

How to reuse your coco coir in soilless growing

Why reuse media

Buying new media and spending labor to mix, expand, and even amend it can be a costly process for growing facilities. Dumping media also involves going through a composting process, wasting nutrients that are already present in that media when it is thrown away. However, media in hydroponics serves a mostly structural role and there are no fundamental reasons why media like coco cannot be recycled and used in multiple crop cycles.



Coco coir commonly used as a substrate in soilless agriculture.

By reusing media, a grower can substantially reduce operational costs. This is because the media itself often contains an important amount of surplus nutrition and the roots and other organic components left behind by previous

plants can also be used by new crops to sustain their growth. These added decomposing root structures also reduce channeling in the media and help improve its water retention as a function of time. After a media like coco is reused several times, the coco also degrades and becomes finer, further improving water retention.

Why media is often not reused

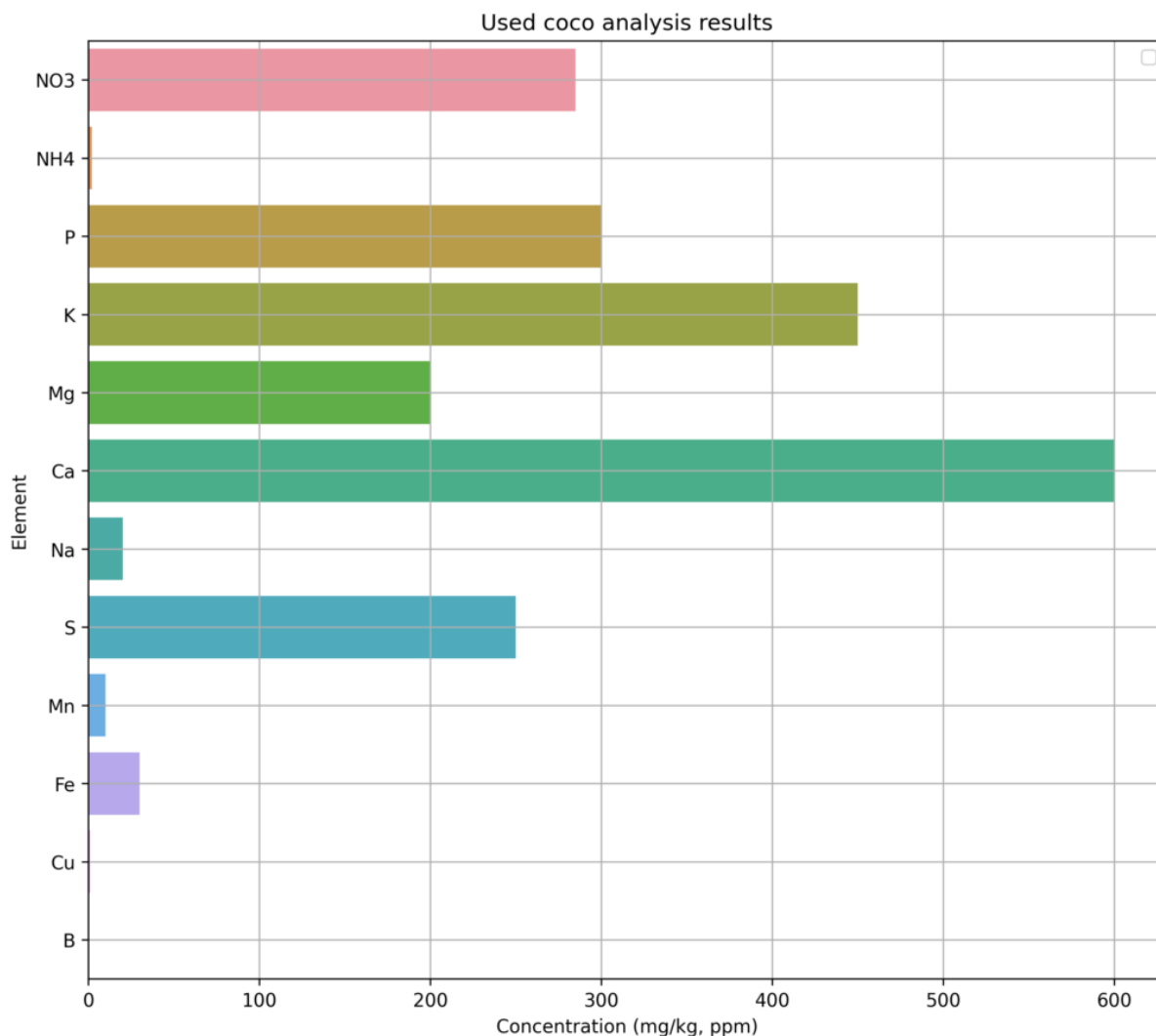
Reusing media is not without peril. When media is pristine, it is more predictable. You know its basic composition and you can feed it the same set of nutrients and hope to obtain very similar results. Nonetheless, after media goes through a growing cycle, its chemical composition changes and the starting point becomes much more variable. This means that a grower needs to somehow adjust nutrition to the changes in composition, which can often make it difficult for the crop to achieve consistent results.

If a grower reuses media but tries to feed as if the media was new, then problems with overaccumulation of nutrients in the media will happen and it will be hard for the grower to obtain reliable results. Reusing media requires a different approach to crop nutrition which scares people away because it strays from what nutrient companies and normal growing practices require. However we will now learn how media is chemically affected by cultivation and how we can take steps to reduce these effects and then successfully reuse it.

Media composition after a normal crop

In traditional coco growing, fertilizer regimes will tend to add a lot of nutrients to the coco through the growing cycle. From these nutrients, sulfates, phosphates, calcium and magnesium will tend to aggressively accumulate in the media

while nutrients that are more soluble like nitrate and potassium will tend to accumulate to a lesser extent or be easier to remove.



Analysis of used coco from a tomato crop. This analysis uses a DTAP + ammonium acetate process to extract all nutrients from the media. This media had a runoff pH of 6 with an EC of 3.0 mS/cm.

The above image shows you the analysis results of a coco sample that was used to grow a tomato crop. In this analysis, the media is extracted exhaustively using a chelating agent, to ensure that we can get a good idea of all the cations that are present in the media. The chelating agent overcomes the cation exchange capacity of the media, forcing all the cations out – fundamentally exchanging them for sodium or ammonium – and showing you the limits of what could be extracted from the media by the plant.

In this case, the amount of Ca is so high, that it can fundamentally provide most of the Ca required by a plant through its next growing period. Since most of this Ca is going to be present as calcium sulfate and phosphate, it will only be removed quite slowly from the root zone by leachate. The amount of potassium is also quite high, but this potassium is going to go out of the media quite easily and is only likely to last for a short period of time.

In addition to the above mineral content, coco that is reused will often contain a lot of plant material, roots that remained from the previous crop, so the subsequent reuse of the media needs to incorporate adequate enzymatic treatments to help breakdown these organics and ensure that pathogens are not going to be able to use these sources of carbon as an anchor point to attack our plants.

Steps before the crop ends

Because of the above, one of the first steps we need to carry out if we want to reuse media is to ensure that the media is flushed during the last week of crop usage with plain water, such that we can get most of the highly soluble nutrients out of the media so that we don't need to deal with those nutrients in our calculations. This will remove most of the nitrogen and potassium from the above analysis, giving us media that is easier to use in our next crop.

In addition to this, we will also be preparing our media for the digestion of the root material. Before the last week of cultivation, we will add [pondzyme](#) to our plain water flushing at a rate of 0.1g/gal, such that we can get a good amount of enzymes into our media. We should also add some beneficial microbes, like [these probiotics](#), at 0.25g/gal, so that we can get some microbial life into the media that will help us decompose the roots after the plants that are currently in the media will be removed.

How to manage the new crop

Once the crop ends, we will remove the main root ball from the media. There is no need to make an effort to remove all plant material as this would add a lot of labor costs to media reuse. The media should then be allowed to dry, such that the roots that are left behind can then be easily broken up before new plants are placed in the media. Machines to breakup any roots are ideal, although this can also be done manually and easily once all the root material in the media is dead and the roots lose their capacity to hold their structure together.

Once we have dry coco with the root structures broken up, we can then fill up new bags to reuse this media for our next crop. After doing a lot of media analysis and working with several people reusing media, I have found this method works well. If we performed the flushing steps as instructed before, then we can use the media runoff EC as a way to evaluate the type of nutrition needed.

While the runoff EC remains above 1.5mS/cm , we feed a solution containing only potassium nitrate and micronutrients (no phosphorus, sulfates, calcium or magnesium) at 2g/gal of KNO_3 + micros. After the runoff EC drops below 1.5mS/cm we return to feeding our normal regime. The idea here is that while the media is above 1.5mS/cm the plant can take all the nutrients it needs from the media, but once the media EC drops below 1.5mS/cm , the media is deprived from these nutrients and we need to provide them again for the plant.

Bear in mind that while the nitrogen content of the above feed seems low (just 73 ppm of N from NO_3) there is additional nitrogen that is coming from the decomposition of the organic materials left in the media, which can supplement the nitrogen needs of the plants. Despite the flushing on the last week, there is always some nitrate left from the previous crop. I have found that this is enough to support the plant until the

runoff drops below our 1.5mS/cm threshold. After this point, the plant can be grown with its normal nutrition.

Simple is better

Although you would ideally want to find exactly which nutrients are missing or present after each batch of media and adjust your nutrition such that you can get your plants the ideal nutrient composition every time, this is not cost effective or required in practice to obtain healthy plant growth. A media like coco possesses a good degree of nutrient buffering capacity (due to it's high cation exchange capacity and how much nutrition is accumulated after a crop cycle), so it can provide the plants the nutrition of certain nutrients that they need as long as the nutrients that are most easily leached (K and N) are provided to some degree.

The above strategy is simple and can achieve good results for most large crops that are grown using ample nutrients within their normal nutrient formulations. It is true that this might not work for absolutely all cases (or might need some adjustments depending on media volumes) but I've found out it is a great strategy that avoids high analysis costs and the need to create very custom nutrient solutions.

Do you reuse your coco? Let us know which strategy you use and what you think about my strategy!

Using coco coir in

hydroponics

Side by side with peat moss, coco coir is one of the most commonly used media in hydroponic culture. Its excellent root propagation and aeration properties, coupled with its adequate water retention, make it an ideal medium for hydroponic culture. Nonetheless, there are several issues that can arise when using coco coir, particularly due to its chemistry and variability. Today we are going to talk about using coco coir in hydroponics, what the main problems with coco can be and how these problems can be avoided.

TABLE 11.7 Levels of pH and EC in Coir

pH	EC (mS cm ⁻¹)	Reference
4.9–6.4	0.17–2.32	Noguera et al. (2003b)
5.6–6.9	0.13–1.26	Evans et al. (1996)
4.8–6.8	0.32–0.97	Meerow (1994)
5.5–5.7	0.80–1.90	Handreck (1993)
5.0–5.7	0.12–1.51	Prasad (1997b)
4.9–6.6	0.32–0.41	Smith (1995)
6.0–6.7	0.2–0.4	Kipp et al. (2000) (coir dust)
5.9–6.1	0.2–0.9	Kipp et al. (2000) (coir chips)

Values of Noguera et al. (2003b), Evans et al. (1996), Meerow (1994) are based on saturated media extract, Smith (1995) on 1:5 water extract, and the others on 1:1.5 water extract. EC values have been converted to 1:1.5 water extract (see text).

EC and pH values for different coco coir sources

Coco coir is basically ground up dried palm tree husks. Although it is organic, it is much more fibrous than peat moss and for this reason, it does not suffer from some of the pH and decomposition issues commonly found with peat. Although coco is biodegradable, its decomposition can take more than 20 years, reason why it is a suitable media for hydroponics. It can even be used several times within a hydroponic crop in order to save production costs, as long as plant material is removed and the media is properly treated between crops.

Since coco coir comes from large plants grown across a variety of different conditions, the actual chemical makeup of the coco can change very substantially. The table above shows the pH and EC of different coco coir sources. As you can see, we have everything from an EC of 0.1 mS/cm to an EC of 0.9

msS/cm, with pH values that cover anything from 4.9 to 6.8. This is mainly due to the big variations in the ions contained within the coco and how these ions interact with the plant material.

Coco coir also has a high cation exchange capacity, meaning that it can retain large amounts of ions. These are only taken out if they are replaced by others with stronger affinity for the media or when strong interactions with chelating agents are possible. This is generally why coco is treated with calcium nitrate solutions, to remove many of these ions from the media structure and allow the media to be as neutral as possible when used in hydroponic culture. However, many coco producers do not treat the media at all – or simply wash it with plain water – leaving a lot of potassium and sodium within the coco that needs to be accounted for. A lot of micro nutrients that are tightly bonded to cation exchange sites are often also often present inside the coir.

TABLE 11.9 Chemical Properties of Coir (CaCl₂/DTPA Extractable Macronutrients) (mgL⁻¹)

P	K	Ca	Mg	Na	Reference
–	183–222	100–172	36–58	85–92	Kipp et al. (2000) (coir dust)
–	47–98	56–60	31–79	30–78	Kipp et al. (2000) (coir chips)
8–17	304–720 69–128	6–15	8–28	110–114	Handreck (1993) Prasad (1997b)

TABLE 11.11 Chemical Properties of Coir (CaCl₂/DTPA Extractable Micronutrients) (µg L⁻¹)

Fe	Mn	B	Zn	Cu	Reference
	1100–1500	120–180	700–1300	170–2200	Handreck (1993)
79–157	814–1540	66–77	429–527	0–6	Kipp et al. (2000) coir dust
45–140	484–561	66–154	364–552	240–448	Kipp et al. (2000) coir chips
4100–7700	900–5000	200–400	500–1100	100–300	Prasad and Maher*

*Prasad and Maher unpublished data.

Some of the chemical properties of different coco coir sources
If you want to ensure your coco is as neutral as possible in terms of nutrients, you can extract it with a 1 g/L solution of calcium nitrate and then with 2g/L of tetrasodium EDTA. This will extract both macronutrients that are exchangeable for Calcium, and micro nutrients that can be extracted when using EDTA. The EDTA step is important, as coco can hold a

large amount of micro nutrients within it, that can be exchanged and used by the plant. If you want your nutrients to all come from solution you will need to remove these contributions from the media. After this, you will then want to run plain water to remove any excess Ca and EDTA and then run your full strength nutrient solution for a few days. This will strip the coco from excess ions and equilibrate the cation exchange sites with your nutrient solution's composition.

Note that these steps aren't necessary to grow successfully with coco, but they can give the grower more control over the nutrients received by the plants. You can alternatively run nutrient solution through the coco and then perform an analysis of the output, so that you can compensate for the nutrients that are given by the coco through the growth cycle. This of course means that you need to spend money doing solution analysis through the crop's life to ensure that you're adequately compensating for the coco's contributions through the entire growing period.

When properly treated, coco can be a very good media for growing hydroponic crops. The larger aeration, better chemical stability and fibrous structure makes it better for root growth than most peat moss sources. Yields for several plants are also often larger or just as good in coco when compared with peat moss. The lack of important decomposition during growth cycles is also a big advantage over peat, as important drops in pH due to media decomposition can be avoided and the media can be more readily recycled.