

Grow Media and Hydroponics

In hydroponics, the growing medium takes the place of the dirt/soil. Not to provide nutrients, but so the roots can support the plants weight and hold it upright. Just about any inert material can be used as a growing media. Inert meaning that it can't/won't decay or break down quickly, thus providing nutrients to the plants. Hydroponic growing media is simply a soil-less material that is generally porous so it can hold the moisture and oxygen that the root system requires to grow. Non porous materials can be used as well, but watering cycles would need to be more frequent so the roots don't dry out between waterings.

The growing medium won't be able to grow anything on its own. If you placed plants in hydroponic growing media, and watered it with plain water, the plants would starve from nutrient deficiency. It's simply there to help support the plants weight as well as the moisture and oxygen the roots need. The nutrients the plants need, are provided by the nutrient solution, and is what the growing media is watered and moistened with.

Some of the most widely used growing media's include Rockwool, Lightweight Expanded Clay Aggregate (called Hydroton), Coconut Fibre/Coconut chips, and Perlite or Vermiculite. While there are a lot of materials that can be used as growing media in hydroponics, they can all have very different properties than another type of media. We have even seen the use of hay bales as growing medium to grow tomatoes, using a drip lines on top to drip the nutrient solution onto the hay bales and tomato plant roots.

There isn't one growing media that is better than the rest. Especially with so many different hydroponic system designs possible. However many growers eventually favour one type over others. There are a lot of things to consider when choosing what to use as a growing media. The type of system you're growing in and how you design and build that system is the biggest factor.

While there is no one best growing media for all situations, some growing media's work better than others in different systems. With any hydroponic system, and/or any type of growing media, the goal is still the same. You just need the roots to be moist, not soggy and saturated. If the growing media is saturated and soggy, the roots will suffocate from lack of oxygen. That situation can easily lead to roots dying, and root rot.

Things to consider about growing media for each type of hydroponic system

Drip systems

Drip systems are fairly easy to control moisture in. As long as you design it so it has good drainage, and limit water pooling at the bottom you should be able to keep your growing media from being too soggy. We like to use river rock at the bottom to aid drainage, and keep the growing media from sitting in a pool of water at the bottom.

NFT systems

NFT systems use a very shallow, but continuous stream of water at the bottom of a channel where the roots wick up moisture. Most NFT systems either use small starter cubes or small 1 inch baskets, and then let the roots just hang down into the flowing water. If these cubes or baskets are too close to the water supply, and your growing media can become saturated easily, that combination can lead to "stem rot" if the growing media around the stem is always saturated.

Ebb-Flow (flood and drain) systems

Flood and drain systems can vary quite a bit in design. But generally you would want to stay away from any growing media that floats like Perlite and Vermiculite. Each time the system cycles on for the flooding stage the growing media will become weightless, and then your plants will lose all their support and want to tip over.

Depending on your system you could lower the flood level so floating is minimal, as long as the root-ball can still get plenty of moisture and you don't lose much plant support. Plant support may not be as much of a factor if growing vine type plants like tomatoes, peas or melons that would be tied to a trellis as well.

Also with flood and drain systems, and depending on the type of growing media you choose, you want to make sure you have good drainage so that the growing media isn't continually saturated. Grow rocks won't pick up much moisture, but we like using coco chips a lot because they are inexpensive, but coco chips wick up water if they are sitting in it. So a layer of river rock at the bottom keeps it from sitting in the water.

Water culture systems

Water culture systems don't generally use much if any growing media because it is designed so the plants roots are submerged into the nutrient solution itself. So plants are generally started using small starter cubes or small baskets. Starter cubes typically are suspended above the water line, while baskets can be suspended either just above or just below the water line. The growing media you choose and how much it absorbs moisture will make a difference. You don't want it to become saturated, you just want it to be moist at the bottom, and the top should be dry. The roots will grow downward into the nutrient solution.

Now you may be wondering if it's so bad if the growing media becomes saturated, why the roots won't become suffocated if they're under water all the time in a water culture system. First not all plants do well in water culture systems. Second and most important, a water culture system uses an air pump to generate a lot of air bubbles to the roots under water. The plants get oxygen from these air bubbles directly, as well as the air bubbles increase the dissolved oxygen levels in the water itself.

Aeroponic systems

Aeroponic systems typically don't use much growing media at all. Aeroponic systems are designed to allow the roots hang in the air while getting frequently misted with nutrient solution so the roots don't dry out. Seeds are started in either small starter cubes or small baskets, then when they're big enough they're planted in the aeroponic system. You'll want to make sure the cubes or growing media in the baskets don't become saturated. While almost all the roots will be hanging in air with no chance of becoming suffocated, wet growing media around the plants stem can lead to "stem rot."

Wick systems

Wick systems are the least used type of system, but with no moving parts, motors or pumps, they rely on wicking up moisture into the growing media and to the plants roots through a piece of fabric. With wick systems you'll want to use a growing media that absorbs and holds onto moisture easily. You can control the amount of water getting to the plant by using a larger/wider wick, or more than one.

List of different types of growing media for hydroponics

Rockwool

Rockwool is one of the most common growing media's used in hydroponics. Rockwool is a sterile, porous, non-degradable medium that is composed primarily of granite and/or limestone which is super-heated and melted, then spun into small threads like cotton candy. The rockwool is then formed into blocks, sheets, cubes, slabs, or flocking. Rockwool sucks up water easily so you'll want to be careful not to let it become saturated, or it could suffocate your plants roots, as well as lead to stem rot and root rot. Rockwool should be pH balanced before use. That's done by soaking it in pH balanced water before use.

Hydroton (LECA) Hydroton is a Lightweight Expanded Clay Aggregate (L.E.C.A.) that is a type of clay which is super-fired to create a porous texture. It's heavy enough to provide secure support for your plant's, but still light weight. Hydroton is a non-degradable, sterile growing medium that holds moisture, has a neutral pH, and also will pick up nutrient solution to the root systems of your plants. Hydroton grow media is re-usable; it can be cleaned, sterilized, then reused again. Although on a large scale, cleaning and sterilizing large amounts of hydroton can be quite time consuming. Hydroton is one of the most popular growing medium used for hydroponics, and just about every store selling hydroponics supplies carries it.

Coco Fibre Coco Chips "Coco coir" (Coconut fibre) is from the outer husk of coconuts. What was once considered a waste product is one of the best growing mediums available. Although coco coir is an organic plant material, it breaks down and decomposes very slowly, so it won't provide any nutrients to the plants growing in it, making it perfect for hydroponics. Coco coir is also pH neutral, holds moisture very well, yet still allows for good aeration for the roots.

Coco fibre comes in two forms, coco coir (fibre), and coco chips. They're both made of coconut husks; the only difference is the particle size. The coco fibre particle size is about the same as potting soil, while the coco chips particle size is more like small wood chips.

The larger size of the coco chips allows for bigger air pockets between particles, thus allowing even better aeration for the roots. Also if you're using baskets to grow your plants in, the chips are too big to fall through the slats in the baskets. Both the fibre and chips come in compressed bricks, and once soaked in water it expands to about 6 times the original size. Coco fibre does tend to colour the water, but that diminishes over time. And you can leach out most of the colour if you soak it in warm/hot water a few times before use.

Perlite

Perlite is mainly composed of minerals that are subjected to very high heat, which then expand it like popcorn so it becomes very light weight, porous and absorbent. Perlite has a neutral pH, excellent wicking action, and is very porous. Perlite can be used by itself, or mixed with other types of growing media's. However because perlite is so light that it floats, depending on how you designed your hydroponic

System, perlite by itself may not be the best choice of growing media for flood and drain systems.

Perlite is widely used in potting soils, and any nursery should carry bags of it. However perlite is sometimes also used as an additive added to cement. You may find it for a better price with the building supplies, and/or at places that sell concrete mixes and mixing supplies. When working with perlite be careful not to get any of the dust in your eyes. Rinse it off to wash out the dust, and wet it down before working with it to keep the dust from going airborne.

Vermiculite

Vermiculite is a silicate mineral that like perlite expands when exposed to very high heat. As a growing media, vermiculite is quite similar to perlite except that it has a relatively high action-exchange capacity, meaning it can hold nutrients for later use. Also like the perlite, vermiculite is very light and tends to float. There are different uses and types of vermiculite, so you'll want to be sure what you get is intended for horticulture use. The easiest way to be sure is to get it from a nursery.

Rockwool

Rockwool is an open cell material which means that the cells can absorb water and air. The open cells wick moisture throughout the material, and the roots can easily grow and expand through the open cell structure. While rockwool is usually used as starter cubes for hydroponically grown plants, they also have bags you can fill your growing containers with.

Floral foam

Floral foam can be used as a growing media in hydroponics as well, and is similar to the oasis cubes, though the cell size is larger in the floral foam. Depending on the type of hydroponic system you're using, and how you designed it, you may notice a couple of problems with using floral foam. First it can crumble easily and that can leave particles in your water. Second you'll want to be sure it doesn't get water logged. Floral foam absorbs water easily, so make sure it isn't in constant contact with the water supply.

Growstone Hydroponic Substrate

Growstones are made from recycled glass. They are similar to grow rocks (hydrocorn) but are made of clay and shaped marbles. Growstones are light weight, unevenly shaped, porous, and reusable, they provide good aeration and moisture to the root zone. They have good wicking ability and can wick water up to 4 inches above the water line. So you'll want to make sure it has good drainage or is deep enough so it doesn't wick water all the way to the top. Otherwise like with the growing media in any hydroponic system, if the top of the growing media is continually wet, you may have problems with stem rot. While they are made from recycled glass, they're not sharp and you won't get cut from it, even if they break.

River rock

River rock is common and easy to find in home improvement stores, as well as even pet supply's stores (with the fish and aquariums). River rock is fairly inexpensive (depending on where you get it from), and comes in many different sizes. River rock is rounded with smooth edges from tumbling down the river. Though manufactured river rock is rounded using large mechanical tumblers, it has the same end result with smooth edges.

You can use regular rocks from your back yard in hydroponic systems as well if you don't mind the jagged edges. Just make sure to clean and sanitize them before using it. Just spray all the dirt off of the rock using the jet spray from your hose to clean it, and then soak it overnight in bleach water to sanitize it. Then just rinse and use. Though using rock as a growing media is inexpensive and easy, it will get heavy quickly, so you won't want to move it later.

River rocks are not porous; therefore it doesn't hold and retain moisture in the root zone of hydroponic systems. Rock is uneven so it has a lot of air pockets between the rocks so the roots can get plenty of oxygen, but water easily drains down to the bottom. Rock won't pick up moisture either, so you will need to adjust your watering schedules so the roots don't dry out between watering's. You can mix in some coco chips or other growing media that holds moisture with your rock to aid it

in holding onto moisture longer.

Because of the good drainage properties of rock, it's very good to use to aid in the drainage of other hydroponic growing media's that might otherwise become saturated from sitting in water. A layer of rock at the bottom of the growing container will keep your growing media from sitting in water at the bottom of the container, keeping it from being saturated.

Pine shavings

Pine shavings are an inexpensive hydroponic growing media as well, and a lot of commercial growers use it. Generally for large scale hydroponic drip irrigation systems. Don't confuse pine shavings with saw dust. Saw dust will become compact and water logged easily. You'll want to make sure your pine shavings were made from kiln dried wood, and does "NOT" contain any chemical fungicides. Kiln dried to burn off all the sap in the wood that is bad for the plants. Most pine shaving products would be kiln dried to begin with.

Good source to find pine shavings are pet supply stores. It's used for things like hamster and rabbit bedding. Just make sure to read the package to be sure it doesn't have any chemical additives like fungicides or odour inhibitors. You should be fine if it states it's organic. Another good cheap source for pine shavings is at feed stores, it's also used as bedding in horse stalls and they sell it by cubic yard. If you have a choice get the largest partial size you can. The larger the air pockets between the shavings, the better aeration to your roots.

Pine shavings are a wood product, so they absorb water easily, thus can become water logged easily. So make sure you have good drainage so the shavings don't sit in water. If there is a possibility of it sitting in water, a layer of rocks at the bottom will aid drainage greatly.

Composted and aged Pine bark

Pine bark is one of the first growing media's used in hydroponics. It was generally considered a waste product, but has found uses as a ground mulch, as well as substrate for hydroponically grown crops. Pine bark is considered better than other types of tree bark because it resists decomposition better, and has less organic acids that can leach into the nutrient solution than others. Bark is generally referred to as fresh, composted, or aged.

Fresh bark uses up more nitrogen as it begins to decompose, so commercial growers generally compensate by adding extra nitrogen to the nutrient solution. During the composting process, nitrogen is added to the bark, and mixing it in while breaks down. So nitrogen issues are far less of a concern with composted pine bark.

Ageing is a similar process, but has less nitrogen added to it, so it's better than using fresh bark, but not as easy as the composted bark. Pine bark can be found at places that sell ground mulch, as well as ground mulch for playgrounds.

Poly (Polyurethane) foam insulation

Poly foam is not commonly used in hydroponics, and hydroponics stores don't carry it. But has been used as an alternative to using rockwool or oasis cubes as starter cubes with great results. Poly foam is cheap and easy to find. Any hobby store or place that sells fabrics should carry it. It's most commonly used as furniture foam, and is also referred to as "foam batting." It comes in sheets or rolls of different sizes and thickness. You can make your own starter cubes for about one penny each using the poly foam if you get the one or two inch thick sheets/rolls and cut them into cubes.

Water absorbing crystals (water-absorbing polymers)

Water absorbing polymer crystals have been around for quite a while, and are used in many industries. Everything from baby diapers, to the sports industry where they are used in cloth rags they can wear on the head or neck to keep cool. They are also used in gardening where the crystals are mixed into the soil to help retain moisture in the soil. Florists use them in vases to keep flowers fresh, and the colour ones make for a nice decorated display.

The crystals expand to many times their size as they soak up water. One pound of the crystals can hold as much as 50 gallons of water. The crystals come in many sizes, everything from a powder, to marble and even golf ball size. Depending on the size of the crystals they can take more than an hour or two to fully absorb. When they are full of water they look and feel like a glob of jello. Once they dry out, they can be stored and reused again over and over.

The water absorbing polymer crystals are not a common hydroponic growing media, but like everything else, it's growing in popularity. Mostly due to their increased availability. They are quite inexpensive, and reusable. However used alone by themselves they don't allow the roots to get much oxygen/air. Being like jello they pack together and fill the air pockets. The larger size crystals are better suited for use in hydroponics. The larger size helps retain some of the air pockets

between the crystals. Also by mixing some river rock or other similar growing media with the crystals will help increase the air pockets between the crystals.

Using the polymer crystals for hydroponics allows for some of the simplest hydroponic system designs. Even on the slimmest of budgets. Simply soaking some water absorbing crystals in nutrient solution, then setting them in a container and placing your seedlings in it, you've got a hydroponically grown plant. You don't need any pumps. Just make sure there are holes in the bottom of your container, and just place your container in nutrient solution once or twice a week to re-hydrate the crystals.

You won't find water absorbing polymer crystals in hydroponic shops, but they are easy to find. Because of their popularity, most large nursery's carry them as soil amendments. Also if you do a search for them online, you'll find hundreds of places selling them.

Sand

Sand is actually a very common growing media used in hydroponics. It's the main growing media used at the Epcot Centre Hydroponic Greenhouse in Florida. Mainly for their large hydroponically grown plants and trees. Sand is like rock, just smaller in size. Because the particle size is smaller than regular rock, moisture doesn't drain out as fast. Sand is also commonly mixed with Vermiculite, Perlite, and or coco coir. All help retain moisture as well as help aerate the mix for the roots.

When using sand as a growing media you will want to use the largest grain size you can get. That will help increase aeration to the roots by increasing the size of the air pockets between the grains of sand. Mixing Vermiculite, Perlite, and or coco coir with the sand will also help aerate. You will also want to rinse the sand well before use to get as much of the dust particles out of it as you can. One big downside to using sand as a growing media for hydroponics is that it is very heavy. 3-4 gallons of wet sand can weigh up to 50lbs. So you won't want to be moving it once you get it set up.

Or use it in a ratio of something like 20% -30% sand and the rest Vermiculite, Perlite, or another type of growing media to reduce weight.

Rice Hulls

Depending on your location, rice hulls may be readily available. It's a by-product of the rice industry. Even though they are an organic plant material, they break down very slowly like coco coir, making them suitable as a growing media for hydroponics. Rice hulls are referred to as fresh, aged, composted and parboiled, or carbonized. Fresh rice hulls are typically avoided as a hydroponic growing media because of the high probability of contaminants such as rice, fungal spores, bacteria, decaying bugs, and weed seeds. Parboiled rice hulls (PRH) are done by stemming and drying the rice hulls after the rice has been milled from them. This kills any spores, bacteria, and microorganisms, leaving a sterile and clean product.

Rice hulls are also often used as part of a mix of growing media such as 30%-40% rice hulls and pine bark mix. The overall pH of parboiled and composted rice hulls range from 5.7 to 6.5, which is right in the pH range for most hydroponically grown plants. Fresh and/or composted rice hulls tend to have a high Manganese (Mn) content. But problems with Manganese toxicity can be avoided as long as the pH is above 5. This is below normal range for hydroponics anyway.