about different hydroponic mediums is that they have varied abilities to maintain and control pH.



Perlite



Expanded Clay Pellets

So Let's Take A Closer Look At Them

OK, so we had a look at some growing mediums. Now we'll look at them and a few others in a different perspective. In hydroponics, there are two basic types of growing mediums: those that are pH independent and those that are pH dependent. Let's take a closer look at these mediums differences.

Well, each one of them has a certain ability to stabilize or buffer pH, which is another way of saying they have varied abilities to keep the pH from changing on you. This ability is called cation exchange capacity or CEC.

In other words, CEC refers to the ability of the medium to absorb and release cations. Remember the cation stuff I mentioned at the beginning of this report? We'll be looking at this a little bit closer now.

Dependent Vs. Independent

Mediums that are pH dependent have little to no CEC and cannot resist a change in pH and this results in the pH going high or low very rapidly.

So, then, mediums that are pH independent have a high CEC, are more buffered and can resist a change in pH for long periods of time. And that's good! That's what you want.

As an example your everyday, garden, soil-based medium contains some humus and clay and is pH independent with a high CEC because of the humus and clay. They are great to grow plants in because it is not affected by rapid pH swings.

But Indoor Growers Have To Follow Different Rules

Now, hydroponics is different. Many of its mediums have a low CEC and needs to have the pH continually balanced and monitored. More on this later. Of course, there are some that have a higher CEC and are better buffered than others. For example, coco coir and sphagnum moss have higher CEC capacities. This means they are capable of maintaining a more stable pH level. These are said to be pH independent. Sphagnum actually has eight to ten times the CEC as soil pound for pound, but there are other drawbacks.

But not to worry, these could be easily remedied, though no manufacturer has done this yet. You see, Sphagnum doesn't have the bulk density that soil has. After all, it is a moss and is light in weight. But you can add something called calcined clay to solve that problem.

Calcined Clay

All you need to do is add 5% – 7% to your sphagnum growing media. And what is calcined clay?

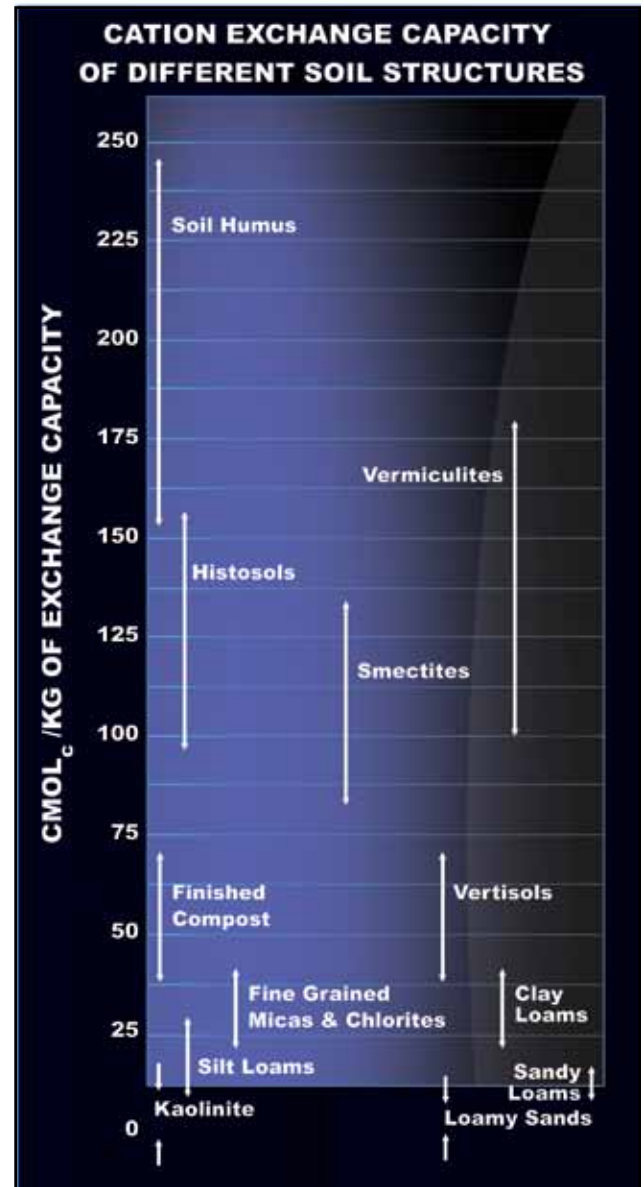


Calcined Clay

Calcined Clay can be added to sphagnum moss and coco coir growing mediums to increase its (CEC) cation exchange capacity so your growing medium will have a much more stable pH.

Well, this is clay that has been heated to drive out volatile materials. One word of caution though. Make sure you use a low sodium source of calcined clay because you don't want extra sodium in your growing medium.

Now what about low CEC growing mediums? Some hydroponic mediums that we use, such as rock wool, expanded clay pellets or perlite, have a low CEC and so they have a hard time stabilizing the pH. We call them pH dependent and, you probably have already guessed by now, you will need to correct the pH more often.



These are the cation exchange capacities of different soil structures at pH 7.0. You can clearly see how important the addition of humus is to your soil and growing mediums ability to hold a stable pH. You can easily build more humus structure in your soil and growing mediums by adding humic and fulvic acids to them. As an aside, if you're an outdoor grower you can now see the importance of growing in soils with high humus values because it will definitely make a difference in getting you bigger yields.

How about the Sunshine #4 mix that we mentioned earlier? Actually this is a very, very good medium. When it comes out of bogs, it has a pH of 3.5 to 4. This is actually too low, so dolomite lime is added to it to raise the pH. (We'll talk about adding dolomite a bit later.) This brings the pH of the Sunshine #4 to 5.8 to 6.3 for a 6 week period.

More About “Sunshine #4” And How It Can Make Your Life A Lot Easier

So what's Sunshine #4 mix made of? It's made of 60% – 70% peat and 30% – 40% perlite. This is the combination you want and gives you excellent aeration which you'll need for great big thick root development. And as hundreds of university studies have conclusively shown the bigger the root system the bigger the yield. And that's what we're after isn't it. BIGGER YIELDS.

It also has a starter charge of fertilizer that gives it an NPK ratio of 6-5-11 meaning it has a ratio of 6% nitrogen (N), 5% phosphorous (P) and 11% potassium (K). All you have to do, then, is add a bit more nitrogen to the mix and this would be a near perfect medium for growing your plants. Sunshine #4 also contains a wetting agent (surfactant) to ease surface tension and allow for better initial water penetration to the growing medium.

Coco Coir (And How To Overcome Its Limitations)

Let's have a look at coco coir. It starts out with a better pH of 5.5. But the problem with this medium is that magnesium and calcium binds to coco and doesn't want to easily release. And that's not good. Your plants need to be able to get to those nutrients.

Now if you add dolomite lime, as a lot of companies out there will do because dolomite is cheap to use and made up of magnesium and calcium carbonate and a source of alkalinity, that will eventually raise your growing mediums pH and this is not what you want to do. So what do you do? You would solve the problem by adding chelated calcium and magnesium either to the coir or in the base nutrients.

Unfortunately, other nutrient companies won't do this because of the very high added expense, but that is exactly what we put in all the base nutrients at Advanced Nutrients. However Advanced Nutrients doesn't make a specific coco nutrient yet.



Coco coir comes from the outer husks of coconuts.

Coco coir also has a lot of potassium so you'll need to use a fertilizer with reduced potassium so you don't end up with potassium toxicity.

There is one other thing to be aware of: low quality coconut husks are often soaked in salt water as part of the manufacturing process to break down the husks and quite often not properly flushed by the coir manufacturer overseas.

You'll need to make sure that the extra salt is flushed out of your medium with water by either yourself or the manufacturer you're buying it from before using it.

This Step Is Very Important

Because if you don't, you will have high sodium content in your growing medium and that will severely reduce your yield when using cheaply produced coir, and this problem is more common than you might think.

If you're thinking about using coco coir as your growing medium, you're going to find coir still has some inherent problems with it that have not been resolved completely, that's why you'll probably have to use a Cal Mag product when growing with coir.

At one point Advanced Nutrients pulled Sensi Cal calcium and magnesium product off the market because we figured if a nutrient was built right you didn't need it. Man, stores started calling and demanded we keep it on the market, so we did.

Here's what the hydro store owners told us was happening: Growers growing with coco coir were using Sensi Cal to fix the calcium and magnesium deficiencies caused by the coir they were using. Which of course told us that there hasn't been a correct coco nutrient formula made yet that addresses the needs of the growers using coir growing mediums.

So, at some point we will bring out a coco coir nutrient and then later on down the road, a coir growing medium that will be perfectly aligned with each other. We'll be doing the same thing for a sphagnum moss growing medium too. Enough of the commercial.

Monitoring Your Growing Medium pH

Remember, we talked about monitoring growing medium pH? One of the most overlooked areas by growers is checking their growing medium pH on a regular basis. That is probably the biggest single culprit for yield inconsistencies from crop to crop and it could be costing you a lot of money.

Let me explain how this happens. As the roots take in an element, it gives off a positive charge, pH down (hydrogen ion) or a negative charge pH up (hydroxide ion), and depending on the nutrient elements being used, some carry more of the same charges than others.

What's more, because of this it affects the pH of the surrounding root area and growing medium. If it's hydrogen ions being excreted, it becomes more acidic, and if it's hydroxide ions, it becomes more alkaline.

How To Measure Your Growing Medium pH

So it's important to monitor the pH levels in your medium as well as your nutrients and the alkalinity of water you are using. So how do you measure your growing medium pH? Basically, there are three ways to do it:

- 1. Saturated media extract – you add distilled or de-ionized water to the medium just to the saturation point and measure.**
- 2. Pour-through method – the water is poured through the pot to replace the water that was in there and collected.**
- 3. Squeeze method – the water that already exists in the medium is gently squeezed out in a measured amount and pH readings are taken.**

In all three of these, you just use a pH meter or color test to measure the pH. The easiest of the three is the squeeze method. If you are using rock wool, you just take one of the cubes after a feeding and you gently squeeze it.

Repeat this with at least six different cubes so that you get a couple ounces or 60 milliliters from each cube. After combining and mixing these six extractions together, check the pH. This tells you what the pH is in the growing medium.

What you're looking for is a pH range of 5.3 to 6.8. In our labs we've extensively tested pH ranges and yields, this is the "sweet spot" for nutrients that are not fully chelated. The range is even wider for fully chelated macro, micro and secondary nutrients.

When your growing medium is coco coir or sphagnum moss, you water your medium to the point of being saturated (but not leaking out the bottom) and then take a sample from the bottom 2/3 of your pot where your roots are most actively growing.



You don't want to take your growing mediums pH readings from the top third of your container because there usually isn't enough root activity there. Instead take your readings from the bottom two thirds of your growing medium where the most root growing activity is to ensure an accurate reading.



pH Meter With Soil Probe — This is a very good growing medium pH meter to use when you're checking your growing medium's pH.

Next...you take the same amount from six different pots and mix them together. Make sure to take the same amount from each pot. Then gently squeeze it and get an extraction from which you will measure the pH. Look I realize that taking samples from grow buckets is a hassle however; it is the most accurate.

There's An Easier Way

A much easier way is to get a pH meter with a metal spike probe and take readings simply by sticking the probe deep down into the growing medium and calculate the average of all six containers.

Now, don't take the sample from the top third of the container, here's why. There isn't as much root growing activity at the top of the soil. So use the bottom two thirds of your growing medium to take your pH readings because that is the active zone for root growth.

There's another reason for taking the samples near the bottom of your container, and that's because nutrients will tend to crystallize near the top and can precipitate out a little bit and will give you a false reading.

Using pH Meters

So now, we should look at the meters we need to measure the pH. There are so many different pH meters available, but get one that uses dual solution to calibrate your pH meter. It's a good idea to get one that auto adjusts and has ATC (automatic temperature compensation).



Laboratory Grade pH And EC Meters- Here are high end laboratory grade EC, pH meters and probes that cost from several hundred to over a thousand dollars.

This will be more expensive but worth it. The cheaper ones are a pain to use while the auto-adjust ones calibrate at a press of a button, which makes it a lot easier. You want to make sure that calibration is done every week.

If you're fanatic to detail like I am you'll want to have a pH meter with ATC because as your nutrient solution temperature changes so does the pH of your nutrients when your nutrient temperature gets warmer your pH goes down and when your nutrient temperature gets cooler your nutrient solution pH goes up.

Here's an interesting side note, a pH of 7 is considered to be pH neutral, but in fact is only an approximation and is accurate only at 25 °C or 77°F. A true neutral pH is when the concentration of hydrogen ions (H⁺) is exactly the same as the concentration of hydroxide ions (OH⁻) and those concentrations are effected by temperature so your pH neutral point varies from pH 7.47 at 0°C or 32°F to pH 6.14 at 100°C or 212°F.

A Good Resource

If you're looking for really high quality pH measuring instruments and electrodes check them out: www.pulseinstruments.net

Bacteria In Your Growing Medium

It may surprise you to find out just how much activity is going on under the surface of the growing medium. There is actually a lot going on there including bacterial activity.

But before we get into that, we need to say a bit about beneficial bacteria and nitrogen. Plants need nitrogen as an essential element for its survival. There is a process that bacteria is involved in called nitrification.

The Role Of Nitrification

Nitrification is a process where specialized beneficial bacteria in your growing medium take the urea and ammonium from the nutrients and convert them into usable forms. Then the plant roots can absorb it and use it for plant growth and development.

Celsius (°C)	True Neutral pH	Fahrenheit (°F)
°0	7.47	°32
°5	7.37	°41
°10	7.27	°50
°15	7.17	°59
°20	7.08	°68
°25	7.00	°77
°30	6.92	°86
°35	6.84	°95
°40	6.77	°104
°45	6.70	°113
°50	6.63	°122
°55	6.57	°131
°60	6.51	°140
°65	6.45	°149
°70	6.40	°158
°75	6.35	°167
°80	6.30	°176
°85	6.26	°185
°90	6.21	°194
°95	6.17	°203
°100	6.14	°212

pH Temperature Chart — Contrary to popular belief a pH of 7.0 is not always neutral, in fact it really depends on the temperature of your nutrient solution as the chart above shows. That's why it's critical to make sure you buy a pH meter that compensates for temperature.

By the way, an important thing that happens in this process is that these beneficial bacteria then give off an acid molecule which actually lowers your growing mediums pH as well. And that's a good thing.

Now, if you have a pH that is too low, nitrification will be inhibited. The same happens when your medium has too low a temperature or there is a lack of oxygen through over-watering. Then the pH goes up and the medium becomes more alkaline. Not good!

Beneficial Microbes Switch Gears At Night

At night beneficial microbes are at rest and respirating, and they give off alkaline molecules instead of acid as they do during the day, and the pH goes up.

Some interesting facts, some microbes give off more hydrogen ions (pH down) in a 24 hour period than hydroxide ions (pH up). And some do exactly the reverse.

Also make sure that you do not over water your plants, and provide a somewhat warm growing medium (65°F or 18°C to 75°F or 23°C) so it will encourage active growth of beneficial microbes. This will help to keep your pH stable, and your growing medium more acidic.

A Valuable Secret!

Here goes... I'm going to reveal something I've never told anyone before. And I'm sure it's going to give my competitors something to start researching into.

Advanced Nutrients beneficial bacteria products have microbial interaction with each other that's balanced in a way that assists your growing medium in holding its pH.

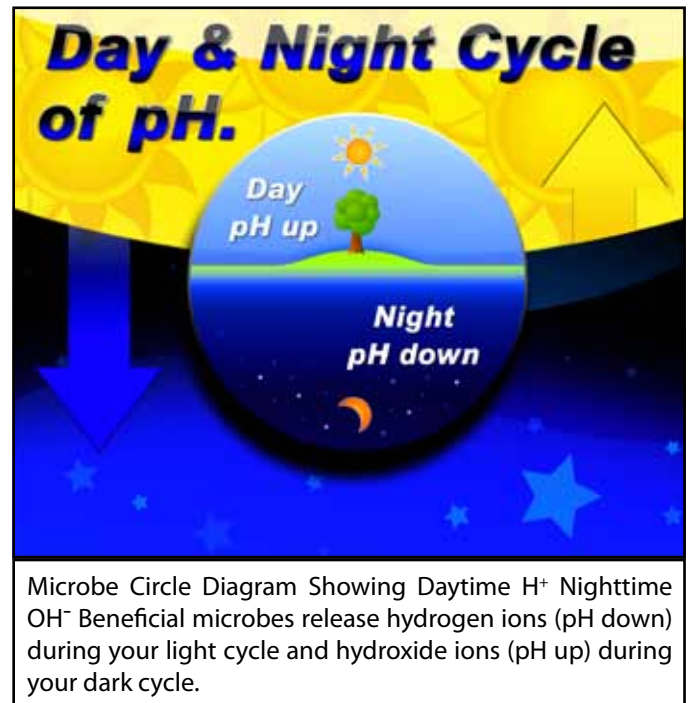
And here's something else you may find interesting. Advanced Nutrients is the only hydroponic nutrient company to breed and produce their own beneficial microbes in house.

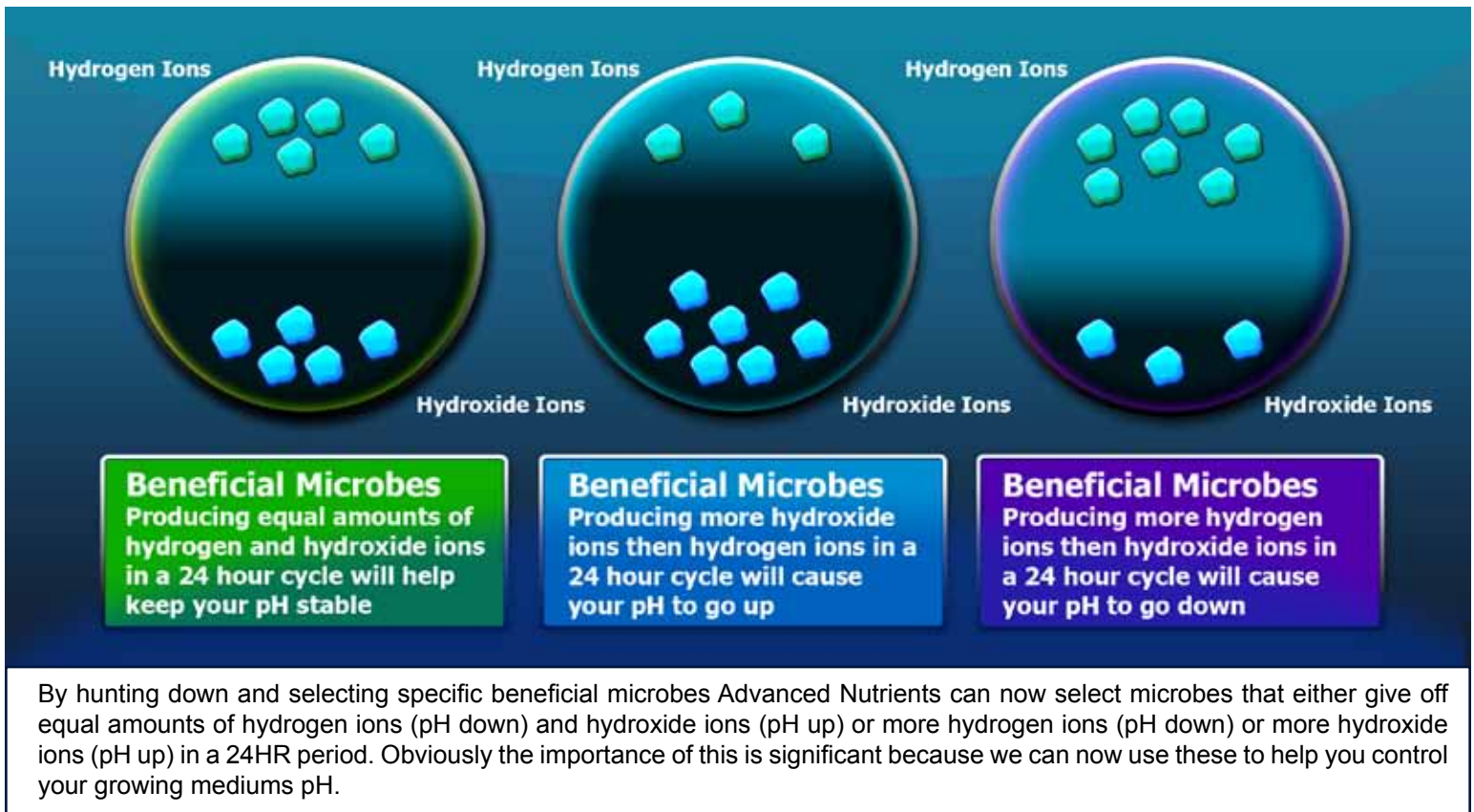
Making Your Own Growing Medium Mix

Now, you might have decided to make your own media mix. If so, alright. But if you start with pure sphagnum moss, you will need to add at least 30% perlite (between 30 – 40%) so that the sphagnum moss can breathe and aerate properly, allowing the roots to pass through quickly and infuse into your growing medium.

When using sphagnum moss you could add 5 to 7% calcined clay to increase the cation exchange capacity (CEC). This would help stabilize the pH in that growing medium. I would not use calcined clay in a recirculating system only in a "one way" feeding program.

Of course, if you are new to hydroponics, I would suggest you start by using Sunshine #4 mix, which has very good CEC and is very forgiving. You will get a good crop even if you make a few mistakes.





Sometimes There's An Unexpected Aspect To "Do-It-Yourself" Mediums You Should Be Aware Of

There is something else that you might run into when mixing your own medium. And that is inconsistent growing medium. The number one cause of pH problems for growers mixing their own mediums is inconsistencies in source materials.

When mixing your own growing medium you need to know the sources of your sphagnum moss and lime because they differ in pH from year to year and locations.

The only way to be certain you are working with the right pH materials in your medium is to test it frequently. See "Laboratory Registry for the United States and Canada 2nd Edition," CRC Press (ISBN 1-57444-179-5) to get a comprehensive list of soil-testing laboratories in the United States and Canada.

Adding Limestone

Earlier I mentioned adding limestone or lime. When you have a medium that is too acidic, you have to add something to bring it up into a better range. For example, you will find that sphagnum (pH of 3.5 to 4.0) is very acidic to use as a medium.

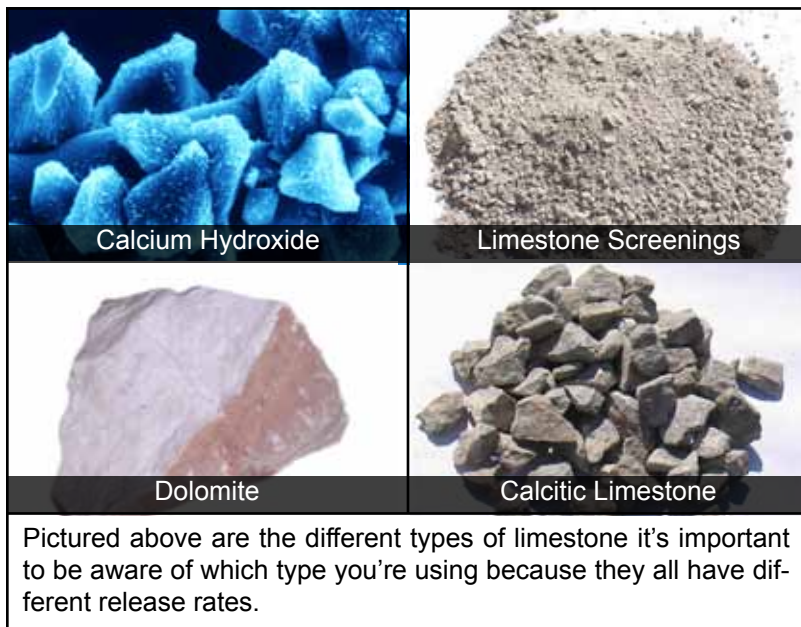
So you'll want to use limestone to neutralize this acid and raise the pH to a level acceptable for plant growth. The amount needed depends on different factors such as sphagnum sources, types of ingredients, and limestone type.

Another thing, when limestone is added to your growing medium, only a fraction of the lime reacts to increase the pH to a stable level in 5 to 10 days after planting. And this is called the reactive fraction.

So what happens to the rest that doesn't react? Well, this is called un-reacted or residual limestone, and it affects the long-term buffering capacity of your growing medium.

It is the residual limestone that you want to measure regularly in order to test how good your limestone source is. Actually, each limestone source is different, so there is no way to determine the residual fraction except to test it.

There is also a variance in the limestone you get depending on what part of the quarry it comes from. You will find a variance in pH with sphagnum moss as well, depending on what part of the bog it is harvested from and what time of year or even what year.



The Three Main Features Of Lime

So when you use sphagnum as your medium, there are three main features of lime that determine how much is needed to raise its pH. These features are limestone type, particle size and hardness.

Limestone Types

In dealing with limestone type you actually have two choices:

1. **Calcitic which is straight calcium carbonate.**
2. **Dolomite which is a combination of calcium and magnesium carbonate.**

I do not recommend Calcitic limestone as your optimum choice because it releases too fast and usually raises the medium pH too high. Dolomite is slower and doesn't do that, so it is a better choice. With dolomite you get a more even pH and buffering over a longer period of time.

Just remember that different sources of dolomite will give you different reaction fractions or percentages of the limestone. The only way to really ensure you have the dolomite lime with the right residual balance and the right reactive component to it is to test it by doing the following:

- **After placing the medium in pots, irrigate with tap water avoiding any leaching to take place.**
- **Reapply the water daily as needed to keep the medium moist.**
- **Measure the pH at days 0, 3, 7, 10, 14, and 21.**
- **Plot your results on a graph. You should see the pH stabilize after some time and see what the final pH was as well as how long it took to stabilize.**

Particle Size

Now that we looked at limestone type, let's look at particle size. Particle size also makes a difference in how reactive the limestone is. The finer the particle size is, the more reactive the limestone is. Just so you're aware, limestone is sold in mesh sizes. The higher the mesh size, the finer the particle size.

Hardness

Hardness is the third important feature of limestone. A soft crystal reacts more quickly with acid than a hard crystal. Of course, there is no real way to tell if the limestone being used is soft or hard except by testing it. You have to add it to your growing medium and raise the pH to 5.3 – 6.8 and observe what happens.

You can conduct a test for determining the reactivity of your limestone by adding 4 to 6 pounds of limestone per cubic yard of growing medium. If this adequately brings the pH up to 6.0, you know that the limestone is reactive, and there is little residual left once a stable pH is reached.

Needing to add 8 – 12 pounds of limestone indicates the limestone is moderately reactive. Adding more than 15 pounds per cubic yard indicates an un-reactive limestone and that is not good.

Hydrated Limestone (A More Volatile Option)

If you use hydrated limestone, it's another story. Hydrated limestone is known as calcium hydroxide and is a white, crystalline, slightly-soluble alkali used in the neutralization of acid soils.

It reacts completely and rapidly and does not have any available residual limestone. You have to be careful with it because it will quickly shoot your pH way up.

Some Challenges You Should Be Aware Of

Now you might run into a problem with adding limestone. Because adding too much limestone adds alkalinity to your growing medium which could raise the pH levels too high.

In limestone, the bicarbonates settle around a pH of 6.5 to 6.7 and this is dangerously close to the pH where precipitation of iron and manganese start to happen unless they are properly chelated.

If you use Sunshine #4 growing mix, you don't want to add limestone as it already has sufficient limestone in it, and adding more will increase your growing medium's pH.

Be careful...if you've been using limestone in your Sunshine #4 mix you might end up with your pH going high. You might even cause your nutrient elements locking out in the growing medium. However, if you use fully chelated macro, micro and secondary nutrients, this won't happen.

We will talk about chelates in a bit. Many of the nutrient companies don't bother with using any chelates and the ones that do usually only chelate the iron and manganese. Properly chelating nutrients is an expensive endeavor. And the lack of proper chelation is likely costing you bigger yields, and you end up having to monitor your nutrients and growing medium continually to get the right pH.

Reusing Your Growing Medium

One thing to remember if you re-use your growing medium is that you may not get consistent yields. You should be exceptionally cautious re-using your growing medium if any of the following happens during your growing and flowering cycle: your pH is currently running wild, you're using a lot of limestone, not watering regularly, or not leaching all the nutrients out at the end of your flowering cycle.

This is especially applicable to re-using sphagnum moss or coir. You might want to store your sphagnum or coir from one crop to the next and, while the other crop is growing, you can work with the stored medium to replenish it and get it to the right pH level for the next crop.

The Advantage Of Expanded Clay Pellets

Expanded clay pellets are my personal choice for running hydroponics systems because it's easy to work with and cleans up easy for re-use. You can also re-use perlite just sift it and clean it with very hot water or use a weak solution of hydrogen peroxide and then rinse. The same can be done with expanded clay pellets.

If you're using rockwool just throw it out after every crop. Though I've seen and personally re-used rockwool, it's a pain in the ass and I wouldn't do it because it has too many down sides. You're better off buying it new.

Here's the bottom line: you have to be interested in your growing medium's pH and make sure it's clean if you're going to re-use it to grow your plants. Otherwise, it will be difficult for you to grow a consistently high-yielding, high-quality crop.

If you don't want to invest the time and money in this project, you'll be better off to go to your hydro store and get new growing medium for each crop.

Your Nutrients

Lets Take A Closer Look At This Critical Piece Of The Puzzle

Let's have a look at how the different elements that make up your nutrients affect your pH. We mentioned this earlier at the beginning of this report. Your nutrient solution is made up of macro, micro and secondary nutrients.

Macro means large and micro means little. Macro nutrients are those elements like nitrogen, phosphorus and potassium that your plants use a lot of.

Micro nutrients, on the other hand, are nutrients that are only needed in very small quantities like iron, manganese, boron, copper, cobalt, molybdenum and zinc.

Secondary nutrients are calcium, magnesium and sulfur and are used in smaller amounts than macro nutrients.

All of these elements, macro, micro as well as secondary nutrients carry either a positive charge (cations) or a negative charge (anions) and will effect the pH of your growing medium as your plants use them up.

In fact, most macro, micro and secondary elements can be manufactured to carry more cations or anions if a manufacturer is willing to go the extra mile and spend the additional money required to have them custom made. And of course, that's something Advanced Nutrients does.

Cations include potassium, magnesium, calcium, zinc, copper, cobalt, manganese, iron and ammonium. Anions include nitrates, phosphates, sulfates, carbonates, bicarbonates. And different forms of these elements carry different amounts of anions and cations.

How It All Comes Together

Your plants roots take in both anions and cations but when they do, different things occur. Like when the roots take in cations, they give off a hydrogen ions-which are acidic-and is then released into your growing medium. This makes your growing medium acidic and the pH is lowered.

Now, when anions are taken in by your roots, hydroxide ions are released which are alkaline and that raises the pH of your growing medium.

But as it goes, cations and anions actually work together.

Like I Mentioned Up At The Beginning... “It’s A Balancing Act”

The whole trick is to balance the cations and the anions; then you can maintain the ideal pH in your growing medium. This does take a lot of work and research, but it can be done.

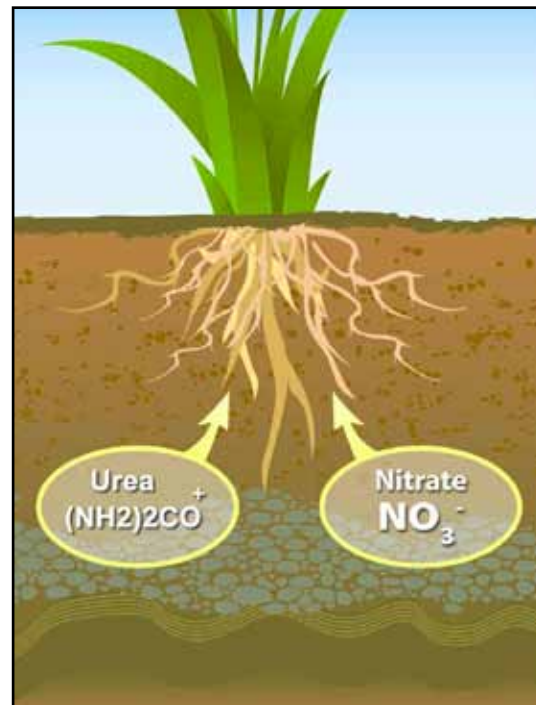
Why is this important? I’ll let you in on the secret. When you use the cations in an ammonium based nitrogen source, it gives off acid molecules and that helps to maintain the ideal pH around the roots and in your growing medium.

But when you use a mainly nitrate base nutrient, you are working with anions which gives off alkaline molecules and that raises the pH. This means you’ll need to continually adjust your pH down.

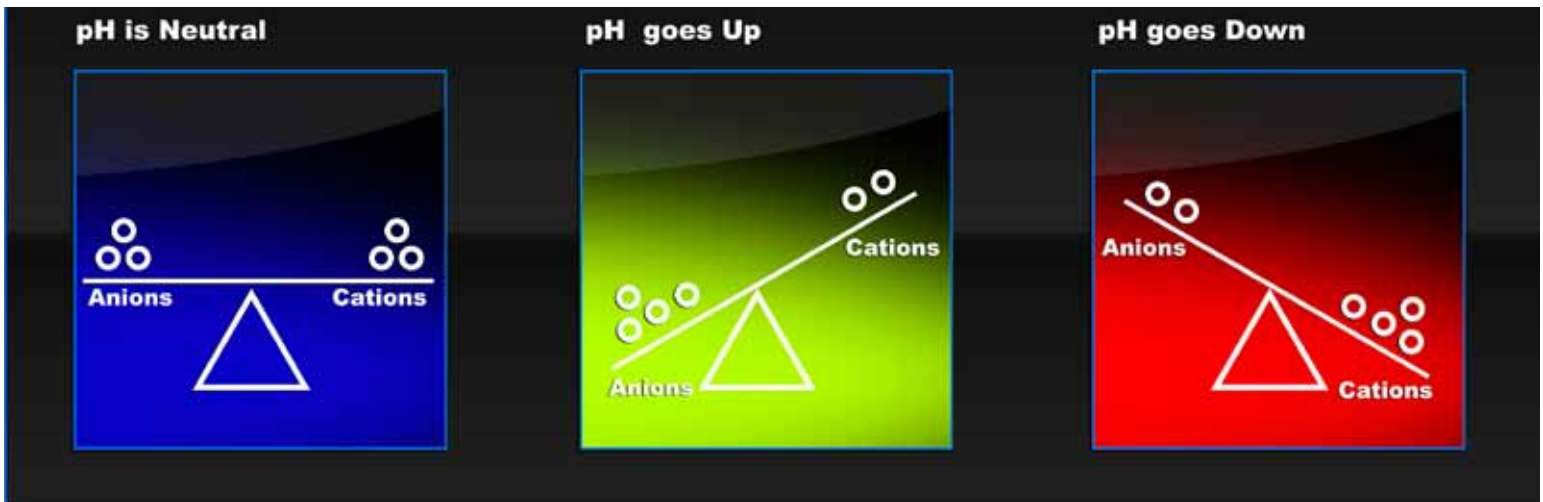
Why do the extra work when you can just maintain the right balance of ammonium and nitrates, cations to anions, right from the start.

And I don’t know for sure, but because of this imbalance of anions to cations you may have a high pH in your growing medium. And the worst part is, you aren’t even aware that this harvest robbing culprit is lurking in your growing medium.

Also, if you use a recirculating system you’ll be continually adjusting your reservoir’s pH in an unending cycle of pH balancing. And this directly affects the bigger yields that you could be getting.



Pictured above are urea and nitrate molecules. When properly used together they will help balance your growing medium’s pH. Plus, will give you more robust thicker stalk plants and bigger yields. Plus, urea is also a great food source for your beneficial microbes.



Shown above are the different outcomes that your nutrients will have depending how their cation and anions are balanced when formulated. When done right, they will work in your favor and give you a great crop. When done wrong you'll find yourself battling constantly with your nutrient solutions pH. Worse yet, your growing medium's pH will be on the rise. And if you've never measured your growing mediums pH you would never be aware of this yield reducing trap that's been silently stealing your crops true harvest potential.

A Few More Fundamentals Of Nutrients

So let's talk more about your nutrient. Since a lot goes on in a nutrient, you'll need to have one that takes everything into account and makes the proper adjustments for you. It should work with and within the pH range of where your plants are growing and not against it.

Plants that are subjected to stress due to limited and incorrect ratios of nutrient elements show slower growth, smaller bud size and weaker potency. In fact your plants use very little phosphorus they are actually nitrogen and potassium hogs.



Too much nitrates as a source of nitrogen will give shorter petioles, smaller leaves and thinner stems that won't be able to support heavy flower weight.

Unfortunately, other nutrient companies haven't taken the necessary tissue samples to find this out. We've taken thousands of samples for all parts of the plant through all phases of growing and rigorously tested many different nutrient ratios and have optimized your plants nutrients based on that research.

To make matters worse, we found that as nutrients move away from your plants ideal ratios and element forms, yield and essential oil production rapidly deteriorate.

For example, when you feed your plants with ammonium nitrogen you will get a greater petiole leaf expansion. But fertilizing with too much nitrate nitrogen will give you shorter petioles, smaller leaves and thinner stems making it difficult to pack on a lot a weight because your plants can sense whether they have the proper support to grow bigger flowers.

But Wait, There's More!

The form of nitrogen used also affects the color of your plant, as is seen in the case of fertilizing with ammonium nitrogen component which develops richer vibrant hues of green leaves.

Now, temperature is something you have to take into account also. When the growing medium temperatures are below 60°F or 15°C, you are wiser to use nutrients high in nitrate-nitrogen. Remember the ideal root zone temperature is between 65°F and 75°F or 18°C and 24°C.

This is because at below 60°F or 15°C temperature, the little microbes are just not working as fast and the nitrification process is inhibited. And this means the ammoniacal nitrogen is just not converted as well to ammonium.

The only problem with that is that over time the nitrate-nitrogen will cause the pH to increase in the growing medium.

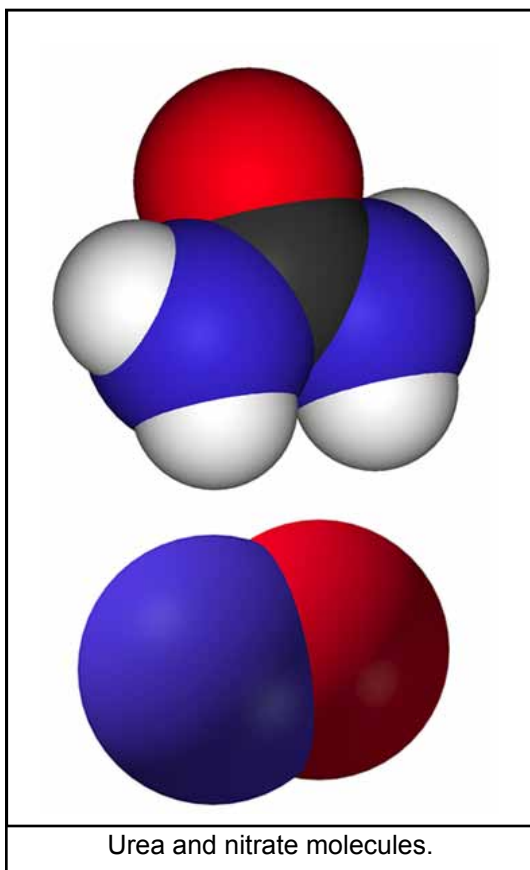
As an aside the fertilizers that you find in garden centers and nurseries marked as “high acid” are high in ammonium and have a lot of cations in them.

Here’s how it works; as the plant begins to take in these cation nutrients through their root system, it releases acid back into the soil or growing medium and that brings the pH down.

So adding a “high acid” fertilizer to the reservoir does not make your nutrient solution have a lower pH; as you can now see the process comes about in the soil as the plant roots use the cation rich fertilizer and excrete acid into the soil.



When you get it right your plants will have nice vibrant green leaves.



The Source Of Nitrogen And...How It Makes A Big Difference

We explored the importance of nitrogen for plant growth and bud growth, but it’s the source of nitrogen and the amount of that source that makes the biggest difference in your nutrient. For example, there is potassium nitrate, magnesium nitrate, and calcium nitrate.

When a plant takes in nitrates, it gives off an alkaline molecule, and you get a rising pH near the roots making the pH of your growing medium alkaline.

A great cation rich nitrogen source that we use at Advanced Nutrients is urea. It’s a great source because it acts like ammonium and keeps the pH nice and acidic in the growing medium.

Urea also makes great microbial food and beneficial microbes love urea. The combination of urea and nitrates actually makes for a bigger, more vigorous growing plant and increases your crop yield. And yes, I just gave up another inside secret.

Remember, when your plants root’s take in elements that are cations they excrete acid molecules into your growing medium. And when your plant roots take in anions they excrete alkaline molecules into your growing medium.

The Next Step For Nutrient Companies

So if a nutrient company actually cared enough, knew what they were doing and was willing to spend the extra time and money they could make a perfectly balanced nutrient solution that would keep the pH in the 'sweet spot' in your growing medium at all times.

How would a nutrient company do that exactly? First they would have to tune the cations and anions of all the elements in the nutrient solution to a specific type of plant. And once you also knew what the exact macro, micro and secondary nutrient ratios of that specific plant was...

You could then use your nutrient solutions nitrogen sources to help do the "balancing" act for you, because nitrogen is abundantly used by your plant and it is available in both cation (ammonium) and anion (nitrate) forms. Now we're getting some place.

Only problem is, if you look at the hydroponics nutrients out there most of them use only nitrate forms as their nitrogen source, which is an anion form of nitrogen and drives your pH up in your growing medium as fast as a speeding bullet.



Alkalinity can run out of control faster than speeding bullet in your growing medium and severely reduce your harvest, or worse, in extreme cases kill your crop.

The Straight Goods On Different Formulas For Hydroponics And Soil

Here it is, simply put it's cheaper to make nutrient formulas for soil than hydroponics. Because soil has some nutrients (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, and for the most part small quantities of iron, manganese, copper, zinc, boron, and molybdenum) already present in them so companies just figure that they don't have to put as much of those elements into their nutrient formulas.

There's a danger with that kind of thinking, because soils are very diverse not only in the macro, micro and secondary nutrients they hold, but also in their availability, as well as the soil's pH .

However that's not all, soil has a high cation exchange capacity, so companies also wouldn't - if they chose to - have to use as much if any pH buffer.

Bottom line is... saving a few bucks per bottle for them is more important than building a sound and sturdy nutrient platform that delivers to you, one high quality formula built right from the get-go, so to speak, for both hydroponics or soil.

And with that being said, Advanced Nutrients base nutrients can be used in all hydroponics including rockwool,



expanded clay pellets, perlite, volcanic rock, foam, styrene, sphagnum or soil growing mediums, and any combination of those, it's totally your choice. The only growing medium the base nutrients are not made for, at this time, is coco coir. That requires a totally separate base nutrient and bud enhancer.

Some nutrient companies save a few bucks per bottle, by selling separate soil formulas instead of an-all-one high quality hydroponics and soil nutrient.

Even better, all Advanced Nutrients base nutrients and supplements can be used in any and all growing systems like flood and drain, nft, drip irrigation, continuous feeding and aeroponics.

And while we're at it, almost all Advanced Nutrients supplements can be used in all your growing mediums including coco coir. Just look for the coco coir safe emblem on your supplement bottle or jar.

Balancing Your pH

When adjusting your reservoir's nutrients to adjust your pH. For example, potassium hydroxide (also called caustic potash) can be used to raise your pH up. Use nitric and phosphoric acid to lower your pH down.

You can use nitric acid in your vegetative cycle because it will add nitrogen to your crop and phosphoric acid in your flowering cycle because it will add phosphorus.

And guess what? Personally I prefer to use nitric acid in my flowering cycle because tissue samples have shown your favorite plant doesn't use a whole lot of phosphorus during flowering. In fact, in most cases nitrogen use increases.

If you're looking for organic forms of pH down you can use citric acid to bring the pH down. This you can get at a vitamin store; just make sure that it is a really pure type of citric acid.

You can even use vinegar (acetic acid) but the acetic acid varies in different vinegars so you have to be a bit more careful and watch what goes on. For this reason, citric acid is the preferred acid to use.

How about Using Buffers?

Some companies promote using chemicals to buffer your hydroponics nutrients. So what is a buffer? A buffer is a chemical that helps maintain pH stability of the nutrient solution.

A lot of growers aren't aware of this little known fact, but a lot of nutrient companies use magnesium, calcium and potassium carbonate or bicarbonate as their pH buffers. This is absolutely not a good idea.

Here's why: remember that carbonates and bicarbonates are anions and add to the alkalinity of your nutrient



Pictured are various stand alone pH and EC meters and combo meters that do both pH and EC at the lower to medium end of the price scale.

solution and growing medium, and even though they might buffer the pH a bit, these "down and dirty" pH buffers will cause your growing mediums pH to accelerate up.

Vitally important last and final point: Calcium, Magnesium and Potassium, using these carbonates and bicarbonates will actually diminish your crops yield potential. So check out what's in the nutrients you're using and see if they're using any magnesium carbonate, calcium carbonate, potassium carbonate, bicarbonates or worse, a combination of them.

For all these reasons, Advanced Nutrients won't use them, period. Instead we invest our money in pH buffers that give you rock solid stability over your nutrient and growing mediums pH while never adding alkalinity in any way that will diminish the size of your harvest.

Adding Chelates

OK, so lets take an in depth look at chelates. What are they, anyways? Well, chelates are complex organic molecules used to allow the micro, macro and secondary nutrients to remain available to the plant over a wider pH range.

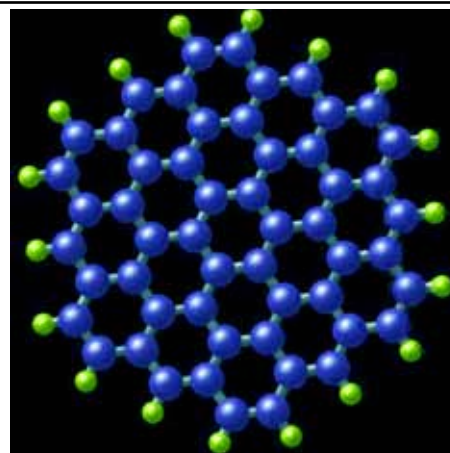
They do this by binding them to ions, and this prevents those ions from precipitating or locking out with other elements.

You can use different chelates to lower and raise the pH level as well, depending on what you need. So the whole activity is another balancing act. Adding chelates to the mix makes it easier for the plants roots to absorb the macro, micro and secondary nutrients that it needs.



There are several advantages of using chelates :

- **It increases availability of nutrients.**
- **Mineral nutrients are prevented from forming insoluble precipitates.**
- **Toxicity is reduced of some metal ions to plants.**
- **It prevents nutrients from leaching.**
- **The mobility of plant nutrients increases.**
- **It suppresses the growth of plant pathogens.**
- **When formulated correctly can help stabilize pH.**



Pictured is a simplified version of the way chelates bind to elemental ions.

CHELATED VS NON CHELATED NUTRIENT AVAILABILITY

Non Chelated Nutrients



Proprietary Chelates Macro, Micro & Secondary Advanced Nutrients



The chart on the left shows the absorption range of typical non chelated macro, micro and secondary nutrients. The chart on the right shows the absorption range of Advanced Nutrients pH Perfect macro, micro and secondary nutrients. The only limit to absorption is the ability of the plants root system to keep growing it's roots faster than they "burn" back from extreme pH levels. Typically those extremes are around pH 2.5 and pH 9.5.

How We Give You The Best

Advanced Nutrients micronutrients are 100% chelated, and our macro and secondary nutrients are chelated as well (although not as much as the micro nutrients because it's not as critical). This makes them more available to the plant over an extremely wide pH range.

The chelates that we use in your nutrients are EDTA, EDDHA, DPTA, Amino chelates and our own proprietary blend. And together they will give you a theoretical plant absorption range of pH 1 to pH 10.

I say theoretical because at pH 2.5 the roots are being burned up faster than the plant can produce them and the same thing happens at pH 9.5



The tanks on the left show precipitation at pH 4.5 and pH 8.5 of typical hydroponics nutrients. The picture on the right shows Advanced Nutrients chelated nutrients at pH 4.5 and pH 8.5.

And most other nutrient formulas will start to precipitate and lock out at a pH of 6.8, at that pH, precipitation is microscopic and easily stays in suspension and usually can't be seen with the naked eye. And it's not until a pH of 7.5 to 8 you can visibly see it.

Then at the other end of spectrum at pH 5, iron and manganese start to become way more available and can lead to plant toxicity. You won't have to worry about any of this with Advanced Nutrient products because of all the chelates that are used.



This is what healthy roots should look like. With the exception of using organic formulas, which will usually stain your healthy roots with a brownish tint.

You can plainly see that without chelation your plants ability to absorb nutrients is placed in a very narrow pH range. And constant pH adjusting and monitoring will be required.

Advanced Nutrients extensive use of chelates powerfully protects your crop with a second layer of pH protection and Advanced Nutrients is the only hydroponics company to do this and obviously goes to great lengths and expense to ensure you get the bigger yields you deserve.

Expensive Chelates And A Street Racer Named Allan

Using these types of chelates is literally 7 to 10 times more expensive than using straight non chelated elements in your nutrient solution. So why do we pay so much attention to all the details when making your nutrient formulas.

Well a long long time ago when I was a very young man. I was just 19 years old. There was a street racer by the name of Allan in my hometown of Aurora, Illinois and he had the fastest car in a fifty mile radius.

It was a Chevy Nova and it turned very low 10 second quarters consistently. Allan was a good 7 years older than me, and late one night on a summer evening a group of us were hanging out and talking to him. And I was asking a lot of questions about his car.

Out of the blue he asked me if I wanted to go for a quick spin. Man, I was in that front seat of that car in a split second. I had barely gotten my seat belt on when we rolled out onto Lake St.

The light was already green in front of us and the moment the car was in a straight line all hell broke loose the engine came alive, the tires hooked up and the sound of it all shattered the quiet of the still night air, echoing and reverberating off the store windows like intense thunder in a canyon of glass.

I was pinned to the seat as if a powerful magnetic pull had gripped onto every cell in my body and firmly held it into the seat. I glanced over and saw how effectively the Hurst straight line shifter was making quick work of changing gears.

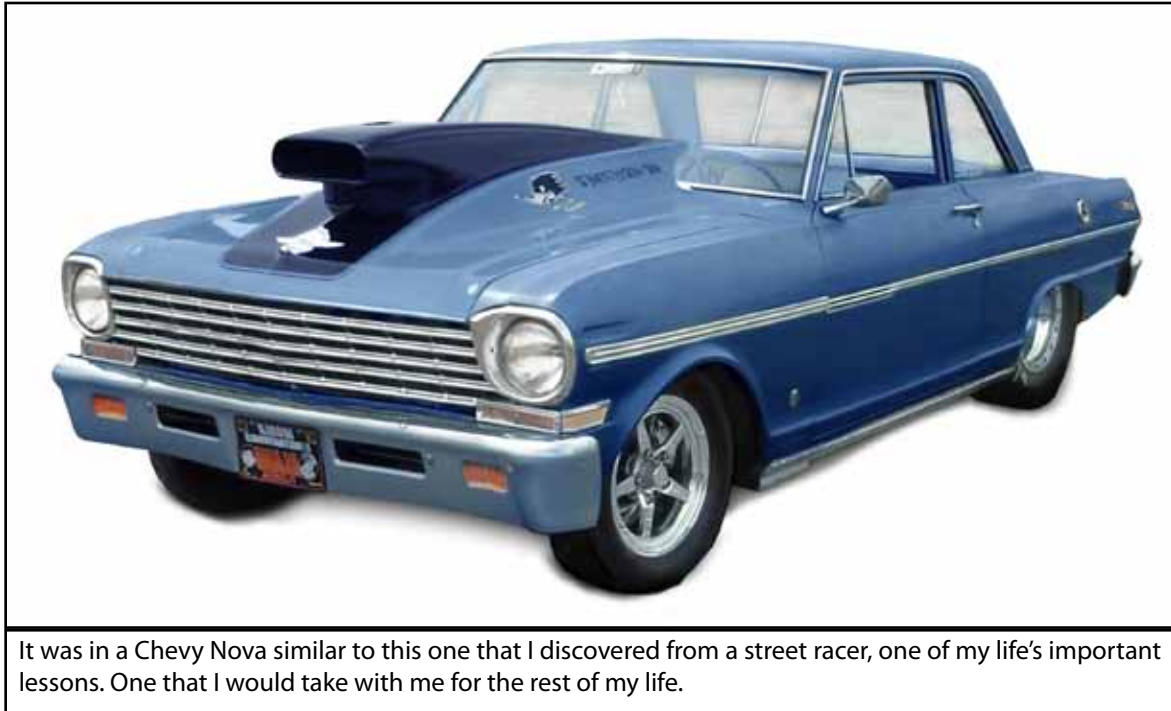
And I was amazed how he deftly squeezed every last RPM out of top end of every gear. By the time I looked forward again we were already coming out of third gear and into fourth gear.

I couldn't believe what I was seeing, the interval lines on the road had all become a solid stripe and vision off to my sides became blurred while my frontal vision became razor sharp and all my senses were lit up like Las Vegas at night and sensory overload was setting in. Just then the run was over.

He eased off the gas and just as quickly brought the car back down to a somewhat normal speed. I turned to Allan after we got done running that car through the gears and my ears had a chance to adjust from the roaring thunder. I asked him why his car was so fast.

I asked him, was it because he had a triangular valve job, was it the headers, the dual Holley double pumpers on the high lift manifold, 12 to 1 compression pistons? The Muncie Rock Crusher transmission? Was it the ported and polished heads? The 4:11 posi traction rear end with traction bars? The roller cams?

He stopped me mid sentence and said words I would carry with me for the rest of my life, and has served me well.



It was in a Chevy Nova similar to this one that I discovered from a street racer, one of my life's important lessons. One that I would take with me for the rest of my life.

He looked at me and said “Mike it’s all of it, and a whole lot more things than you’ve mentioned. You see – it all matters – a lot of guys think they can go out and do just a few of those things to their cars and run hard.

But what happens is when they do just a few of those things, there’s something they don’t realize and understand, it effects something else that they didn’t think about, and then something snaps or limits their performance.

When I built this car, I looked at everything and went through the entire car, and then built up each system. That’s why I don’t get beat.”

Little did I realize on that warm summer evening that a street racer had just handed me one of my keys to life that would open many doors.

For whatever reason those words have stuck with me “it all matters” and throughout my life I’ve always put those words to good use.

Talk Soon :-)
BigMike