BEST OVERALL
SYSTEM INTERGRATION

ABSTRACT:

This article is all about building a system that takes advantage of the techniques and equipment that will best provide for healthy, happy, stronger plants which will in turn provide for larger, more bountiful yields time and time again (and it doesn't matter if this in Hydro or Soil, Soiless, Rockwool or Coco.)

The hardest aspect of growing healthy plants is Mastering Root Health. When roots are unhealthy (or not as healthy as they can be) the overall plant health will diminish. Depending on the phase of growth the plants are in, the overall yield will suffer. Growers often tell us that they are growing strong healthy plants with a healthy root zone, but many of them have never actually seen a healthy root zone and have nothing to compare health to. All, as in life, boils down to perspective. Eventually, after enough growing cycles, we find that most growers develop a more expansive perspective and have the experience necessary to be able to tell if their plants are Healthy and Flourishing, or sickly and not doing so well. It takes a keen eye to tell when Plants are beginning to take a dive for the worse. You need to be able to see their issues early on and steer them through their stress and put them back on course. The best thing to do of course, is to build a system which will plan for and avoid these problems from the beginning.

Key Points to Dialing in an Ideal System (Not necessarily in any perfect order)

- Aeration in the Root Zone
- Heavy Roots
- Water Chiller
- Beneficial Microbes
- Enzyme Solutions (Not all are created equal)
- Drip System Setup
- Drain to Waste
- Sterile Equipment
- RO Water with UV Sterilizer
- Applying Additives (Don't over-add them)

Aeration to the Root Zone

Aerating the Root Zone is probably the single most important concept for new growers to get a handle on (next to learning how to pH their solution). The more Oxygen provided at the Root Zone, the faster plants will grow, the healthier they will remain and the more overall weight they will yield at harvest time. Make sure their medium is porous and aerated. If it is not, then aerate it using coarse media such as perlite or pumice rocks. Make sure a given medium goes from wet to barely moist before it is watered again. (If growing in hydroton, hygromite, Silica Stone, etc. Then ignore this because it is almost impossible to over water.) Coco is also an exception to this rule. It is very porous to begin with and holds a good amount of air to water ratio at almost all times. Still make sure that it dries out some before watered again. (If you want to error on the side of caution, let even coco go from "wet" to "barely moist" before watering again.) By doing this with a medium you are ensuring that there is ample oxygen contained within it. It is always a good thing to employ air pumps into your watering source, especially if it is a reservoir containing nutrient solution. For the best aeration possible within your water supply make sure that you are creating enough air bubbles so that your reservoir looks more like a hot tub - strongly bubbling. The more we break the surface tension of the water by blowing fresh air through it, then the better. Also a drip system provides more aeration than almost any other system. (More to come later.)

Heavy Roots

We cannot speak highly enough of this product. **Heavy Roots** promotes unbelievably healthy root growth (it blows newly formed roots "way out of the box") that stays crazy healthy the whole way through the plants life-cycle. We have never seen a product that has broken as many rules that we have come to accept as "laws of conduct" as this one has. (Ex. Never let your water get above 75 deg. F. - With Heavy Roots we have seen many a root zone that has remained healthy even at 80 deg. F.) And it can work with any other product we have tested it with. Enzymes, beneficial, no problem; whatever you want, as long as it is not a "sterilizing" product like Hydrogen Peroxide, or DutchMaster's Zone, etc.)

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Water Chiller

Nothing works as well at controlling water temperatures as a water chiller. Frozen plastic liters of ice water can be added to a reservoir to help control temperatures but it rarely, if ever works in the long run. It is of critical importance for a healthy root zone, that water temp stay at 66-68 deg. F. This does not mean that they can sometimes be between this temp zone and sometimes hotter or colder than this temperature. It is about consistently staying at 66-68 deg. F. At this level, the nutrient solution holds a good amount of oxygen within it, and the nutrient absorption rates are still high enough for most plants. Lower water temperatures contain more Oxygen, while interfering with nutrient absorption rates. (Available Oxygen, and Nutrient absorption rates are inversely proportional to each other.) The only way we have found to keep the nutrient solution contained within a reservoir consistently within the correct temperature range is to employ a Water Chiller. Also note: Lower water temps (since they have more oxygen contained within) will promote more aerobic (oxygen loving) microbial life (the "good guys") and discourage anaerobic ("bad guys" - pathogens) microbial life from out colonizing the aerobic ones. Lower temperatures help prevent problems and can help solve existing issues.

Beneficial Microbes

There is a complex relationship between plants and the microbes that live in and make up the rhizosphere. The light energy captured from photosynthesis in the leaves is channeled down to the external root surface. Up to 40% of the plant's energy is exuded as mucilage into the ectorhizosphere as carbohydrates, amino acids, and other energy-rich compounds. As these molecules are released, they serve as food and growth stimulants for billions of bacteria, fungi, algae, actinomycetes, protozoa, and other microbes. In return for the release of nutritional substances from plant roots, microbes themselves produce chemicals that stimulate plant growth and/or protect the plant from attack. This large array of substances include hormones, enzymes, vitamins, amino acids, indoles and antibiotics. These complex plant cells are transported to other parts of the plant, with minimal change to chemical structure, where they can stimulate plant growth, increase metabolic functions and enhance plant reproduction. As growers we want to inoculate and promote healthy microbe colonies. Some of the more common varieties to look for are Mychorizzae, Trichoderma, and Bascillus Subtillus. There are a plethora of products that help us in our endeavors, including **Vermi-T, Piranha, Subculture, Tarantula, Voodoo Juice**, and **Great White** to name a few. We even brew our own concoctions.

Enzyme Solutions

Along with the major plant hormone research, enzymes have become the recent focus of much attention. Small, yet amazingly powerful -- enzymes have a variety of important benefits for the grower. There are many different enzymes that all have different functions. We are most concerned about two types of enzymes. There are those that accelerate sugar / resin production and work to create flavor and aroma. Then there are those that break down dying and dead plant proteins (dead leaves and roots) into their component parts – amino acids, lipids and smaller molecules which can be reabsorbed by the plant and the beneficial microbes. This also prevents thoste proteins from being food for pathogens. Some of the Enzyme solutions we like are **Hygrozyme** (for better, faster overall growth), **Cannazyme , Ecozen** and **Sensizyme** and for their enzymatic breakdown of dying root tissue capabilities.

Drip System Setup

Drip systems are the most widely used hydroponic systems in the world and **our personal favorite**. They provide plenty of aeration because plant roots are never totally submerged, but are never allowed to dry out. Drip systems also pull oxygen down with the water emitted from the drippers. This oxygen rich water trickles over the plant roots and nourishes them. Operation is simple, a pump has tubing connected to it which branches off to feed individual plants. Nutrient solution is dripped at the base of each plant where it trickles through grow media and into the roots, finally draining into the reservoir where it can be reused or sent to waste. A timer is used to space waterings.

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Drain to Waste / Flushing

Drain to waste is another method of growing that can be easily used, providing better control as well as faster growing plants with healthier root zones. Instead of recycling the nutrient, it is used once, thereby eliminating a whole host of problems. We have another Info Sheet dedicated to illustrating "Drain to Waste".

Sterile Equipment

Sterilizing equipment is extremely important and often handled incorrectly. Many people mistakingly use Hydrogen Peroxide for sterilization purposes. It happens to be a poor oxidizer, unable to kill many different types of pathogens, and is only truly effective at a pH of 2.0. **Bio-Green Clean** is an organic enzyme that does a great job. It is especially good at cleaning those hard-to-clean white trays - makes them WHITE again.

Bleach, although not the most environmentally friendly product, is our perennial favorite. It can kill anything, and is very cheap, making it hard to resist. Do NOT use it sparingly - Make a very concentrated solution. Go all out, let it soak for at least an hour, and let it run through all equipment (including pumps.) Scrub any surface as with a strong Bleach solution. Then make sure to do multiple rinses with plain water to rid the trays of any residual Bleach still lining the trays. When using strong bleach solutions, wear gloves & work in a ventilated area.

Reverse Osmosis Water with UV Sterilizer

Why would you drink purified water and not feed it to your "prized plants" as well? RO water is purified of all contaminants and minerals, effectively cleaning the life-blood of your plant's vascular system. Coupling an RO water purification system like the **Hydro-Logic Evolution** or the **Stealth 200** to a UV Filter System which ensures that your water is fresh and clean and that it is also free of any pathogens coming into your delivery system / reservoir. Most importantly for growers is that when running city water to your plants, not only are you feeding them chlorine and other contaminates, but you are taking up valuable "head-room" that can be used for additives or a higher concentration of base nutrients. Usually, every 300ppms of nutrient that you can further feed your plants (without burning) will allow for 10-15% greater yield. Most city water TDS levels hover between 300-400 ppms. With an RO system, that number goes down to about 25 ppm, leaving much more room to pack in nutrients. Also note: The chlorine in the city water supply is very strong and does NOT evaporate over night. It WILL kill off beneficial microbes.

Applying Additives

With so many additives being available today, and so many additives coming to the market place every month, it is extremely tempting to use an ever-growing amount of them. This can be extremely catastrophic to your plants root system as well as your plants overall health and vigor. There are so many products out there from different companies touting the fact that they "increase the plants metabolism" or "help with nutrient uptake", that is increasingly easier to add 2 of the same products (just from different manufacturers). If both products are applied at their full strengths or even 1/2 strengths each plants can be "stressed" or worse still "burned" or even straight up killed. Make sure you research what you are adding and have at least a cursory understanding of what you are giving your babies.

We Suggest: Add additives at 1/4 strength to be safe at first then increase the dosage by 1/4 the next week until you have a good understanding and feeling of what this additive is doing.