



AEROPONICS: AGRICULTURE WITHOUT SOIL

Dr. SATHISHA, G. S.
Assistant Professor, Dept. of Agronomy, College of Horticulture,
Mudigere, Karnataka

INTRODUCTION

It is a system where roots are continuously or discontinuously exposed to an environment saturated with fine drops (a mist) of nutrient solution. Or Aeroponics is the process of growing plants in an air or mist environment without the use of soil or an aggregate medium. The word "aeroponic" is derived from the Greek meanings of aero- (air) and ponos (labour). Aeroponics is a hydroponic system in which plant roots are suspended in air and misted with a nutrient water. Maximize oxygen available at the root zone, thus helping to maximize plant growth.

HISTORY

In 1942, W. Carter first researched air culture growing and described a method of growing plants in water vapor. F. W. Went who first coined the air-growing process as "aeroponics" in 1957. The first commercial aeroponics setup was the Genesis Rooting System, commonly called the Genesis Machine, by GTi in 1983.

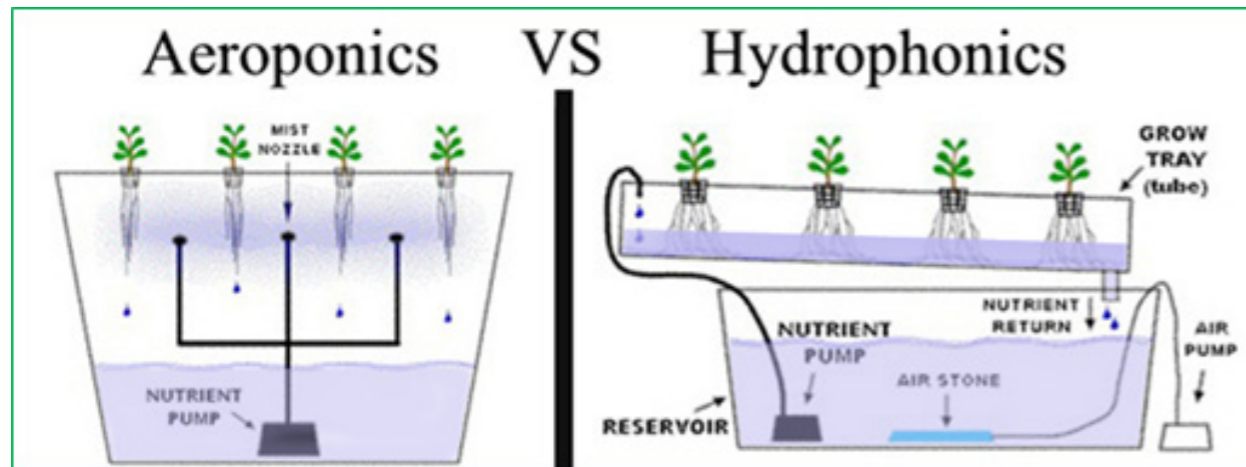
NEED FOR AEROPONICS

- ✂ Growing in soil is no longer a sustainable way to grow food for the 7 billion people on the planet.
- ✂ Urbanization and fragmentation of land and labor
- ✂ Reduce water usage by 95%
- ✂ Reduce the pesticide usage 99%
- ✂ Increase crop yields by 45% to 75%



HOW IS AEROPONICS DIFFERENT FROM HYDROPONICS?

- ✂ Although the words may sound alike, hydroponics is grown in water, and uses water as a growing medium to convey essential minerals to sustain plant growth.
- ✂ Aeroponics is conducted without a growing medium.
- ✂ A medium is an agency by which something is accomplished, conveyed, or transferred.



HOW AEROPONICS WORKS...!

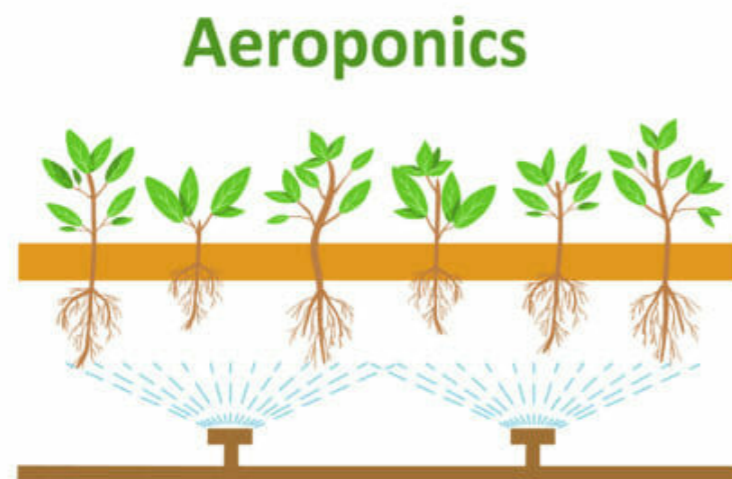
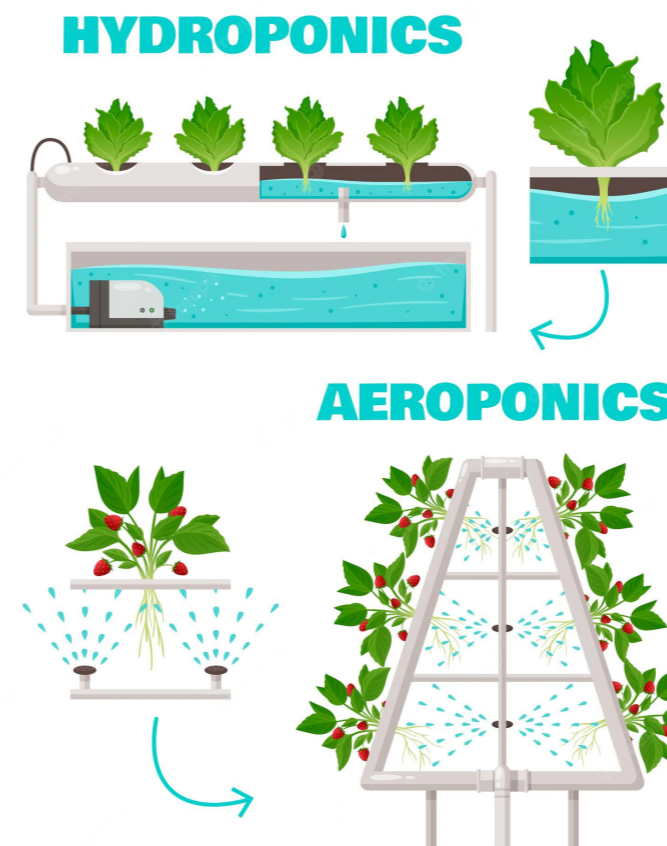
Aeroponic grown crops are suspended while a nutrient solution is delivered by sprayer nozzles, thus surrounding the roots with a fine mist of nutrients for the roots to absorb to grow. Nutrient solution sprayed onto roots in chambers where roots are suspended.

- ⊗ The ideal droplet size range for most plant species is 20 - 100 microns
- ⊗ Within this range the smaller droplets saturate the air, maintaining humidity levels within the growth chamber
- ⊗ The larger droplets 30 - 100 microns make the most contact with the roots.
- ⊗ Spray droplets less than 30 microns tend to remain in the air as a fog.
- ⊗ While any droplets over 100 microns tend to fall out of the air before containing any roots. Too large of a water droplet means less oxygen is available to the root system.

Aeroponics	Hydroponics
Roots: Suspended in air or in an enclosed environment, thus, the plants are able to absorb the nutrient-rich water solution and is able to remain oxygenated	Roots: Immersed in a nutrient-rich medium such as water or soil or may be supported by inert media such as gravel or perlite, Thus, the plants are able to absorb the dissolved nutrient in the medium
Solution: Sprayed onto the fine mist of mineral nutrients	Solution: Dissolved in the medium
Crop Yield: Harvest better quality and more food due to better aeration available to roots	Crop Yield: Harvest poorer quality and less food due to a limited amount of air and nutrient
Exposure to CO₂: Greater and Larger exposure	Exposure to CO₂: Smaller and Less exposure
Spread of Diseases: Reduced	Spread of Diseases: Possible
Water: Required in minimal amount	Water: Required twice the amount of water by aeroponics

NUTRIENT SOLUTION FOR THE AEROPONICS

Nutrient	Concentration (g/L)
N-NH ₄	0.54
N-NO ₃	0.35
P	0.40
K	0.35
Ca	0.17
Mg	0.08
Na	0.04
Fe	0.09
Zn	0.03
B	0.03
Cu	0.04



Nutrient	Quantity (g/l)
KNO ₃	0.54
Ammonium nitrate	0.35
Calcium superphosphate	0.28
MgSO ₄	0.24
Fe(EDTA) Fe 6%	0.009
Micro (fetrilon):	
9% MgO, 3% S, 4% Fe, 4% Mn, 1.5% Cu, 1.5% Zn, 0.5% B, and 0.1% Mo.	0.012

pH and electrical conductivity of water required for different crops

Crops	pH	EC (mS/cm)
Cucumber	5.8-6.0	1.7-2.2
Lettuce	5.5-6.5	0.8-1.2
Onions	6.0-7.0	1.4-1.8
Potato	5.0-6.0	2.0-2.5
Spinach	5.5-6.6	1.8-2.3
Tomato	5.5-6.5	2.0-5.0
Carrots	5.8-6.4	1.6-2.0

CONCLUSION

- ⊗ Aeroponics growing allows crops to grow without the use of pesticide and thus it will be disease free.
- ⊗ Aeroponics is conducted in air combined with micro-droplets of water, almost any plant can grow to maturity in air with a plentiful supply of carbon dioxide, water and nutrients.
- ⊗ Aeroponics helps conserve water, land and nutrients, so the aeroponics system is the way of the future, making cultivation of crops easier.
- ⊗ Aeroponics appeared to be a highly feasible method for the production of both aerial parts and roots as raw materials for the herbal dietary supplement and phytopharmaceutical industries.

WORKING PRINCIPLE OF AEROPONICS

- ⊗ The principles of aeroponics are based on the possibility of cultivating vegetables whose roots are not inserted in a substratum or soil, hanging in a containers filled with flowing plant nutrition.
- ⊗ In these containers root can be find the best condition regarding the best oxygenation and moisture.
- ⊗ These conditions allow for the better plant nutrition assimilation in a more balanced way, with consequential faster development of the cultivated plant.
- ⊗ Plant nutrition is supplied into a closed circuit.
- ⊗ Consumption is consequently limited to only the quantities absorbed by the plants, allowing for water savings.
- ⊗ For example: to produce a kilogram of tomatoes using traditional land cultivation requires 200 to 400 liters of water, hydroponics requires about 70 liters, aeroponics utilizes only about 20 liters.

