

Campesino's Guide to Growing in Coco

The topic of feeding and watering in Coco has come up in several different forums recently (I may be responsible for that). I have done a lot research on this topic recently and have made numerous posts on different threads. I wanted to pull all of that together, edit and improve it, include references, and post it in one thread, which could be a resource... Or the start of a great debate.

I provide this as my guide for growing in coco. It is scientifically based, and I am currently practicing it. I am well aware that it is not the only way to grow in coco – and I do not intend to suggest that it is.

This Guide will be posted in installments. In the first part, I present the theory and practice of growing in Coco. The points that I make in this section of the article are:

- 1. Water your plants at least once per day (do not let your coco get dry)**
- 2. Provide nutrients in all water (do not alternate nutes with “plain” water)**
- 3. Buffer Coco to satisfy CEC**
- 4. Be aware: Environmental Impact and Waste Water disposal**

In the second part of the Guide (included below), I discuss the decisions you have to make to follow the strategy that I laid out in the first section. I specifically address the following points:

- 1. Use fabric pots: Size depends on several factors but mainly watering frequency**
- 2. Mix Coco with Perlite: Ratio depends on container size (and climate variables)**
- 3. Consider Climate in the Tent**

In the third part of the Guide, I discuss Managing the Grow. The first installments of that part of the Guide are already included. In that section I discuss EC, PPM and Fertigation. It includes critical info to help manage your application of nutrients to achieve the best results. I specifically address the following points:

- 1. What is EC and Why does it Matter**
- 2. The Effects of Incorrect EC**
- 3. Where Does the Water Go**
- 4. Target EC Ranges**
- 5. Mixing Nutes and Achieving the Target EC**
- 6. Run-Off: Measuring and Correcting EC**
- 7. Flushing**

Campesino's Guide to Growing in Coco

Part 1: Theory and Practice

Point #1: Water your plants at least once per day (do not let your coco get dry)

Although plants can survive for a while in dry Coco, it is not good for them. It is very difficult to overwater coco/perlite at the ratios I am suggesting (below). You do not need to wait for the surface of the coco to be dry. In fact, **the surface of the coco should never get so dry that it changes color** to lighter brown. If that occurs, it is an indication that the coco is too dry and watering frequency should be increased. Every single watering should produce 10-20% run-off, but not considerably more than that. 10-20% run-off ensures that salts do not build up in your medium.

How much to water: add water to achieve 10-20% run-off

How Frequently: Water frequently enough that 5-10% of container volume of water produces run-off. For example, I have 5 gallons of media and apply no more than 1.5 quarts to achieve run-off. If I ever have to apply more than that, I increase watering frequency.

Start with DAILY watering: In most containers, during veg, once daily watering is recommended as a starting point. For 5-10 gallon containers in most environments, this will suffice during Veg. If you use smaller containers (3-gallon or less) you should start 2x daily watering in mid-late Veg.

During flowering, water needs increase and your watering frequency should as well. Plan to increase to 2x per day in 7-gallon or larger, 3-5x per day in smaller containers. The best results come from small containers with 3-5x daily watering (discussed in the second installment of the article below).

Don't treat your Coco like Soil! Treating your Coco like soil and allowing it to dry dramatically between waterings reduces the rate of growth and can harm harvest size if done during the flowering period. Unlike soil, Coco maintains sufficient oxygen in the root zone even at field capacity (saturation). In soil, you need to allow it to dry because at field capacity there is insufficient oxygen in the root zone and roots can drown. Unless water is being constantly added, there is always sufficient oxygen in the root zone with coco.

As water evaporates from pots, nutrient concentrations in the coco increase and get out of balance. In dry coco, your plants will be exposed to increased N. Meanwhile, P becomes less available – this is a particularly problematic combination for flowering cannabis plants. Maintaining adequate moisture at the appropriate nutrient levels and EC for the stage of growth is important to achieve best results. **Do not let your coco get dry!** (see reference excerpt below)

Reference: Excerpt From "Soilless Culture: Theory and Practice"

The beneficial effects of high-frequency irrigation were recognised some decades ago, and it is considered a useful tool for optimising the root environment. Rawlins and Raats (1975) stated that '... we should not overlook the possibilities for conserving and making most effective use of our water, land and fertilizers resources by using high-frequency irrigation', and Clothier and Green (1994) provided further support. Although these conclusions were based on studies of soil and of soil-grown plants, their basic approach is valid for soilless media as well. It is important to note that in the 1970s and until the 1990s, high-frequency irrigation was defined as having intervals of less than 7 days (Martin et al., 1990), but nowadays the time between successive irrigation events has diminished to hours, or even less. Recently, micro-drip irrigation systems have been developed that provide emitter discharges of $<0.5\text{Lh}^{-1}$. These systems are mostly based on low-pressure gravity flow and have been studied mainly with soilless-grown crops. Preliminary results have indicated promising potential. Adsorption on the solid phases and precipitation of insoluble compounds decrease the concentrations of nutrients in the root area (Chap. 6). Thus, the nutrient concentrations in the rhizosphere may be high or even excessive immediately after irrigation, and may subsequently fall to deficit levels as illustrated in Fig. 8.12A. These processes are time dependent; therefore, reducing the time interval between successive irrigations to maintain constant, optimal water content in the root zone may also reduce the variations in nutrient concentration (Fig. 8.12B), thereby increasing their availability to plants and reducing their leaching out of the root zone.

...a higher irrigation frequency maintains higher dissolved P and K concentrations in the substrate solution, by shortening the period during which precipitation takes place. The indirect effect of irrigation frequency on nutrient availability is manifested through the higher convective and diffusive fluxes of dissolved nutrient from the substrate solution to the root surface, which increase with increasing irrigation frequency. The findings that increasing the fertiliser rate improved nutrient uptakes and plant yield, and that increased irrigation frequency resulted in systematic diminution of the nutrients uptake enhancement, may indicate that the main effect of increased fertigation frequency was related to an improvement in nutritional status, mainly with regard to P (Silber et al., 2003, 2005a; Xu et al., 2004). Thus, increasing the irrigation frequency may compensate for certain nutrient deficiencies and in the above examples the lower yields of plants fertigated at low frequency might have been a result of nutrient shortage rather than water shortage.

...It has been shown that yield gained under high irrigation frequency can be primarily related to increased availability of nutrients, especially P (Mbagwu and Osuigwe, 1985; Silber et al., 2003, 2005a).

Point #2: Provide nutrients in all water (do not alternate nutes with “plain” water)

I suspect that this is the point that many of you will have the hardest time swallowing. It was certainly the point that I resisted the most. However, all scientifically rigorous sources concur: Nutrients should be added to all water – Coco does not require an interval flush with “plain” or pHed or CalMag only water. Indeed, alternating nutes with non-nutes hinders plants growing in Coco and limits their potential.

Plants need nutrition: In a soil-less media like coco, the plant takes nutrients directly from the water largely through diffusion. Nutrients must be present in the water for plant nutrition to take place.

Osmosis and EC: Plants draw in water from the media through osmosis. Osmosis flows in the direction of higher EC. To draw in water, plants produce sugars to raise the EC within their roots. When roots are exposed to alternating irrigations with nutrient solution and “plain” water, they deal with a constantly

fluctuating EC. As a result, they are forced to adjust constantly. This stresses plants, produces weak structural growth and fluffy flowers. I dive deeper into this topic in a future installment of this guide, "EC, PPM, and Fertigation".

You do not need "Plain" water to flush out "extra salts"! It is simply a myth that somehow the coco holds on to excess salts that need to be flushed with an interval of plain/pHed/CalMag water. Whatever nutrients are not used and whatever ions are exchanged with the plant, will flush out of the media with the nutrient water run-off if given at least 10% run-off. There are not many places for these unwanted elements to cling to in coco. If you monitor EC, as I describe in Part 3 of the guide, you have nothing to worry about in terms of salt build-up!

Online References:

- 1 <https://www.alchimiaweb.com/blogen/electrical-conductivity-cannabis/>
- 2 <https://www.icmag.com/ic/showthread.php?t=307683>
- 3 <http://blog.botanicare.com/feeding-and-watering-frequency-drain-to-waste-setups-and-coir-based-media-by-botanicare/>

Point #3: Buffer Coco to satisfy CEC:

Rinsed coco should be buffered prior to first use. Soak coco in a solution of Cal Mag for several hours (overnight). Allow to drain. Buffering like this allows the Potassium Cations that are bound to the Colloids in the Coco to be replaced with Cal and Mag Cations. If un-buffered, coco will steal Cal and Mag and release K, which is why so many growers suffer Cal deficiencies early in Coco grows. The Colloids in Coco are taking the Cal and releasing K until it is essentially buffered. You can prevent this by pre-soaking your coco in Cal Mag and allowing those exchanges to take place prior to adding your plants. Once buffered, the CEC in Coco should not be an issue and plants will take nutrients directly from the water.

Online References:

- 1 <https://growguru.co.za/blogs/hydroponic/buffering-coco-coir>
- 2 <https://www.maximumyield.com/buffering-up-adjusting-the-cation-exchange-capacity-in-coco-growing-media/2/1318>

Additional Points:

1. **Measure and adjust EC in – Measure EC out – They should be very close.**
 - SEE PART 3 of the Guide Included below!
 - Always add water at the correct EC. **Avoid adjusting EC of the inflow to correct the EC of the run-off.**
 - **If run-off EC is higher than inflow EC** the first action should be to **increase watering frequency** (At desired EC levels) to help flush unwanted salts. This sounds counter-intuitive, but the idea is that the problem originates because water is evaporating from the pot leaving salts behind which can be flushed with additional water. Only if this fails to resolve the problem should proper flushing be considered.

2. **Drain to waste:** Since coco interacts with pH and ions in the water it is difficult to maintain appropriate levels in a recirculating system. Please see point #4 Below
3. **Drip systems and other auto-watering systems are an excellent option**, but should be set for watering intervals and not continuous drip
4. **Measure and Adjust pH in, do not worry about pH out.**

Point #4: BE AWARE: Environmental Impact and Waste Water Disposal

What to do with your waste water is a serious concern. The nitrates and phosphates in the water are great for our plants but are serious environmental pollutants. There are differing opinions about the best way to dispose of this water – and the best practices may not be practical for everyone.

The best option is to dilute your waste water and use it to water other potted plants. I do this, but there is a limit to the amount of plants my condo will hold and their ability to drink water. You can consider bottling the water and passing it along to friends for their plants.

Be very careful if you use waste water to water plants grown in the ground. Do not do this if the area is already saturated, if it is raining, or if you are near streams or bodies of water. We are trying to prevent these chemicals from entering the water table! (See KingKush's Comment below)

According to some sources (and not others), it is acceptable to dump waste water down the drain. If you are on a septic system this is not a practical option. **You should call your local water treatment facility before dumping down the drain.** Explain that you are a hydroponic grower and need to know if it is safe to put your waste water in the drain. They will provide alternative sites to dispose of your waste water if it is unacceptable to "drain" it.

I also yield to the knowledge and experience of @KingKush who posted the following in reply:

[KingKush](#) commented

[Campesino](#)

The best way to deal with excess rinsate or fertilizer runoff is through bioremediation areas such as turf, deep rooted native grasses, perennial shrubs, and trees. Plus, all the microbes in the soil will rapidly break down the nitrates and phosphates. The people who say "don't put it on your lawn" are only half correct: yes it can still runoff and leach but it has to get by mother natures little microbes and root zones first. So as long as you don't put your rinsate in a flooded field or when it's raining outside it's all good.

The need for fertility in all the other biospheres will rapidly consume and breakdown any nitrates and phosphates that we apply. We still apply nitrates and phosphates onto our turf, but with a concerned approach instead of Willy Nilly. Nitrates and Phosphates are found in nature and are essential to plant health. It's just when we concentrate these ions artificially into point source pollution is when we run into headaches.

I would treat rinsate like a form of fertilizer: apply with reason on your lawn. Buy an extra hand sprayer so you can actually do a legit application. There is no formal rules because marijuana is federally illegal, so it's bad just to be a pot head according to any official documents. But from a seasoned chemical applicator I'm saying your lawn is fine if you distribute widely when it's not flooded. We do it all the time on golf courses and rely on Buffer Zones with tall grasses bordering any water bodies. The low fertility and deep roots suck up any extra runoff like a sponge. Plus, trees help too, those roots run deep and are scavenging nutrients with the large network of mycorrhizza (fungal hyphae roots). So between bacteria, fungus, and plants, nature has a way of recycling that's better than what we can do as humans.

It's completely responsible to apply your rinsate from your grow on your lawn; professional fertilizer programs still include phosphates and nitrates for optimum plant health. There are obvious limits to this, but I wouldn't go so far as to label fertilizer rinsate as toxic waste. That is for the batteries and old computer equipment we landfill instead of recycling



I almost did not publish this article because I did not want to contribute to harmful environmental practices! Please be responsible with how you dispose of your waste water!

Online References:

<https://www.maximumyield.com/disposing-growroom-waste/2/1511>

<https://blog.1000bulbs.com/home/hydroponic-waste-water-part-1>

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Part 2: How to get set-up

In order to get the most out of your Coco grow, you need to consider your schedule and your climate as you get set-up. The best plants are grown in small containers with very frequent watering, but that may not fit your schedule. It is important to mix perlite to aid drainage, but less so in very dry climates. So, to determine how much perlite and the size of your final containers, you need to keep several things in mind.

In this installment of the article I address the following points:

- 1. Use fabric pots: Size depends on several factors but mainly watering frequency**
- 2. Mix Coco with Perlite: Ratio depends on container size (and climate variables)**
- 3. Consider Climate in the Tent**

Point #1: Use fabric pots: Size depends on watering frequency

In addition to all of their other benefits, fabric pots are really important if you are going to follow the watering strategy that I laid out. It is important to encourage drainage in whatever way you can.

Choosing the correct container size depends largely on how frequently you can water your plants. Unlike soil, where bigger pots usually produce bigger plants, in Coco, the best plants are often grown in smaller containers with more frequent watering. Coco provides so much more room for the roots that the container does not have to be very big to grow giant plants.

According to several sources, to get the best growth you should water your plants 3-5 times per day during flowering! In order to water this frequently, you would need to be using 2-gallon containers (or smaller!). If you can water several times per day (probably because you have an auto water system) then the best plan would be 2-gallon final containers. Don't worry you can grow cannabis plants into virtual trees in 2 gallons of coco. The reality is that frequent waterings help the plant far more than reduced root space hurts them. There is tremendous root space in any quantity of coco.

You can reduce the percentage of perlite if you are in containers less than 3-gallon. If you go smaller than 2-gallon, you can actually eliminate perlite and run 100% Coco because drainage is no longer a serious concern in containers that small. The grower, "The.Cook" at icmag grows in 5-liter plastic(!) containers of 100% coco. He waters 4x per day during flowering. Check out his plant!

<https://www.icmag.com/ic/showthread.php?t=307683&page=5>

If such frequent watering is not possible, then you need to use larger containers so that the Coco does not get too dry between your daily waterings. As I discuss in the first section of this article, if your coco gets dry it starves your plant of nutrients (more than just water), so it should be avoided. I have 7-gallon fabric pots with about 5 gallons of medium. I get away with once daily watering through Veg, but need to increase to 2x daily during the stretch and through most of flowering. If once per day is your maximum availability to water than you should use at least 7-gallon and possibly 10-gallon fabric pots

Smaller pots with more frequent watering is best. On my next grow I am considering going with 3-gallon final containers.

The following chart is offered as a guide, however, you should also consider your climate as discussed in Point #3 below

Key question for choosing container size: How frequently can you water during Flowering?

Watering Frequency (during Flower)	Recommended Final Container Size
3-5x daily (auto watering system)	3-gallon or smaller
2x daily	5-7 gallon container
1x daily	10 gallon container
Less than 1x daily	Not advised in Coco

Point #2: Mix Coco with Perlite: Ratio depends on container size (and climate variables)

Perlite dramatically improves water drainage in Coco. Mixing Perlite at a ratio of 30-50% makes it very difficult (but not impossible) to overwater. Also, since it improves water flow through the medium it improves the flushing of unwanted salts. Coco without perlite does not drain as well. If you have large containers and your Coco has less than 30% Perlite you may not be able to follow my recommendations for watering frequency.

The one exception is if you are using very small (less than 3 gallon) final containers. In such small containers perlite is not needed and you can use 100% coco. Using containers this small will require you to water 4 or more times per day during flowering. As I explain above, this may actually be the best method, but it is impractical for most of us.

Again, as a general rule, **for 3-5 gallon containers the ratio should be at least 30% increasing to 50% at 7 gallon containers or larger.**

My Coco "recipe" for a 7-gallon fabric pot: 800g (dry weight) Coco and 6qt Perlite

Online References:

1 <http://www.growweedeasy.com/coco-coir>

2 <https://www.icmag.com/ic/showthread.php?t=307683>

Point #3: Consider Climate in the tent

There are many ways to control climate in the tent, but regardless some tents run hot and others cold. We all deal with different struggles with humidity. As you consider following this guide, you should consider your climatic struggles and set-up your grow accordingly. Your decisions about container size, perlite % and watering frequency should be made with climate in mind. In response to climate differences you can achieve balance in different ways.

If your tent runs hot: (Options)

- Decrease perlite (reduces drainage)
- Increase container size (reduces drainage)
- Increase watering frequency (Best option)

If your tent runs cold: (Options)

- Increase perlite (improves drainage – recommended)
- Decrease container size (improves drainage – recommended)
- Reduce watering frequency (not ideal)

Be aware Relative Humidity may run high.

Low humidity should no longer be a problem. However, high humidity may become one because this grow style produces a lot of humidity. All climates and ventilation systems are different, so you need to determine if you will be able to handle a grow that produces a lot of humidity.

Please feel free to ask questions/post comments/etc. I am posting this as a resource and hope the community finds it valuable. There will be no love lost if you prefer to follow other coco strategies! If you decide to follow this guide – or change your practices because of it, please make a post and let me know! I will be happy to follow your grows and see your results!

Happy Growing!!!

Acknowledgment: I forwarded an early draft of this section of the guide to @Dangerdan for a peer review. He contributed valuable insight, additional references, and helped to improve and solidify the science that I present here. This article benefitted tremendously from his input and I am thankful for his contributions. Any errors or omissions that remain are solely my responsibility.

Contact:

<https://forum.growweedeasy.com/forum/growing-community>

Handle: Campesino

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Campesino's Guide to Growing in Coco

Part 3: Managing the Grow:

EC, PPM and Fertigation

Welcome Back! In this section of the guide I dive deeper into Grow strategy and specifically the topics Electrical Conductivity (EC), PPM and Fertigation. This is related to but different than “Plant Nutrition and Supplements”, which will be the topic of an upcoming installment. EC is relevant to nutrition, but it is also relevant to how water moves through the plant. The role that EC plays is often misunderstood... For example, when plants get “nute burn”, it is not a result of taking in too many nutrients, it is a result of taking in too little water because EC is too high! It should absolutely be called “EC Burn” instead! Understanding EC and managing it during your grow are even more important than a deep understanding of nutrients and supplements.

As is the case with all sections of this guide, what follows is scientifically based and thoroughly researched. This is the knowledge that I have and the strategies that I am [currently following](#). **I try to make this as simple as possible and give clear guidelines for how to set a target EC for inflow and manage EC during your grow.**

This section of the guide is organized into 7 points:

- Point 1: What is EC and Why does it Matter**
- Point 2: The Effects of Incorrect EC**
- Point 3: Where Does the Water Go**
- Point 4: Target EC Ranges**
- Point 5: Mixing Nutes and Achieving the Target EC**
- Point 6: Run-Off: Measuring and Correcting EC**
- Point 7: Flushing**

At the end of this section of the guide I present:

- Principles in Practice: Campesino's Garden**
- Campesino's Nutrient Schedule**

Point 1: What is EC and Why does it Matter:

- **What is EC**
EC stands for “Electrical Conductivity”. It is a measure of the salinity of the water. Water filtered through Reverse Osmosis (RO) or distilled water has an EC of 0. EC is measured in millisiemens per centimeter (values like 0.00-2.00) or microsiemens per centimeter (values like 0-2000). One millisiemen = 1000 microsiemens. My meter reads in microsiemens so I use those values below.
- **EC and PPM**
Many growers are more familiar with PPM than with EC. PPM is actually calculated by measuring EC. EC is a more accurate measure, because there are different formulas for calculating PPM from EC and all PPM “measurements” depend on actually measuring EC. Most meters will give both EC and PPM. If yours only does PPM that is not a deal breaker, because

there is a close relationship between the two. The conversion that my meter uses is about 2 to 1 where a PPM reading of 500 is equivalent to an EC of about 1000. However, some meters use a conversion of about 10 to 7, where PPM 500 reading would be equivalent to an EC of 714. I use the 2 to 1 conversion throughout as a rough estimation. **It is better to simply follow EC.**

- **Why does EC Matter**

Plants receive water from the media via osmosis across the membranes in their roots. Osmosis draws water in the direction of higher EC. In order for the roots to get water from the media, the concentration of sugars within the roots must be higher than the EC of the nutrient solution. Plants produce sugars to create high EC in their roots and pull water in. If the EC of the nutrient solution is higher than the roots, bad things happen as I describe below. Conversely, if the EC of the Nutrient solution (or any “non-nute” water) is significantly lower than the roots, it leads to disappointing results. See Point 2 below.

- **pH**

Although I do not elaborate on pH here, I felt that I needed to mention it. Ph should run 5.5-6.5 in Coco. Ph affects the solubility of the nutrients in the solution. Although suppliers work to make these nutrients available across a range of pH values, there is a reason they all still advise you to adjust pH to this range. I will address pH in greater depth in an upcoming installment on “Nutrition and Supplements”. But for now...

When hand-watering I vary my pH daily moving in small steps up and down the range. I include appropriate pH ranges in my nute schedule below. You must measure and adjust pH of inflow to prevent nutrient lock-out, however, you may ignore the run-off pH value.

You should measure and adjust pH before measuring final EC. Both Ph Up and Down raise EC somewhat.

- **Online References**

- <https://scholar.lib.vt.edu/ejournals/JARS/v55n3/v55n3-hammer.htm>
- <https://courses.lumenlearning.com/boundless-biology/chapter/transport-of-water-and-solutes-in-plants/>
- <https://www.alchimiaweb.com/blogen/electrical-conductivity-cannabis/>
- <https://www.zambeza.com/blog-the-perfect-ec-to-grow-perfect-cannabis-n140>
- <https://www.maximumyield.com/master-the-art-of-measuring-ec/2/1425>
- <https://www.gbwaterwatch.org.au/resources/ID1297390048.pdf>

Point 2: The Effects of Incorrect EC

Fertilizers are like Vitamins more than “Food”

Many growers mistakenly think of fertilizer like it is “food” that plants “eat” to grow bigger – This is FALSE. Even if you understand the reality of photosynthesis, it is easy to fall back into that kind of thinking. **Fertilizers are not food – think of them more like vitamins.** The goal is finding the correct balance, NOT giving as much as possible!

Once it is properly buffered, Coco is essentially an inert growing medium. It holds onto very little nutrition that can be used by the plant. Instead, the plant gets all of its nutrition directly from the water.

Thus, **it is critical to provide nutrients with all water**. I made this point in the first section of the article, and as you will see, I continue to provide reasons for this below.

Since we are adding fertilizer to all irrigation water, the correct term is “**fertigating**”. I will use this term going forward to remind that all water should have nutrients.

- **What happens when EC is too HIGH**

Plants receive water from the media through the roots by way of osmosis. Water moves through root membranes in the direction of higher EC. Thus, it is critical to keep the EC of your nutrient solution lower than the EC of the water in the roots. Plants are adapted to produce sugars in their roots which raise the EC and encourage water to enter the roots. However, you can easily overwhelm the plant's ability to raise its EC if the nutrient solution is too high. Plants will start to struggle to get water at High EC and if it gets too high, Osmosis can flow in the opposite direction and water is literally pulled out of your plant. This struggle for water and “reverse osmosis” is what causes all of the signs that we know to be nutrient burn: wilting, crispy dry leaves, leaf curling, slow growth, eventual plant death.

If you are experiencing even minor signs of nutrient burn, that indicates that your plant is struggling to pull water against a too high EC. Rather than helping growth by “giving lots of food” you are hindering it by starving the plant of water. Burn indications should be met with remedial actions (See points 6 and 7 below).

- **What happens when EC is too LOW**

When the EC of the nutrient solution is too low, plants drink too much water. This is because the EC within their roots is much higher than the EC of the nutrient solution. Drinking this extra water does not mean they are taking in additional nutrients. Plants take in water through Osmosis and nutrients through separate diffusion processes. Low EC also exposes the risk of under-fertilizing, because there is necessarily less fertilizer in the water. The combined effects of increased water intake and decreased nutrition may result in nutrient deficiencies and may also result in weak structural growth and “fluffy” buds. Plants produce sugars and other good things when EC is correct. They must do this to raise their own EC and pull water into the plant through osmosis. **If EC is low, plants produce less of the “good stuff”.**

- **What happens when EC is not stable**

When EC is constantly varying, the plants are constantly working to adjust.

To receive water through osmosis, plants need to adjust the EC of the water within their roots by producing sugars. Remember, water moves from low to high EC during osmosis. When exposed to low EC water, roots must lower the level of sugars they contain to avoid taking in too much water. If the next water has a higher EC, plants can suffer burn even at relatively low ECs because the roots are set for even lower. As discussed above, when the root EC is too low compared to the EC of the nutrient solution, plants struggle for water or water is actually pulled out of the plant. Conversely, when EC moves from high to low, plants take in too much water resulting in weak structural growth and fluffy buds.

The common practice of interval flushing in Coco with one watering of nutrient solution and one watering of “plain”, “pHed”, or “CalMag” water should not be practiced because it results in unstable rootzone EC and forces plants to constantly adjust. Every time you do that interval

flush with “plain” water you are increasing water flow into the plant and producing a weaker structure and fluffier flowers. Every time you follow it with high EC nutrient solution, you are risking burning your plants and starving them of water. The effects are perhaps somewhat less dramatic than I am making it seem, but you should be able to see why this practice is not advised.

Keeping plants healthy and happy requires delivering a nutrient solution with a consistent EC at each fertigation event. AND, delivering it often enough that EC does not increase through water losses to transpiration and evaporation between fertigation events. As I discuss in the previous sections of this article, **high frequency fertigation with consistent EC levels (nutes in all water) is the best strategy for vigorous healthy plants.**

- **When changing nutrient solution to higher or lower EC** (following stage of growth): It is recommended to slowly transition over several days rather than suddenly from one fertigation to the next.
- **Online References**
 - <https://www.alchimiaweb.com/blogen/electrical-conductivity-cannabis/>
 - <https://www.cannabis.info/en/blog/ideal-ec-range-plants>
 - <https://www.maximumyield.com/master-the-art-of-measuring-ec/2/1425>

Point 3: Where Does the Water Go

When you add nutrient solution to the media, the water goes to three different places: Much of it goes to **the plant**, we know some of it **Runs-off** and ends up in the drain, but we often forget that quite a bit is **lost to evaporation** from the media.

1. **The Plant:** Plants absorb water through osmosis leaving increased concentrations of nutrient solution. The vast majority of this water moves through the plant and is lost through transpiration. **The water that goes to the plant raises the EC of the nutrient solution in the media.** In separate processes, diffusion and active transport, the plant draws in nutrients. During these processes, the plant exchanges ions with the nutrient solution, thus they have no impact on EC.
 2. **Lost to Evaporation:** As water sits in the pot suspended in the media between fertigation events it is constantly evaporating. The water that is lost to evaporation causes EC in the remaining nutrient solution to increase. Because of both evaporation and transpiration, EC is lowest immediately following a fertigation and “Peak EC” occurs just prior to the next fertigation event. **Evaporation raises the EC of the nutrient solution in the media.**
 3. **The Run-off:** As fresh nutrient solution washes through the media during a fertigation, it picks up the additional solutes that were left behind through evaporation and carries them out of the media and into the drain. **Run-off lowers EC back toward the target**
- **Online Reference**
<https://www.maximumyield.com/master-the-art-of-measuring-ec/2/1425>

Point 4: Target EC Ranges

- **Nutrition and Growth Phase**

If you have ever seen a cannabis feedchart, you will know that the nutrition needs of a plant change during its life cycle. Its optimal EC range also changes: starting low, reaching a peak during mid-late flowering, and easing down in the final weeks and sharply at the end. In addition to the base nutrients that are required for healthy growth, other supplements may be useful. The amounts of these will change following the plant life-cycle as well. I do not elaborate on specific nutrient needs or supplement benefits in this section of the guide. You are welcome to follow the nutrients I use or a different line. The information I present here can be applied broadly.

There are many good nutrient lines. I use General Hydroponics (GH) Flora series along with their supplements: Armor SI, CALiMAGic, RapidStart, Diamond Nectar, and Liquid Koolbloom. I calculate ratios for each of these based on its purpose and the recommended feeding schedules. It is important to realize that almost everything that you add to the water raises the EC – and you have a specific target to reach.

- **Determining Target Inflow EC:**

You can easily find generic guides for optimal EC at different life stages, however, there are differences between different nutrient lines. Therefore, I start with the recommendations from GH, and I suggest that you start with the recommendations from your supplier.

I am currently in Mid-Bloom on my grow and GH recommends PPMs of 600-800 with the full line. This converts to an EC of around 1250-1700 for this stage of growth.

Many growers are scared to follow nute recipes at 100%, with reason! If I tried putting all the things that GH recommends at the levels they suggest there is no way that my EC would stay within the range they advise! I cut the base nutrients almost in half, use only about half the supplements and still arrive at the low end of the range. And I am starting with water that is only 40 EC and 19 PPM. The EC or PPM ranges provided by the nutrient company are generally acceptable to follow, the problem is that their recipes would never produce solutions in those ranges.

If your inflow is at the top end of the range, your run-off will be significantly higher. Even under ideal fertigation frequencies, the EC within the media will be up to a couple hundred points higher than inflow. Therefore, **I recommended starting your Target EC calculations with the low end of the nutrient company's recommendations and adjust from there.** I actually run just under the 600 PPM (1250 EC) that GH advises. I discuss further below how I arrived at my target PPM (560) and EC (1175) for my plants in Mid-Bloom. But before considering my target EC, you need to consider yours!

Beyond the manufacturer's recommendations there are several factors that you should keep in mind when determining your target EC:

- **Strain**

Different strains have different nutritional needs. Check with the breeder or do research on your strain. If you are growing a strain that likes high nutes then target the high end of the EC range. If you are growing a plant that prefers lower nutrition than target the bottom. Checking with the breeder information is best, but as a general rule:

- **Fast flowering strains (Indicas) enjoy higher EC**

- **Slow flowering strains (Sativas) enjoy lower EC**
- **Quality of starting Water**
 - **Starting with good quality (low EC) water: Target Lower EC**
If you are starting with low EC water, the bulk of the EC will come from the base nutrients. Rather than increasing nutrients to achieve an EC high in the range, you should set your target towards the bottom of the EC range.
 - **Starting with poor quality (high EC) water: Target Higher EC**
If the starting water already has a high EC, you may target an EC higher in the range. A general rule would be to add the EC of the starting water to the bottom EC range score. For example, if EC range is 1250-1700 and you are starting with water that is 250, your target EC could be 1500 (1250+250), which is still comfortably in range.
- **Fertigation Frequency**
As water transpires from plants and evaporates from pots it causes EC of the remaining nutrient solution to increase. If the time between fertigation events is greater than 12 hours, you should target a lower EC so that the natural rise in EC does not cause damage to your plants. If you are able to fertigate 3x daily or more, then you can target a higher EC.
 - **Infrequent fertigation: Target Lower EC**
 - **Frequent fertigation: Target Higher EC**
- **Environmental factors**
 - **If your Tent Runs Hot or Dry: Target Lower EC**
Heat and low humidity increase the rate that plants draw in water through their roots making lower EC desirable. Both heat and low RH will also cause evaporation, which raises EC between fertigation events. With increased transpiration and evaporation you should set a lower initial target and expect EC of run-off to be slightly higher.
 - **If your Tent Runs Cool or Humid: Target Higher EC**
- **Your Plants**
 - **Always “listen” to your plants!** Once you determine your target inflow EC and are maintaining the EC in your medium within 200 points, make sure that your plants are happy! If there are any signs of burn, and the run-off is not significantly higher than inflow, then your target EC may be too high.
 - **Realize:** Plants may be burned by abrupt changes, but they may be able to adjust to the new higher levels. Be patient if minor burn shows as you increase EC. Slow the increase and allow plants to adjust.

Point 5: Mixing Nutes and Achieving the Target EC

Once you determine your target EC, you need to determine the recipe to achieve it.

Your Nute Recipe: Start with your current nute recipe, use Nebula's posted [HERE](#), or Mine below. Both Nebula's and My nute schedules are about 50% of the manufacturers recommendations for amounts of the base nutrients. So, if you are new and/or using a different line, mix the base nutrients at 50% to start. If you study my feed chart, you will realize that I give most other additives at or near their full recommended dose.

Mix everything and adjust the pH, then measure the EC.

- **If EC is too high:** dilute with plain water until desired EC is achieved
 - Note the quantity of water and reduce the base nutrients by that percentage
 - For example, if it took an additional quart to reach desired EC than reduce the base nutrients to 80% of original recipe (Keeping other supplements at original desired levels)
 - Adjust recipe but always verify EC (don't just follow your recipes)
- **If EC is too low:** Add something! Remember, EC determines the rate and direction of osmosis in the roots. Plants produce sugars and other good things to raise their own EC and draw in water. If the EC of the nutrient solution is too low, plants will not produce as much of the good stuff! – keeping the right EC is important even if you feel the recipe has all that they need. **If EC is below the target you should add something.**
 - Make a high EC gallon to mix with a Low EC gallon rather than adding nutes individually at the end.
 - **You can increase the base nutrients, maintaining the same ratios.**
 - Use your best judgement to adjust the recipe
 - Never exceed the nutrient company feedchart quantities – I recommend never exceeding 75% of those quantities.
 - **Alternatives**
 - Cal/Mag raises EC considerably and is always useful in Coco
 - Other supplements may or may not have considerable impact on EC
- **Precision of your Target:** Ideally, EC will stay fairly consistent, but you cannot expect it to always be precise. When mixing water gallon by gallon, I follow my recipe and each gallon ends up a little different. Recent gallons have run from 1155-1206 EC (Target =1175) and 543-567 PPM (Target = 560). This degree of variance is acceptable.
The EC within the root zone will fluctuate much more than this anyways. Expect your run-off to be a couple hundred points higher than inflow EC, this is normal.
- **Consistency of Starting Water:** If your starting water is consistent, the recipes that you create should help you arrive at your target EC. As you progress through the nutrient schedule you will be able to predict how you may have to adjust the recipe to arrive at your target EC.
If your starting water is not consistent, it is more important to maintain consistent EC than to maintain consistent nutrient levels! You will need to adjust the recipe based on the starting EC of the water. This can be easily accomplished through dilution.
- **Always provide base nutrients at the recommended ratios:** For example, if there is twice as much "Bloom" than "Grow" in the feed chart, there should be twice as much in your nutrient solution. The total amounts can vary to achieve target EC, but the relationship among them should be the same.

- Online Reference:

<https://www.maximumyield.com/master-the-art-of-measuring-ec/2/1425>

Point 6: Run-Off: Measuring and Correcting EC

Measuring EC: It is important to measure EC of the inflow and periodically measure the EC of the run-off. I have not always measured EC, so I sympathize with those of you who prefer to simply follow nute schedule recipes. However, for all the reasons I am describing here it is really one of THE critical measurements to take and reliable meters can be had for about \$15. This is my meter

<http://a.co/c7zdMW0>

- **Campesino's Rule: EC out should be within 300 points of EC in (150 PPM):**
EC of all inflow water should be tested, and adjusted if necessary to achieve your target EC. EC of run-off should be tested for each plant at least weekly. The EC of the run-off will be slightly higher than the inflow, but should be very close, and both values should fall within your target EC range. Under normal conditions, **the run-off EC may be up to 300 points higher than the inflow (+150 PPM)**. This is acceptable and a good reason to target the lower end range of the nutrient company's recommendations. If it is higher than that, remedial actions should be pursued. See my EC Run-off Guidelines below.
- **If Run-off EC is High:**
The most likely cause of high EC run-off is excessive losses to evaporation between fertigation events. **The best solution is to increase fertigation FREQUENCY**, which will help to prevent EC from drifting too high between fertigation events. Only if run-off EC is dangerously or persistently high should flushing with a lower EC solution be considered. See point 7 below.
- **If Run-off EC is Low:**
It is less likely that EC of the run-off will be lower than the inflow. If this occurs, **increase QUANTITY of nutrient solution applied until run-off EC is equal to inflow EC**. It should not be difficult to raise the EC of the run-off.
- **Change EC GRADUALLY!**
There are times when you need to change the EC of the inflow. This occurs with changes in the plant's life cycle following the feed charts. It may also occur after reading this guide if you decide to change nutrient strategies. Be aware, your plants have gotten used to what you have been doing and make your changes gradually.
If moving to a nutrient solution with higher EC (or lower, but especially higher!), you should do so gradually and incrementally. Refer to the section above, "What happens when EC is unstable".
- **Campesino's EC Run-off Guidelines:**
 - **If Run-off ec is:**
 - **Lower than inflow EC:** Increase quantity of nutrient solution applied during fertigation events
 - **Within +200 points:** Ideal zone, weekly monitoring of run-off EC
 - **200-300 points higher:** CAUTION, Not a problem, but daily monitoring of EC is advised. Consider increasing fertigation frequency to lower run-off EC
 - **300-400 points higher:** Increase fertigation frequency to lower run-off EC
 - **400+ points higher:** Consider flushing

Point 7: Flushing

- **When and Why to flush**

Flushing may be required if nutrient lock-out occurs or if EC in the media is persistently too high. If you fertigate without sufficient run-off you may create salt buildup that requires flushing. If you notice signs of nutrient lock-out (often manifested as nutrient deficiencies despite feeding) then flushing is advised.

Campesino's Rule: If Run-off EC is persistently more than 400 points higher than inflow EC despite frequent fertigation (multiple times per day) with 20% run-off, then you should consider flushing.

Although it is to be avoided as an alternating practice, you should not be afraid to flush your coco if needed. One of the advantages of coco is that you can recover from a flush much quicker than in a medium like soil. **Flush when needed!**

Some nutrient lines advise periodic pre-emptive flushes on a schedule, some as often as weekly, like [Cyco](#). However, they suggest really high EC ranges! They also may be concerned about lock-out issues. Pre-emptive flushing should not be required with most lines, but I would follow the supplier's advice if they recommend it.

Final Flush: There has been some debate here about the efficacy of the final flush, however, it is a ubiquitous practice and conforms to my understanding of EC. I do not intend this to be an article on Final Flushing, but plants really do benefit from lower EC at the end of their life cycle. I describe my practice below.

- **How to flush (During the grow)**

During the grow, there are some strategies to follow to minimize the adverse effects of flushing on the plant.

1. Amount needed to Flush depends on EC targets.
2. Using a flushing agent dramatically reduces the amount needed to flush. I use FloraKleen mixed at 5ml/gal
3. Flush at the end of the light cycle – beginning of dark cycle
4. Resume fertigation within 12 hours at target EC
5. During the first several fertigation events following the flush apply an increased quantity of nutrient solution. This helps restore the EC of the media.

- **Final Flush**

I do a final flush over just the last 5 days before harvest. I apply 5 straight irrigations with florakleen over 2.5 days followed by plain water for the remaining irrigations. I do not pH adjust the water once the final flush begins. The purpose of pH adjustment is to make nutrients in the media accessible to the plant. During the final flush we no longer want those nutrients to be absorbed by the plant!

- **Online Reference**

- <https://www.maximumyield.com/remember-to-flush/2/1206>

Acknowledgement: This section of the guide has benefitted from a peer review process with @DangerDan who has offered critiques, improvements, and additional citations. I am grateful for his collaboration in verifying and improving the information that I provide. Of course, any errors or omissions that remain are solely my responsibility.

Again, this is offered to the community as a resource. Your comments and questions are welcome and all feedback is most certainly appreciated! Don't forget, that if you change your practices because of this guide, I would love to know about it and to follow your grow!

Principles in Practice: Campesino's Garden

How I Determined my "Target EC"

As I stated above, my Target EC is just below the guidelines suggested by GH. Where they recommend a PPM range of 600-800, I am targeting PPM 560 (EC 1175). Factors relevant to my decision:

- Quality of Starting Water: Very Good, EC = 40, PPM = 19
- Strain: Growing a mix of Indicas and Sativas – All getting the same blends
- Watering Frequency during Flowering: 2x daily
- Tent Environment: Temperature range 68-76f (Barely Cool) Humidity 40-55% (Leans Dry)
- Plants: Doing Great!

First, I am starting with very good water that has an initial EC of 40 (PPM 19). As a result, almost all of the EC present is a result of formulated nutrients rather than random minerals dissolved in my water. This makes me shoot for the low end of the range

Second, I am growing 5 different strains. In this situation you can either prepare individual batches of nutrient solution or set the target EC for the plant that wants the lowest. I set target EC for all plants based on the needs of my Shining Silver Hazes. They are Sativa dominant with a flowering period up to 11 weeks. Furthermore, they showed signs of burn when EC rose slightly when I missed a watering. This indicated that I was perhaps too close to the edge with them. Therefore, I targeted slightly lower EC.

The other factors mentioned, watering frequency and tent environment are pretty standard and did not require adjusting my target EC. Finally, I watch my plants and they are LOVING IT! You can watch them too... If you haven't already, check out their last few weeks: [TIME LAPSE: "The Stretch in 3 GIFs"](#)

Campesino's Nutrient Schedule

You need to determine your own nutrient schedule recipes after setting your own Target EC and knowing the starting EC of your water. That said, you need a place to start and I am more than happy to let you know exactly what I do. Below is the nutrient schedule that I made and am following. I am currently in Mid-bloom, so the recipes for later in the grow are my best guess and will be refined to achieve the target EC as my grow progresses to each stage.

Campesino's Nutrient Schedule For Coco/Perlite										
DAILY WATERING: NUTES IN ALL WATER										
Amounts are ml/gallon										
	Seedling	Early Veg	Mid Veg	Late Veg	Transitio	Early Bloo	Mid Bloo	Late Bloo	Late Bloo	Ripen
	First 6 days	ONE WEEK (2) DAY 7-14	ONE WEEK DAY 15-20	Day 21- the flip	ONE WEEK	TWO WEEKS (5-6)	TWO WEEKS+ (7-8)	ONE WEEK (9)	ONE WEEK (10)	ONE WEEK (11)
Armor SI	0	0.5	1	1	1.5	1.5	1.5	1	0.5	0
CalMag	5	5	5	5	4	4	2.5	2.5	2.5	2.5
Fmicro	1.25	2.25	2.25	2.5	2.25	2.25	2.25	2.25	2.25	1.25
Fgro	0.6	2.25	2.5	2.5	2.25	1	0.5	0	0	0
Fbloom	0.6	0.6	1	1.2	2.25	2.25	3	4	4	4
Koolbloom	0	0	0	0	0	0.5-1.0	1.5	2	4	5
RapidStart	0	2	2	1	1	1	1	0	0	0
Diamond Nectar	2.5	5	5	5	2.5	2.5	2.5	0	0	0
pH	6.2-6.4	6.0-6.2	5.8-6.2	5.7-6.2	5.8-6.1	5.7-6.3	5.7-6.3	5.7-6.3	5.8-6.3	5.9-6.2
PPM Target	175	480	530	560	560	530	560	560	560	400
EC Target	370	1010	1115	1175	1175	1115	1175	1175	1175	840

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7 Week	1-6	7-16	17-28	29-34	35-39	40-44	45-49
9 Week	1-6	7-21	22-37	38-44	45-51	52-58	59-63
10-11 Week	1-6	7-24	25-47	48-55	55-62	63-69	70-74
Flowering Nutrient Timelines Based on Flowering Period							

4/21/2018

When mixing Nutes: Silica should be added first and given time to dissolve. Cal/Mag is second and should be added before the base nutrients. If using GH nutes, they are listed in my feedchart in the order that you should add them to the water.

Cal/Mag: The one supplement that you cannot avoid in Coco. Although buffering the coco prior to use in Cal Mag should eliminate many of the headaches that Cal and Mag cause, it is still recommended to add Cal Mag throughout the grow.

Updates will follow: Coming Soon... DIY Auto-Watering System

Contact:

<https://forum.growweedeasy.com/forum/growing-community>

Handle: Campesino

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