

...The first photo is a complete "grow module". It is shown with everything except the pulse feed line. Materials are 2 3.5 gal buckets, 1 lid, 2 tire valves, a 6" sink tailpiece, and a piece of 3/16" ID black latex tubing about 3" long.

The next photo shows a complete bottom or reservoir section. This one was just cleaned for a second run. It shows the 2.5" center hole to receive the tailpiece from the upper or grow container and the 7/16" access hole for checking nutrient solution.

Just a quick shot of the bottom bucket showing the only fitting that has to be installed on it. A tire valve again. Then the latex tubing, then the black vinyl drip line. The black vinyl drip line from lowes or wherever, the black 3/16" latex from fishing and tackle and scuba suppliers

Four is just a freshly glued in tailpiece. AMAZING GOOP, plumbers edition.

Five is the same showing the manila folder template I used to get 12 equidistant points.

In six I used the 12 marks I made in 6 to draw 12 lines on the sidewalls to 3.25". this is the point you will use to drill the first set of holes. If using a twist bit use a 1/8" pilot bit first for accuracy. A regular wood spade bit works well too.

Seven shows a completed upper unit from the inside.

Eight is a partially finished one showing the "root pruning" holes. Looking at the bucket there are 60 holes in twelve columns of 5. Center the top hole at the 3.25" point and then drill the bottom most hole as close to the bottom as possible. Then one centered between those and two more centered between those. An easily repeated pattern that achieves 2-3% aerated sidewall in a beneficial area of the container.



For a 2 to 3 week veg period (w/3 week stretch), don't waste medium and use 2 gallon buckets only.



Latex tubing & tire valve size

the latex tubing connection between the tire valve and the drip line is very tight and actually difficult to get apart.

if you are using the stock tire valves and the 1/4" od drip line you want black 3/16" id latex tubing.

i have since drilled the tire valves to 3/16" id and gone to 3/8" od black tubing and 5/16" id black latex tubing for connectors.

i did this because after about a year of continuous use the drip lines were clogging regularly. not a big problem and you could just replace them when they start impeding flow. the drip line is cheap.

the latex tubing can be ordered from fishing and diving supply places online. google 3/16" id or 5/16" id black latex tubing. i cut it into 3" pieces so a little is all you need.

don't use the amber latex, it grows algae like crazy.

i use the .625 tire valves but still only drill a 7/16" hole for it because we are dealing with plastic and it stretches, giving a totally waterproof seal. the tire valves require a 5/8" or .625 hole in a steel rim. i put some dish detergent on the valve sometimes if they are stubborn.

i drill the tire valve to 3/16". if you look closely at the tire valve you will see that it is about 3/16" id already. the constriction occurs at the valve seat inside. i am really just drilling the seat out.

the hole for the complete valve is 7/16".

Height of float valve depends on height of bucket

tire valve installation:

drill a 7/16" hole.



1. control bucket showing float installed centered at the 10" level. please notice the wingnut. this allows you to adjust water level in response to different conditions.
2. control bucket with all parts installed. you need a valve for each plant container and one for the line to the pump bucket.
3. shows pump bucket tire valve, a 3" piece of 5/16" id black latex tubing, and a piece of the 3/8" od, 1/4" id, black food grade tubing.
4. connected
5. this is just to illustrate how tight and waterproof the connection is. it takes some force to get one off.
6. 1/4" tubing to float valve



1 and 2 are pump bucket showing holes. 1/4" holes for the pulse lines, 7/16" hole for the supply line, and a 5/16" hole for the pump power cord. the power cord hole shows the slit cut so that the power cord can be snapped in without cutting off the plug. all holes are through sidewall and tight fitting in order to better control evaporation. a lid is used in operation.

3. mag-drive 950. i'm using this size pump because i had two of them left over from a bio-bucket setup. it doesn't hurt to use the largest pump you can as this shortens the delivery time.

4 and 5 shows a standard pvc connector. this one is for 3/4" pvc pipe. i'm reusing the old one as it already had the holes for the pulse line. i have 9 containers in flower so 9 holes. these holes are drilled 7/32". the od of the drip line is 1/4" so the drip line is held in place once installed.

6. square cut drip line will not go through 7/32" hole.

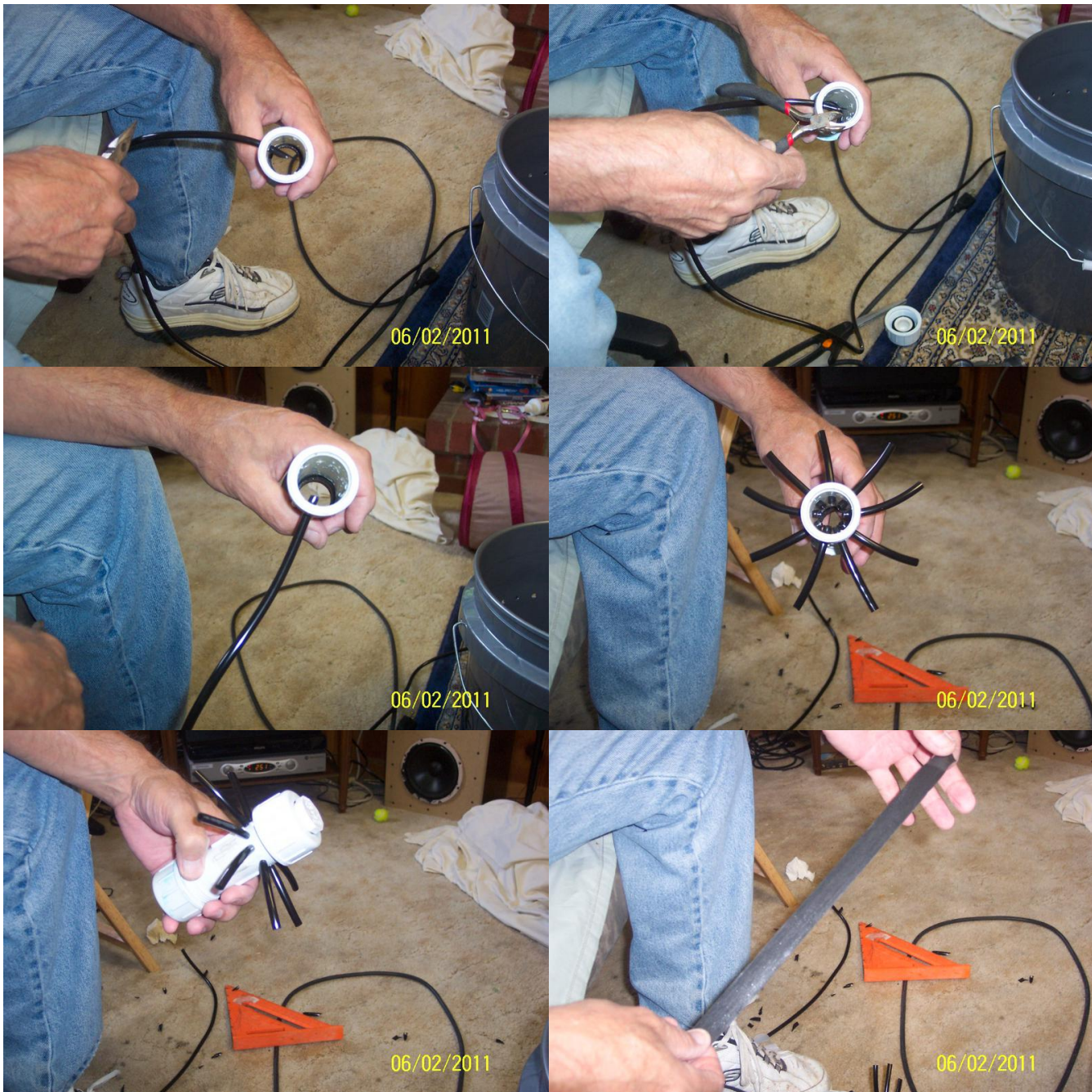
7. so cut it at a taper.

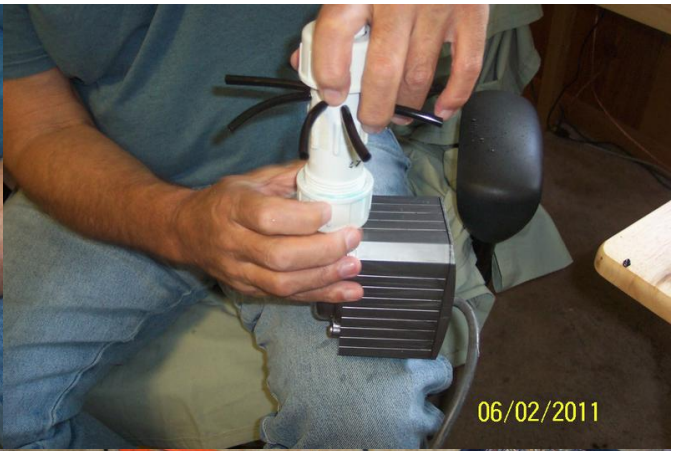
8,9,10. start taper in hole, grab it with a pair of needlenose, and pull it through.





- 1,2,3. show the tapered end being cut off square. repeat as necessary.
4. installed. this method doesn't leak and requires considerable force to remove the lines.
5. with top on and 3/4" plug installed where a pipe would normally go.
- 6,7. rubber electricians tape to build up pump outlet to where you get a tight fit in the connector.
8. these are compression fittings so constrict when tightened.
- 9,10. manifold installed and in the pump bucket.





PPK Theory

Introducing "Hydraulic Redistribution".

In the beginning of this thread with plant or ppk #1, I maintained a strict "no top watering" policy after the first two weeks and I grew a decent plant. It produced 7 1/8 oz of dry bud. I guess I just wanted to see if I could do it with this new device. With each successive plant, however, I began top watering various amounts and frequencies to see if it would have a profound effect upon growth. What I found was that a small amount of top watering produced a better plant. The first plant had the lowest yield of any ppk to date. All subsequent plants have yielded more. What I found was that a very small amount of water applied several times a week to the top of the medium improved growth. I am not talking about enough water to supply the plant, but just enough to moisten the top. The plants were still getting the bulk (90% plus) of their water from sub-irrigation.

I had no clear explanation of why this was occurring, only that it was. I also wondered about the necessity of continuing this practice throughout the life of the plant. I have continued it to date at all stages of growth just because I didn't understand the mechanism.

I now think I know why and for how long.

I believe the top watering is useful in the early stages of root development while you are trying to fill the container with roots. Again, not enough to actually water the plant, but just to keep the top wet while roots occupy the space. We could call this the "wet" season. This parallels wet/ dry cycles in nature where most vegetative growth occurs in the early, and usually, wettest, part of the season. Cannabis, in most areas, finishes during the dry cycle. This is indicated in Robert Connell Clarke's "Marijuana Botany".

I've been doing all kinds of media experiments to compare growth but was new to coco. The more I played with coco the more I liked it. I have committed to growing in coco and now have 8 plants in 100% atami brand coco. 6 in veg phase and 2 in flower. The roots at the end of 6 weeks veg were thick and white just below the surface. Totally occupying the surface of the medium.

Then I stumbled upon this. These are excerpts taken and edited somewhat by me from this link:

<http://www.hydrol-earth-syst-sci-dis...2007-print.pdf>

this paper should be read in it's entirety. Most of it is a presentation of the math used to model the phenomena, and the authors interpretations of that math. I can only pretend to understand some of it. But there are some excellent graphics used to illustrate the principles.

Also, this may be the strongest argument i've ever heard for utilizing a "dark" period during the vegetative phase.

"A model for hydraulic redistribution
incorporating coupled soil-root moisture
transport

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One of the adaptive strategies of vegetation is the development of deep roots and the use of hydraulic redistribution which enables them to make optimal use of resources available throughout the soil column. Hydraulic redistribution refers to roots acting as a preferential pathway for the movement of water from wet to dry soil layers driven by the moisture gradient be it from the shallow to deep layers or vice versa. This occurs during the night time while during the day time moisture movement is driven to fulfill the transpiration demand at the canopy.

Hydraulic redistribution enables the movement of moisture from the upper soil layers to deeper zones during the wet months and this moisture is then available to meet the transpiration demand during the

late dry season. It results in significant alteration of the profiles of soil moisture and water uptake as well as increase in the canopy transpiration, carbon assimilation, and the associated water-use-efficiency during the dry summer season. This also makes the presence of roots in deeper soil layers much more important than their proportional abundance would otherwise dictate.

Hydraulic redistribution can be defined as a passive movement of water via plant roots from relatively moist soil layers to drier soil layers.

In HR, plant roots form a conveyance system between soil layers through which water is transported. Therefore, moisture gets absorbed and released in response to gradients in water potential between the roots and the soil.

During day time, transpiration from the leaves via the open stomata creates a water potential gradient between the leaves and the roots, resulting in net water movement from the soil to the roots and then to the leaves. Water is absorbed from all depths depending upon the potential gradient and passes into the transpiration stream at the leaves. This is true both during wet and dry seasons. During night time, the stomata closes, resulting in turgor pressure that increases water potential within the plant body. As the potential in the root exceeds the potential in the drier part of the soil, moisture starts to efflux from the root to the dry soil, while water still continues to flow into the roots in the wetter part of the soil.

Hydraulic redistribution is a reverse flow, in the sense that the moisture transport occurs in the reverse direction, from the root to the soil, than what transpiration dictates. The origin and evolution of this phenomenon is not clear yet, but there is much experimental evidence that shows its existence in numerous plant species. This evidence, coming from both laboratory and field experimental studies, shows that this process moves water through the soil profile at a much faster rate than could have been possible by gravity and diffusion in the soil matrix alone.

The root is assumed to absorb moisture from and/or release moisture to the soil, depending on the water potential gradient. In doing so, the root system is considered as a conduit for moisture transport from wet soil reservoirs to dry soil reservoirs, while at the same time conveying moisture to fulfill the transpiration demand at the canopy.

Plant roots can be viewed as a network of pipes consisting of xylem tubes.

In this system, the flow is governed by pressure gradient, established by the transpiration demand at the leaves, resulting in water being "pulled".

For the case where hydraulic redistribution is incorporated into the model formulation, moisture movement between the soil and the roots is bi-directional, with moisture flow from the soil to the root or vice versa depending on the water potential gradient.

During night, water is transferred from a relatively wet part of the soil to a dry part of the soil via plant roots. During day time, water is taken up from all soil layers. The net water uptake profile, averaged over the entire period, shows a disproportionately high water uptake from the deeper soil layers with respect to the proportion of roots in those layers. A noticeable pattern is the nearly uniform uptake of moisture over the vertical profile.

The hydraulic redistribution is modeled by assuming the plant root system as a conduit for moisture transport along a pressure gradient.

The HR phenomenon makes the presence of roots much more important than their abundance for the deep soil layers. This study shows that HR enhances tremendously the contribution of deep roots to the water uptake by plants. The quantity of moisture taken up from deep soil layers is disproportionately high when compared to the proportion of roots at those depths. HR can be seen as a mechanism by which the vegetation makes optimal use of available water. It appears to be a water conservation mechanism for the plant's usage that has adaptive importance and is most significant when deep roots are present. The mechanism may allow the plant to survive under extended dry periods."

After reading this paper I believe the root system can be thought of as a very strangely shaped sack or bag with semi-permeable walls allowing two way transport of moisture, that is, from root to soil or soil to root, dependent upon transpiration in the canopy and the pressure differential created when it ceases.

Hydraulic redistribution can only occur during the "dark" or "lights off" phase. It can therefore be used as a management tool to manipulate the upper medium moisture content.

So, for me, the practical upshot of all this is that I will now top water only during the veg phase and will begin using 20/4 on/off timing during veg. I now believe that once roots are completely established throughout the container hydraulic redistribution will keep the top "air" type roots alive.

Later on, D9

thought i'd leave another little bit of info on hydraulic redistribution.

also, i wanted to report last weeks plant, #7, which i thought might hit 9 oz's, actually went 8.92. best plant yet.

"Science and engineering of natural systems
Tuesday, October 24, 2006

Hydraulic redistribution: Mass transport by underground tubes
Deep down, plants suck.

We should all have a good picture of how plants get water and why. Water is taken up by roots and is transported, along with nutrients, up into the plant through tubes called xylem. Essentially, once in the leaves, the H of the H₂O is stripped away, and combined with C and O from CO₂ to produce carbohydrates. The waste product, O₂, is spat out through openings called stomata (oxygen – "they call it pollution, we call it life").

It's impossible to suck up water above 10 metres in height (at least on Earth). Plants must rely on capillary forces to entice water up the narrow xylem, driven by evaporation of water inside the leaves and its movement out through the stomata. But something else is going on inside the darkness of the earth, in the plant's hidden half.

For plants that close their stomata at night there is no upward flux of moisture from the roots to the stems. But that doesn't mean water stops flowing in the roots. On the contrary, plant physiologists are finding an increasing number of species that exhibit what is known as hydraulic redistribution.

Roots have developed components that greatly restrict the movement of water out into the soil, but the gates aren't 100% effective, particularly among younger roots. If some roots are located in dry soil, and others in wet, the water in the roots' xylem will be subjected to a pressure gradient. The drier soil will be using the xylem as a straw to suck moisture from the wetter soil. This is a purely hydraulic phenomenon, not biological. Water within the soil can thus be redistributed from wetter regions to drier, provided the pressure gradient is strong enough to overcome the resistance imposed by the xylem. This only occurs in times of water scarcity.

If deeper soil is wetter, as is more often the case where hydraulic redistribution has been observed, the roots passively lift water into shallower soil. More water thus becomes available to the abundant shallow roots, to be taken up for photosynthesis the following day. Because water that would have otherwise infiltrated deeper, beyond the reach of roots, is shuttled upwards, more water is available for transpiration. This increase is small but significant, for both plant productivity and the water cycle.

The shallower water also allows greater absorption of nutrients, which are more often concentrated near the soil surface. What's more, water lifted by deep-rooted plants becomes available to shallow-rooted

neighbours (an example of facilitation; though this positive effect may be outweighed by the negative of out-right competition).

Hydraulic redistribution is a fine example of the overlap between physical and biological phenomena. Plants respond, and have perhaps even adapted, to the flux of moisture from wetter soil to dry, and it is roots through which the water is sucked".

Last night i meant to mention the reasoning behind the choice of 4.5" as a water level in the reservoirs.

When looking at my design you can see that essentially it is a 5 gal bucket with a single 1.5" tube protruding from the bottom.

some of you may remember the "controlled water table" discussion from earlier in the thread and how level control can be used to control moisture in the medium. And the "perched water table" phenomena which robs you of usable root space inside your container and has the potential to trigger all kinds of problems with bad bacteria and anaerobic conditions and therefore your ec and ph.

From the various discussions on the pwt we have seen that the initial height of the pwt in a container is dependent upon the fineness of the substrate used. In coco that height is probably around 1.5" maximum.

You may also remember that the height of the pwt will be the same regardless of container diameter.

So what my device does is to move the pwt downward in the container. The total container. Which also consist of the standpipe and reservoir. Out of the root zone. Creating more usable non saturated root volume.

At first glance this may not look to be terribly significant but I have some math for you to look at.

A 5 gal bucket is 10.25" inside diameter at the bottom. With a 1.5" pwt that gives a potential pwt volume of 66.25 oz's.

By moving the pwt downward into the 1.5" pipe that gives us a potential pwt volume of 1.4 oz's. A difference of almost 65 oz's. Since a 5 gal bucket holds a maximum volume of 640 oz's, we are talking about a potential loss of root space of approximately 10% of total container volume. This is especially important to those growing in smaller containers as the pwt will be the same height but will occupy a greater proportion or % of the container.

Since the bottoms of the buckets are 6" above the reservoir floor setting the water level to 4.5" should eliminate the pwt in the root zone.

Normally I would water these to 6" and let the level fall 1.5-2" before topping again. Probably creating an initial too wet condition. Not wet enough to be dangerous to the plant but wet enough to hurt growth and yield. By running the level at a fixed point you can dial in moisture content and therefore total air porosity.

Within days of setting up my linked and controlled vegging system I began seeing a marked improvement in the upper growth. My opinion is that the plants are getting more o2.

the "controlled water table" theory at work.

simply moving the perched water table into the sump or draining it into a reservoir by mechanical trickery is not the same as controlling the water table to manipulate moisture content in the medium.

by raising or lowering the water table, which in our case allows an adjustable air gap, we have another

tool to control the amount of moisture in the medium.

while i've used different gaps experimentally i'm finding that coco responds well to a 3-4" gap.

turface or perlite or any other medium might need a different amount of gap than coco. probably less.

The capillary rise potential of any medium will be fairly constant. By using an adjustable level we can change where that capillary rise potential begins, thereby controlling it's maximum rise and the moisture gradient.

This is affected by your top watering scheme. If you just want to hand water a little from the top once in a while to flush salts back down you might want a 2" gap. This would place the capillary rise potential at it's maximum height while still removing the perched water table from the root zone.

If you have a pulse or drip system also or are just hand watering a lot you might want a larger gap, say 3-4". this reduces moisture from the reservoir to compensate for the extra moisture coming in from the top.

With a timed device for top watering you have two more moisture adjustment tools. One is duration of event and the other is the interval between.

Using all three tools allows you to maintain precision air porosity and moisture content. Never too wet. Never too dry. Just maximum air, water, nutrient, and root interface.

The key to using these tools is adjustability. No two of us have the same environmental conditions. And, within the same room, conditions change from season to season.

Variations in light application and strains will need different settings.

This sounds more complicated than it is. If you build it right the learning curve is intuitive. You walk into your palacial greenhouse with row after row of mother's finest just agrowin' and you notice a few leaves are tubed a little. Looks a little over watered, you think, and you dial your water table down 1/2". or you decrease the duration of the pulse system to deliver 4 oz's instead of 6. or deliver 6 every 3 hours instead of 2, and so on.

Wicks

The biggest single reason that I use a media wick instead of, or in combination with, a fiber wick is that I don't like stratified media.

That is, anything that layers a medium and causes it to display different moisture properties at different points.

I observed first hand the effects of combining the media and fiber wicks earlier in the beginning of the thread.

And came to the conclusion that my medium was a little too wet. Dead center down low. In the area where a lot of growers in coco reported soggy, anaerobic masses.

In the ppk I have tried to maintain the ability to adjust moisture distribution.

I feel using a fiber wick for long term growing is counter to that philosophy.

I am not saying they don't work. They do work. Mine worked. If I had a container full of synthetic fiber growing material that same material would be in my wick.

I have been looking at all fiber media and when and if I find something suitable the same material will be

used throughout the device.

It would be there for uniformity.

I have used a tube for a wick conduit since the beginning here.

I strongly recommend some kind of tube to enclose the wicking material even if that wicking material is just a single piece of microfiber. This tube tends to control evaporation in the "air gap" area and limit root growth into the reservoir.

It also makes the hydraulic properties throughout the whole device more predictable.

About the length of the wick.

The wick needs to be long enough to reach your controlled water level.

And be submersed.

The depth of submersion is not relevant to the operation of a ppk. Enough to operate is enough to operate. The device operates from the waterline up.

You do need to maintain some depth below the waterline to allow for adjustment.

However, any depth beyond this point can function as a reserve if you forget to top your volume tank or go away for longer than expected.

Diameter of wick.

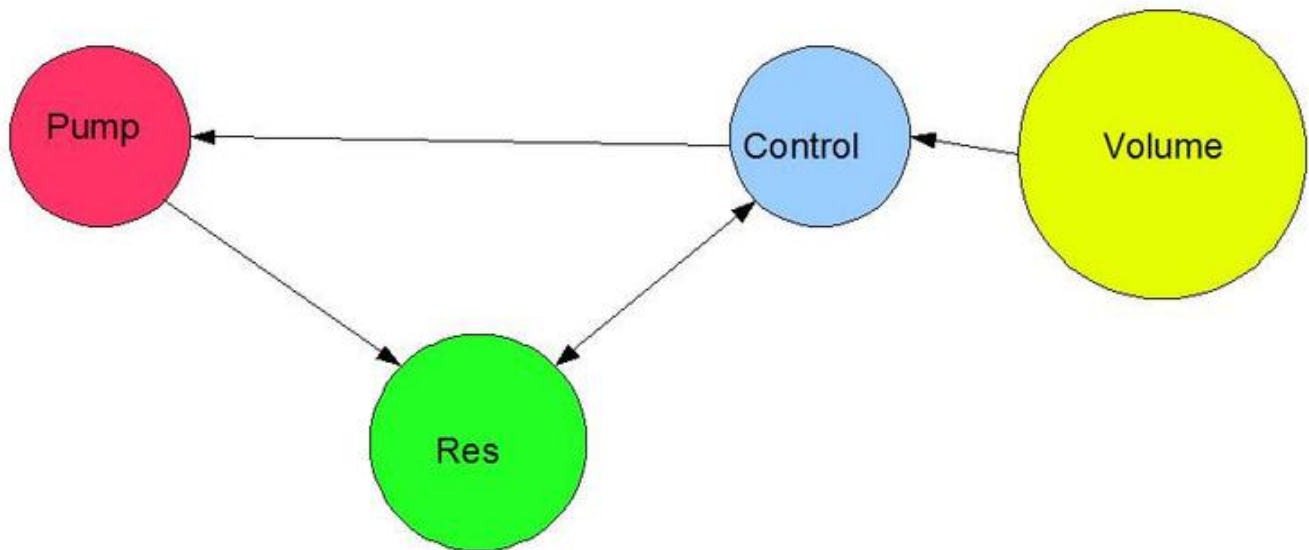
Again, for control of root growth into the reservoir I use the smallest diameter that I can. The 1.5" tube has proven that it is large enough to grow a 20 oz plant.

If you go larger than this you are increasing the size of the perched water table after you have gone through all of this work to eliminate it. That is if you are using a ppk.

The capillary rise potential in this device begins at the surface of the water in your reservoir. Not the bottom of your grow container.

By varying the rise potential, especially with a superconducting fiber, you are creating an artificial floor for that rise potential.

An artificial floor that you may not be able to tune with the range of tools that you have available.



you see in the diagram that liquid is moved by gravity to maintain all containers in the "floor" part of the system towards equilibrium at all times.

the bottoms of all reservoirs are linked to the control/float bucket. the intake at the bottom of the pump bucket is linked to the control/float bucket.

the pump fires onto the top of the medium. this draws down the pump chamber creating a demand from the control bucket.

this also immediately draws down the control bucket and fresh solution from the volume tank begins entering through the float mechanism.

simultaneously the old solution from the pump bucket, which is the same solution as the rest of the floor part of the system, creates a wave effect as it travels through the medium.

this wave moves some solution into the reservoir, which now back flows to equalize with the control bucket.

this causes the control bucket to act like a mixing station for old solution and new solution and the contents of all reservoirs. serving to equalize them as it continuously re-blends solution.

match this to nutrients being fed at the proper EC and ph and sealed containers and you get unbelievable stability.

i have tried to explain before that this occurs immediately after the pump fires. after a period of time, depending on environmental conditions, flow from the control bucket reverses and sub-irrigation takes over again.

forces acting on the medium creating movement:

pulsed body of liquid hitting top surface

wave effect created by pulsed application traveling into a wetted front (see links to hysteresis papers posted earlier).

wave moves the point of equilibrium between the gravitational flow potential and the capillary rise potential downward temporarily until levels equalize throughout the system and then the point of equilibrium moves back up again. i feel this creates a secondary surging effect.

evapotranspiration. in this system evaporation is limited to the medium. thus all movement is through the medium or the plant.

the combination of all this movement plus the elimination of the pwt in the root zone seems to be creating this dynamic effect on the medium and keeping the air, water, nutrient interface nearly perfect.

reading back through the thread i see where there has been quite a bit of discussion about salt build up.

i have been running ec 1.2 for months and producing huge plants. my philosophy on this is that i know that salts tend to accumulate anyway. knowing this, why not limit input to a level that noticeably produces lush, high speed vegetative growth yet does not aggravate build up?

i've noticed very little build up in veg anyway. it seems to occur in flower by the end of stretch and progressively rises. as we don't do a lot of change outs in these type devices it is smart to limit input early. Look for it by the end of the fourth week. By anticipating you are limiting.

It is much more difficult to flush a medium than most think. Better off keeping it right all along.

If you do desire to flush, just pinch off the feed line from the control bucket, drain the plant res and pour ro water through it.

so what if, during late flower ec goes up to say 2 or 2.4 or so? the funny thing about the way the ppk operates is that it does allow different plants reservoirs to vary in concentration significantly, yet is continuously limiting the spread as the re-blending of solution occurs. it's obvious each plant is taking up nutrients at it's own pace. good reason to run your pulse system from your control bucket. i think those thinking about running a ro pulse are going to run into problems with several things. the first is solution stability and the second is that there is an inherent physical problem with feeding these things from two different sources.

there is also the principle of mass balance here. this simply states, that, in a closed system, all nutrients added over the life of the plant are still in the system somewhere. in the solution, medium, or plant itself. the plants take up what they need.

while the pulse equipped ppk is not truly a closed system as there is some solution turnover occurring, it is close to being closed.

one of the advantages of the of this modular bucket approach controlled by a float valve fed container connected to a pure solution supply (volume tanks) is that it has a very limited volume of solution in the floor or "contaminated" part of the system. I used to think of this as something of a drawback and thought larger plant reservoirs were the answer.

further thinking indicates that the smaller the solution volume under each plant the better. To a point. the smaller the volume the faster that volume is exchanged. venturi principle at work. you should have enough for redundancy in case you are not there to top off the volume tanks, but anything beyond that is superfluous.

my medium stays wet yet the plants display no signs of over watering because the design eliminates the perched water table from the root chamber.

keeping the medium wet denies the opportunity for much salt concentration to occur. it does not accumulate salts as it does not allow drying. drying concentrates salts.

the pulsed solution distributes better in a wet medium than a dry medium because of the principle of hysteresis. water "wants" a pre-wetted pathway. microscopically it "jumps to wet" and resists going into "dry". hydrophilic and hydrophobic. hydraulic conductance. i call it the "hook up". letting a medium dry too much can cause "channeling" where the water avoids dry areas and runs through the pot in the same path every time.

the pulsing motion moves far more gas around in the root zone than allowing the pot to dry out. it acts like a big plunger pushing and pulling gas around as it falls. especially with the new hole pattern which is in the bottom 1/3 of the pot sidewall only.

this moves air from the top of the container downward and out of the holes, pulling fresh air behind it.

and we haven't even mentioned air embolisms that occur in the xylem when under watered. each time it happens the damage is irreparable and will impede further growth of that branch or stalk.

intentionally letting your plants dry out is like playing russian roulette. you get away with it a few times and then you don't.

plants in a ppk will never be under or over watered because we have built in tools for precision control of water and air in the substrate. it is adjustable.

the ppk is a "tunable" device. by that i mean it can be adjusted to compensate for different environmental conditions or to achieve different moisture profiles.

there are two methods for doing this.

first, using an adjustable float valve to establish a "controlled water table", you can raise or lower the sub-irrigated wetted profile in the growing container by adjusting the water level in the reservoir.

imagine a car cylinder with a domed top piston in it. that is approximately the shape of the profile of the sub-irrigation. by adjusting the water level you can control the height of the sub profile.

as moisture content is not static but is graded in density by gravity you can alter the amount of solution at almost any point in the medium simply by moving the reservoir level up or down.

practical application in use would be walking by your plants and noticing some of the fan leaves tubed downward. this is a symptom of too much moisture and it is probably robbing you of air porosity so you drop the solution level in the control bucket an inch. or humidity has gone down 30 points and the tops are feeling a little dry even though you are pulsing so you raise it an inch.

the plant will probably survive and grow through these hypothetical events without you doing anything about it.

but if you are observant and make the corrections you will grow a better plant.

the second tool is the pulsed irrigation.

just as you have a wetted profile for the sub-irrigation you also have a profile when watering from the top. the profiles vary according to the manner in which you water.

hand watering is even in application with a water breaker of some kind and if you can do it 12 times a day with precise amounts it will create a very even profile. wide and even.

with a continuous drip the liquid hits the top and spreads initially. then tends to reform into a column. looks kind of like a funnel. this area will be supersaturated at all times and will have little air porosity. water does not disperse laterally very well. this is because of the continuous force of gravity. it does not allow a break from the propelling influence of the mass constantly being applied from above.

the pulsed profile is relieved of this continuous downward force by it's intermittent application. in a moist medium hysteresis causes the solution to disperse in all directions. root growth in the very top of the medium is nothing less than spectacular. looks good too.

whew!

this effect can also be controlled by the duration of the pulsed event and the interval between events.

it is my belief that the combination of the two techniques and resultant profiles creates a unique moisture dynamic that has many forces subtly interacting.