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Hydroponic Produce

I. Definition of Hydroponics

A. Dictionary Definition

(Encarta Dictionary: English (North America))

hydroponics (noun): growing plants in liquid nutrient; the cultivation of plants in a nutrient liquid with or without gravel or another supporting medium

hydroponic (adjective)

hydroponically (adverb)

B. Definition Discussed

The key factor in defining a garden or farm as hydroponic is whether the grower provides the majority of nutrients through water infused with additive nutrients. If crops are getting most of their nutrients from those found naturally in a soil media or other organic matter, they are not considered to be hydroponic. Hydroponic plants thrive on nutrient solution alone. The medium merely acts as support for the plants and their root systems, and perhaps to hold moisture around the roots. The growing medium, if any, is totally inert.

Broadly speaking, hydroponics is considered to be any type of gardening where primary plant feeding is done by irrigating. Local soil farmers may know it as “fertigation.”

II. Brief History of Hydroponics

Plants first grew in the oceans and lakes before moving onto land, so the idea of plants growing without soil and deriving their nutrients from water is as old as

Creation. The use of hydroponics has a long and fascinating history — from the Pharaohs of Egypt, to a lost civilization in Peru that predates Babylon, to the “Hanging Gardens” of Babylon itself, to the Romans, to Marco Polo’s observation of China’s “Floating Gardens,” to the Aztec and Mayans.

In 1627 Sir Francis Bacon published a book that explored the idea of water culture and became an area of scientific study. By the 1860s the German botanists Julius von Sachs and Wilhelm Knop had perfected the first nutrient solution for soil-less agriculture. And by the 1900s scientists and others were experimenting with plants grown in sand, charcoal and other support material or medium, with solutions soaking the roots.

It was not until 1936, at the University of California, that W.F. Gericke coined the name “hydroponics.” The word *hydroponics* literally means “working water.” The idea was to propagate plants in an inert medium. In 1937 gravel cultures were introduced, and modern hydroponics was on its way to feeding more and more people by answering the need for increased production, in less area, at lower cost.

III. Some Big Questions Explored

A. Why Is Hydroponics Needed?

It is the ability to control Mother Nature’s variables that makes soil-less hydroponics superior to conventional gardening. Getting a plant to grow to its full potential in common soil can be very difficult, given the thousands of variables in the soil’s makeup which influence plant growth. A hydroponic grower takes full control over what plants have available rather than guessing or hoping what the soil will provide. With the help of grow lights and environmental control, hydroponic farmers can provide produce for a demanding market with no seasonal constraints.

Hydroponics is increasingly used in areas where the climate prohibits or limits growth, where the soil is too poor to support large-scale crop production, where water is scarce, where there is erosion, or where once-fertile soil has been abused and is now depleted.

B. Is Hydroponic Produce Good for You?

Here we are referring to organic produce grown hydroponically:

1. Hydroponic produce is healthier because growers can better regulate what is put in or on their plants.

2. With little or no use of herbicides, fungicides and pesticides, the resulting produce is healthier to eat. Also, agricultural workers are not exposed to toxic chemicals.
3. Consumption of artificial ripening agents by the consumer is eliminated.
4. New studies show that hydroponic produce is higher in nutritional value than soil-grown crops. Reports show dramatic increases in both the vitamin and mineral content compared to soil-grown produce.
5. Hydroponic produce has a longer shelf life than soil-grown produce.
6. Finally, hydroponic produce tastes better than its soil counterparts.

C. How Does Hydroponics Achieve Optimum Growth?

In hydroponic gardening, roots don't need to elongate to seek food, as they do in soil, so the volume of containers can be reduced. Roots have easy access to water, oxygen, additives and nutrients, growing up to 30% faster and usually producing heavier, tastier and more nutritious yields on such a balanced diet. In soil, most sources of plant food need to break down, whereas the high-grade hydro-organic nutrients of today have already been broken down into pure elements, making them ready for instant plant uptake. There are no weeds or undesirable seeds. Disease and insects are not carried in by soil. The growth medium is easy to disinfect. Very simply, pests are not attracted to inert substrate. Soil-borne insects do not infest it. Disease germs do not take hold or, at worst, they propagate poorly.

D. How Does Hydroponic Growing Compare to Soil Gardening/Farming?

1. Nothing beats hydroponics for starting seeds or cuttings. Most commercial farms use hydro propagation when plants are going into the ground or into a hydro system.
2. Hydroponic methods limit the need for massive pesticide use (since most pests live in the soil), and therefore effectively make our air, water, soil and food cleaner.
3. There is less pollution, since water and nutrients are efficiently recirculated.
4. With hydroponics, no fertilizer is lost with water runoff.
5. There is a more efficient use of land, since there are smaller root masses. A hydroponic garden can even feature a vertical setup. Since plants can be placed closer to one another, there can be a large amount of food production in a small area.

6. Since root systems stay smaller in hydroponic gardens, plants can concentrate their energy on producing plant mass rather than roots.
7. The high labor cost of traditional farming can be reduced, since automation and harvests can easily be manipulated.
8. Hydroponic growing requires only around 25% of the nutrients and fertilizers required by soil-based gardening while producing higher-quality produce. Also, old nutrient solutions may be re-used in other areas such as potted plants and turf management
9. Water usage is 70% to 90% *less* than with soil gardening. Since the water source is usually circulated, there is no crop that drinks too much. Also, hydroponic systems conserve water by preventing evaporation and runoff.
10. Losses due to drought and flooding are significantly reduced.
11. Hydroponics can be used in non-arable regions where water is scarce or where there are inadequate growing conditions.
12. Plants maintain optimum nutrient and moisture levels in hydroponic systems. The result is healthier plants, faster-growing plants, and plants that are more disease-resistant because of less stress.
13. Hydroponics provides a more controlled environment for plant growth than soil gardening. It removes many unknowns and provides consistent results and certainty of plant production.
14. With hydroponics there are no soil-borne diseases, weeds to pull, or soil to till.
15. No soil means that produce is super-clean.
16. With no soil, there is no need to worry about rotating crops.
17. With soil-less growing, plants don't get root-bound.
18. Finally, hydroponics is environmentally friendly. It allows gardeners to get "in tune" with the needs of their plants.

Especially for those considering commercial hydroponic farming, the following is of great interest. Dr Howard M. Resh, a leader in agriculture research, cites vegetable-yield increases that are dramatic! In his book, *Hydroponic Food Production*, he references "identical cucumber plants [that] produced 7,000 pounds per acre in soil but 28,000 pounds per acre when grown hydroponically,

and tomato yields that ranged from 5 to 10 tons per acre in soil but 14 tons per hydroponic acre.” These results are typical for practically any plant. The produce always tasted the same as soil-grown plants as well as having equal or higher nutritional value. Of course, organic farming methods are known for producing the highest nutritional values.

E. Is Hydroponics Difficult?

Hydroponic gardening is both easy and flexible. Only your imagination is the limit. Hydroponics can be passive or active. It can grow an underground crop or an above-ground crop. It can be mobile or even suspended in the air. By adding timers and flow-valves, greater automation can be achieved, making it possible to leave the system unattended for weeks at a time. Further automation can be achieved by adding special monitors and feedback devices, making complete computer control possible.

IV. Your Indoor Hydroponic System

The most apparent advantage of indoor hydroponics is the ability to control the plant-growing environment. A clean environment with fresh-air circulation is essential to indoor gardening under grow lights. Hydroponics can be done more intensively, with more crop cycles, by growing indoors under artificial light or in a greenhouse with the manipulation of sunlight (light augmentation, light color, light timing and light intensity).

With hydroponic technology and a controlled environment, you have the ability to grow premium quality produce using minimal space, water and fertilizer. Amazingly, with artificial light, 6 square feet of space has been proven to nutritionally feed a family of 4 year-round!

A. Start-Up Packages

1. What Do They Cost?

AutoPot[®] Easy2Grow Double Kit (with Reservoir): This Easy2Grow double-pot system costs around \$80. It is a “passive” system that uses gravity to provide the right amount of water to roots in a natural wet/dry cycle, so no electricity, pumps or timers are necessary. You simply fill the pots with your preferred growing medium, use the included tubing to connect the two-pot tray to the included reservoir, and watch as the Easy2Grow system goes to work for up to four weeks! Its sizeable pots are particularly suitable for larger plants like tomatoes, and its root-control mats keep roots from invading the system. The Easy2Grow Double Kit’s large reservoir enables you to place the system anywhere there is light and leave it largely unattended.

Original DWC™ (Deep Water Culture) Hydroponic System: This 8-site system is reasonably priced at around \$150. It boasts advanced technology in a system that is made to last. Its compact design allows you to grow anywhere and fits perfectly in those height-restricted areas. It is an excellent system for cloning; and its larger net pots, combined with realistic spacing between sites, make it easier than ever to grow plants like tomatoes.

AeroGarden™ Deluxe: This popular 7-site starter system costs a little over \$200. It has its own light source, with twice the light intensity of older models for faster and larger harvests. And it has twice the extension on the lamp arm for growing full-size tomatoes, cucumbers, bell peppers and more. Or you can grow an entire garden of cilantro or wildflowers.

2. What Do They Include?

AutoPot® Easy2Grow Double Kit (with Reservoir): This Easy2Grow gravity-fed (“passive”) system includes two large 8.5-liter square growing pots that sit inside a two-pot tray assembly which houses the innovative AQUAvalve. This valve uses gravity to accurately control the flow of nutrient solution from the included reservoir to the individual plant sites as needed. The system also includes reservoir lid, filter, tubing, and helpful root-control mats. And it comes with instructions and everything else you need 2Grow!

Original DWC™ (Deep Water Culture) Hydroponic System: This is an 8-site system that features large 3.75-inch net pots, giving you 25% more room for roots than standard 3-inch net pots. The Original DWC™ comes with a variable-speed, multiple-outlet pump for maximum oxygen levels and total control. The kit also includes a 10-gallon reservoir, an 8-plant reservoir lid, expanded-clay grow media, rockwool seed-starter cubes, a water-level indicator, air stones, fittings and hose, and measures 24 inches long x 20 inches wide x 8.25 inches tall.

AeroGarden™ Deluxe: The AeroGarden™ Deluxe has 7 sites. It has its own light source, with twice the light intensity of older models. And it has twice the extension on the lamp arm.. It includes a Master Gardener Kit for planting and growing a garden of your choice. It also includes a year's supply of Grow Pods (seeds not included) and nutrients, grow domes, labels for identifying your seeds, and a 72-page, full-color, step-by-step *Planting and Growing Guide*.

3. What Are Their Limitations?

These systems have one water source, so there is limited variety potential in one unit. The water supply will only contain nutrients for one cycle of plant growth — in most cases either vegetative growth or fruiting and flowering. You cannot have a healthy leafy green crop alongside a flower crop in the same system, even if the

photoperiods are the same. However, in one system you can grow a good, constant supply of lettuce or culinary herbs for a family of 2, or a couple of large, producing tomato plants.

B. Hydroponic Produce

1. What Can Be Grown?

The limits to what can be grown hydroponically have yet to be explored. But while virtually anything can be grown hydroponically, some plants will do better than others. For example, some plants prove to be more space efficient, or profitable. There are a few special requirements for vegetables such as carrots and potatoes that are grown underground — a full-size variety would require a very thick bed of aggregate. Also, it is a good idea to stay with dwarf or compact plant varieties when gardening indoors, since they will perform better under lights and are lower maintenance. Growing large fruit trees, mushrooms and cacti (in an active system) are rare feats. Growing tea, wheat or tobacco is also problematic.

2. Popular Plants

Popular plants that can be grown easily with hydroponics include:

Artichokes	more fruit than when grown in soil.)
Asparagus	Peppers (colored Bell peppers, sweet peppers, hot chilies)
Leafy crops (The easiest to grow, free of any sand or dirt, and should be sold for a higher price than field-grown competition.)	Spinach
Lettuce (Reports claim that 4 heads of lettuce can be raised in the same amount of space required to grow one head of field lettuce. Lettuce does well having a constant flow of nutrition on its roots. Keep temperature close to 60 degrees. Does well outdoors hydroponically.)	Fennel
Bok Choy (Needs good light and ventilation.)	Chard
Tomatoes (Grown hydroponically, tomatoes can ripen as much as 8 weeks earlier and produce	Squash
	Cabbages
	Celery
	Cauliflowers
	Cucumbers
	Broccoli
	Beans
	Pole beans
	Soybeans (Need bright light but don't like high humidity or temperatures.)
	Brussel sprouts
	Eggplants
	Peas (Grow best in cooler temperatures, 55 to 60

degrees, and like media that drain fast. Pea plants are very sensitive to acidity levels; check pH often: 6-7.)

Snow Peas

Mesclun

Rhubarb

Water-loving fruits:

Watermelons

Cantaloupes

Tomatoes

Strawberries (Hydroponically grown berries can be harvested from a standing position! Good performance in most varieties: plug, fresh-dug, dormant, single and multiple crown.)

Blueberries

Blackberries

Raspberries

Grapes

Okra

Flowers and house plants of all types

Roses (Profitable when grown hydroponically, like in Brazil.)

Surprisingly, there are some trees that can be grown in a hydroponic manner.

Banana trees are one, and dwarf citrus trees, such as lemons.

Herbs (With the exception of lavender and rosemary, they grow easily. Herbs don't need excessive light levels and grow best in cooler temperatures.)

The most popular herbs include:

Arugula

Chives

Lemon Balm

Spearmint and peppermint

Thyme

Basil

Coriander

Mache

Rosemary

Sage

Chervil

Dill

Marjoram

Sorrel

Tarragon

Cilantro (pH range from 6.5 to 7. Plants can grow under low light levels.)

Mint

Parsley

French Tarragon

Oregano

French Sorrel

Rosemary

3. Difficult Plants

Plants that are difficult to grow with hydroponics include:

Large trees in a small system

Succulents in an active system (because they thrive in dry conditions)

Mushrooms

Plants that are grown underground (require a very thick bed of aggregate), such as:

Carrots	between 6.5 and 7.
Onions	Temperatures above
Potatoes	75 degrees Fahrenheit
Beets	will jeopardize
Radishes	growth.)
Yams	Parsnips
Leeks (Roots need plenty	Wasabi (Japanese
of air. Leeks like a pH	horseradish)

There are almost an unending number of crops that, although difficult, can be grown hydroponically, but most home gardeners have neither the time nor the money to pursue them. Some of the most sought-after include corn, cacao, sugar cane, rice, tea, tobacco and cereal grains. In most cases these crops are started hydroponically and, when seedlings reach their desired size, are transplanted to the field.

V. Conclusion: Hydroponics for a “Green” World

Hydroponics is positioned to utilize the best and latest innovations in gardening. It helps us benefit from fine-tuned propagation methods that can be used to feed the world. It lessens our dependence on fossil fuels and enables us to cope with climate change. We must become skilled at propagating without adversely affecting our ecosystem. Hydroponics may well be a large part of the answer to our pressing environmental needs.

“The foolish man seeks happiness; the wise man grows it.” As Vita Sackville said, “The most noteworthy thing about gardeners is that they are optimistic, always enterprising, and never satisfied. They look forward to doing something better than they have before.”

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