

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 is in hydro, soil, soil-less, 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 therefore have nothing to compare it to. It all boils down to perspective. Eventually, after enough growing cycles, we find that most growers develop a more expansive understanding 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 turn for the worse. You need to be able to catch issues early on and steer plants through their stress to put them back on course. The best thing to do 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 the grow medium is porous and aerated. If it is not, then aerate it using a coarse media such as perlite or pumice rocks. Make sure the 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 as it is very porous to begin with and holds a good amount of air-to-water ratio almost all of the time. Still make sure that it dries out a bit before watering again. (If you want to err on the side of caution, let 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 using 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, the better. Using a drip system will also provide 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 incredibly healthy throughout the plant's entire 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. (Ex. It is said to never let your water get above 75 ° F. With Heavy Roots we have seen many a root zone that has remained healthy even at 80 ° F.) And it can work with any other product we have tested it with including; enzymes, beneficial—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 the water temp stay at 66-68°F. This does not mean that they can sometimes run hotter or colder than this temperature, but it is important to consistently stay at 66-68°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 ectorrhizosphere 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 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 the 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 Mychorizae, Trichoderma, and Bascillus Subtillus. There are a plethora of products that help us in our endeavors, including **Mammoth P**, **Azos**, **Mykos**, **Orca**, 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. Those that accelerate sugar/resin production and work to create flavor and aroma. And 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 those proteins from being food for pathogens. Some of the enzyme solutions we like are **Hygrozyme** (for better, faster overall growth) and **Cannazyme** 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 the plant roots are never totally submerged and 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. The 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 a 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've provided an additional info sheet dedicated to illustrating "Drain-to-Waste" systems.

Sterile Equipment

Sterilizing equipment is extremely important and often handled incorrectly. Many people mistakenly 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. **HYCLEAN™** by Hygrozyme is a non-toxic, biodegradable, and environmentally friendly cleaner that removes and prevents the buildup of salts and minerals in irrigation lines and grow media.

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 with a strong bleach solution. 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 and 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 1000** or the **Stealth 300** to a UV filter system will ensure that your water is fresh and clean and that it is also free of any pathogens coming into your delivery system/reservoir. Most importantly, running city water to hydrate plants will not only feed them chlorine and other contaminants, but will take 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 use to 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 claiming that they will "increase the plants metabolism" or "help with nutrient uptake," and it is increasingly easier to add two of the same products (just from different manufacturers). If both products are applied at their full strengths or even 1/2 strength, each plant can be stressed, 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 precious plants.

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.