

# Hydroponic Systems®

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## INTRODUCTION

The basic concept of hydroponics was applied as early as 1699, while the first acknowledged research done in this field was in 1804. Tomatoes were the first crop to be grown commercially in hydroponics as we know it today.

A modern definition of hydroponics is: "A crop production system where plants are grown in an artificial medium other than natural soil. All the nutrients are dissolved in the irrigation water and supplied on a regular basis to plants." Hydroponic systems are used throughout the world in areas where normal field agricultural practices are not possible.

## DEFINITIONS

Various hydroponic/soilless culture systems are used today. If no medium is used, it is called **liquid hydroponics**. If any artificial medium is used to support the plant, it is called **aggregate hydroponics**. Both the aggregate and liquid systems can be divided into open and closed systems. In **closed systems**, the excess nutrient solution is recovered and recirculated. **Open systems** do not recirculate the nutrient solution after it has passed the plant roots. In South Africa two types of hydroponic systems are generally used, of which the open system is the most common. The second is the closed (recirculating) system, of which the NFT and gravel film technique (GFT) are the most popular.

## TYPES OF HYDROPONIC SYSTEMS

### Open Systems.

**Bag or Pot Culture.** Plants are grown in containers (usually plastic bags or pots) filled with a growth medium, such as, sawdust. The containers are placed directly onto the greenhouse floor. The floor is generally covered with white polyethylene sheeting to isolate the system from soil-borne diseases and to prevent plant roots from growing into the soil. One or more plants are planted in each bag or container and a trickle (drip) or micro sprayer irrigation system is normally used to supply the nutrient solution to each container.

**Capillary Mat.** Potted plants placed on a wet bench surface (capillary mat) absorb water through holes in the bottom of the pots. The system is based on the principle that water is lifted from the wet mat surface to the roots inside the pot by capillary forces. Water is usually distributed on the mat by a drip irrigation system. The main advantage of this system is that plant foliage is not wetted by irrigation water.

### **Closed Systems (Recirculating Systems).**

***Nutrient Film Technique Systems (NFT).*** NFT systems consist of a thin layer of nutrient solution (called a film layer) flowing through plastic channels by gravitation, which contain the plant roots. The nutrient solution is recovered, filtered, replenished, and recirculated. There is no solid growth medium. The nutrient solution is very shallow (1 to 3 mm) to ensure enough air, water, and nutrient solution at root level.

***Modified NFT Systems.*** Modified NFT systems include cast concrete systems, movable channel systems, and multicropping systems. In concrete systems, the plastic channels are replaced with concrete channels covered with a waterproof material. In multi-cropping systems combinations of different plants are grown together. The idea behind moveable channel systems is that the point of harvest is at the end of the production line so that no one needs to walk between the plants. It is rarely used in commercial production in South Africa, due to high system costs.

***Aeroponics (Root Mist System).*** Plants are grown in holes in panels of expanded polystyrene called mist beds. The roots are suspended in mid-air and no artificial medium is required. Beneath the enclosed panels are micro misters, which periodically spray the nutrient solution onto the roots. The frame is isolated so that the roots are in total darkness and in saturation humidity. Aeroponics is known for its excellent aeration of roots.

***Ebb and Flood Systems.*** Several versions of the system are in use. The gravel culture or sub irrigation system is a very basic and inexpensive way to produce crops. Water is pumped into the beds or gullies filled with gravel until flooded to several inches of the surface, whereafter the water drains back to the nutrient reservoir. Each irrigation cycle provides adequate water, nutrients, and oxygen to the plant roots. As a variant to the system, potted plants can be placed on top of a gravel layer in the raised bed or bench. Water is pumped into the bench until the media in the pots are completely wetted. The gravel film technique (GFT) is widely used in South Africa. It is based on the well known NFT system, where the nutrient solution flows down gullies by gravitation. Gravel is used to support plants and block out sunlight at root level.

### **LITERATURE CITED**

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