



hydroponics



what is it?

It's growing plants in a non-soil medium, using water with added nutrients. Options:

Deep water culture (DWC) / raft system: a 'raft' floats on water containing nutrients; roots extend into the water through holes in the raft.

Media bed: a medium, e.g. clay pebbles, sand or gravel supports the plants, but they don't get anything from the medium, which is pH neutral. Used for larger plants. Nutrient solution is pumped from a separate tank (floods the medium temporarily, flows through it, or drip-feeds), or without pumps, using wicks that the solution can move through via capillary action.

Nutrient film technique (NFT): nutrient solution flows through tubes. Holes are cut in the top of the tubes for plants' roots to reach the solution.

The plants sit in 'net pots'. A piece of coir mat sits in the pot – seeds germinate on the coir and the roots grow through the bottom of the pot.

'Aeroponics' is a higher-tech system where roots are suspended in air, and are misted with nutrient solution via pumps and timers.

History: the legendary Hanging Gardens of Babylon were said to have used hydroponics. More recently, experiments have been carried out since the 17th century, and in the 19th century, Sachs and Knop discovered that plants need mainly nitrogen, phosphorus and potassium (N, P, K), and developed a formula based on these elements. Hoagland added micronutrients such as iron, magnesium and sulphur in the 1920s.

In the 1970s it was discovered that cannabis thrived in a hydroponic system, which resulted in a boom in the industry. Recently, NASA has developed hydroponics for growing food in space. A lot of lettuces and tomatoes in supermarkets are grown hydroponically in the Netherlands.



Commercial hydroponic lettuce cultivation.

what are the benefits?

There are advantages and disadvantages – we'll let you decide for yourself.

Advantages

- can be stacked / layered / vertical, so can produce more food from a given area
- uses less water for irrigation – it's recycled, in a closed loop
- extends the growing season, again producing more food from a given area
- reduces the need to transport food
- doesn't need pesticides
- can be used to grow plants in places where soil would be too heavy – e.g. in roof gardens
- can grow food where there's no soil, e.g. in the desert – especially in combination with desalination of seawater, ideally with solar. It's being tried in Chile, in the Atacama desert, where it virtually never rains.
- may be needed if ecology is damaged and soil eroded so that they can no longer support us

Disadvantages

- uses synthetic materials instead of just soil
- uses mainly synthetic fertilisers / nutrients, which involve energy use, industrial processes and pollution; organic hydroponics is possible but more difficult (see 'what can I do?')
- needs more resources than a garden
- doesn't create an ecosystem like an allotment, garden or smallholding does, so doesn't contribute to ecology / habitat
- based on technology rather than nature; nature knows best what to give plants (and ultimately us) via the soil and the ecosystem in it
- tests show similar nutrient levels to food grown in soil, but plants grown hydroponically are subjected to less stress, which results in lower antioxidant levels because they don't have to develop natural defences against pests



A net pot.



what can I do?

Starting off: small systems can be housed in a greenhouse or indoors. You can buy kit or build your own system using basic plumbing supplies that are widely available. Specialist equipment required - pumping system and air stones that can be found in any aquarium shop. There are books, websites and videos that will show you how. You'll need a nutrient tank, delivery system and housing for plants. Our contact Joe used reclaimed materials, £600 in total, inc. £200 of epalyn liner (25-year guarantee). Pond liner is much cheaper. He aims to grow c. £300 worth of food per year.

Polystyrene isn't the most eco-friendly material for a raft, but only one sheet is required for a DWC bed, and it's buoyant and easy to cut to insert net pots. A sheet can last more than two years – just periodically wipe algae from the surface.

Nutrients: plants evolved with microorganisms in soil making nutrients available. In hydroponics, all nutrients, including micro-nutrients, must be added to the nutrient mix, apart from carbon, oxygen and hydrogen, absorbed from air and water. Synthetic hydroponic nutrients contain mainly NPK, but with micronutrients like calcium and magnesium.

The nutrient that is most likely to be deficient in a hydroponic system is nitrogen, in the form of nitrates. It's essential to be able to notice the signs that plants aren't getting enough nitrogen.

Plants can only absorb nutrients within a certain range of pH values, so it's essential to check pH – otherwise, even if all the required nutrients are there, the plants won't be able to access them.

The nutrient system can be automated, so you can go on holiday – otherwise it will probably need around 5-10 minutes of your time every day.



Media bed (left) and DWC / raft system.

Growing hydroponically: attend courses and read as much as you can – a lot can go wrong.

Root systems don't need to spread laterally to seek nutrients, so even quite large plants like spinach can grow well 5cm apart. You can't grow root crops though, as they'll be prone to rotting.

There are natural ways to raise the temperature in a hydroponic greenhouse – e.g. by introducing a compost heap or allowing chickens to roost (the plants must be high enough that the chickens can't eat them). This can introduce pests however.

Organic hydroponics & aquaponics: purists say that hydroponics can't be organic, because organic growing involves feeding the soil, and in most countries it's not possible for hydroponically-grown food to receive organic certification. But it's possible to use natural feeds, and pesticides are (often) not used. Very little is available in the way of natural feeds however, because organic compounds tend not to be water soluble. Another process has to be introduced when using natural / organic nutrients – microorganisms must break down insoluble organic material into soluble mineral ions to be taken up by plants. This happens naturally in soil, but in hydroponics, you have to make it happen. You can buy beneficial microbial products that are added to the plant medium and/or the nutrient solution, and will do the conversion for you. This makes 'organic' hydroponics tricky – care is needed with aeration and not overwatering, because the beneficial microbes need a constant supply of oxygen. Also, you won't use synthetic pH-altering products in an organic system, so the pH will have to stabilise on its own, making the system less controllable.

Aquaponics is a combination of hydroponics and aquaculture (fish farming). You can feed the fish organic material and their waste will feed the plants. You can harvest fish as well as fruit and veg, and the water gets cleaned for the fish at the same time.

resources

- lowimpact.org/hydroponics for info, courses, links, books, including:
- H Resh, *Hydroponics for the Home Grower*
- James Coble, *DIY Hydroponics Gardening*
- Sarah Cleaver, *Hydroponics for Beginners*
- hydromag.co.uk - hydroponics magazine
- homehydrosystems.com - lots of useful info
- carbon.org - Institute of Simplified Hydroponics

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