

## LESSON 1

### INTRODUCTION to HYDROPONICS

#### LESSON AIM

Discuss the nature and scope of hydroponics systems.

#### INTRODUCTION TO HYDROPONICS

Hydroponics is the process used to grow plants without soil and literally means 'working water'. The grower is taking 'control' of the plant's root environment, and losing the benefit of 'mother nature's' finely-tuned mechanisms which normally control that part of the plant's environment.

Hydroponics is not an easier way to grow plants! It is a more controlled way of growing plants!



Growing in hydroponics can offer the following advantages:

- It can reduce the physical work involved in growing.
- It can reduce the amount of water used in growing.
- It can save on space...more can be grown in the same area.

There are six basic types of hydroponic systems:

- Wick
- Water Culture
- Ebb and Flow (or flood and drain system)
- Drip (with either a recovery or non-recovery process)
- N.F.T. (Nutrient Film Technique)
- Aeroponic

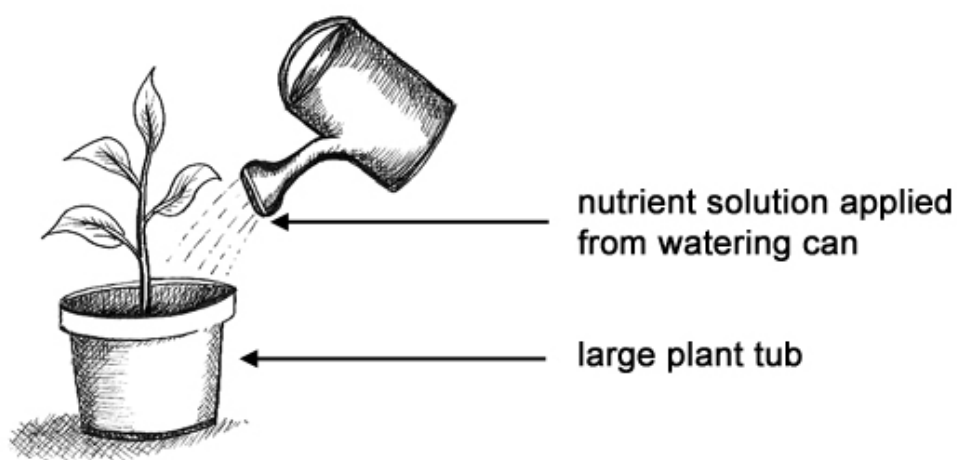
Over time the basic models have evolved and resulted in hundreds of different variations.



\*The **wick system** is passive, with no moving parts, and is also the simplest type of hydroponic system. The nutrient solution is drawn into the growing medium from the reservoir with a wick. The grower using this system can use a variety of growing media such as perlite, vermiculite or coconut fibre. However large plants tend to draw and use the nutrient water at a faster rate than the wick can supply it.

\*The **water culture** system is the simplest active system to use. A styrofoam platform floating on the nutrient solution holds the plants. Oxygen is supplied to the roots of the plants through a bubbling air stone that is attached to an air pump. Water culture is the system most often used for leafy vegetables such as lettuce that require fast growth and ample water. It is not suitable for most other plants that require a longer growing period.

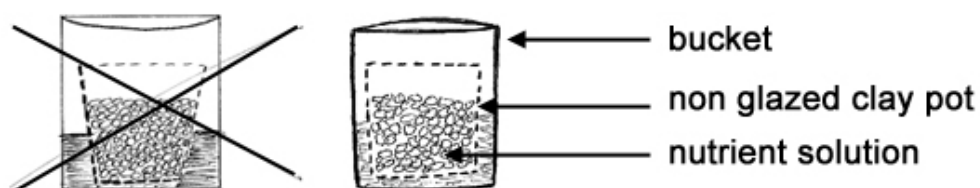
**The Pot plant is the simplest system involving a pot filled with an inert hydroponic media (eg sand or perlite)**



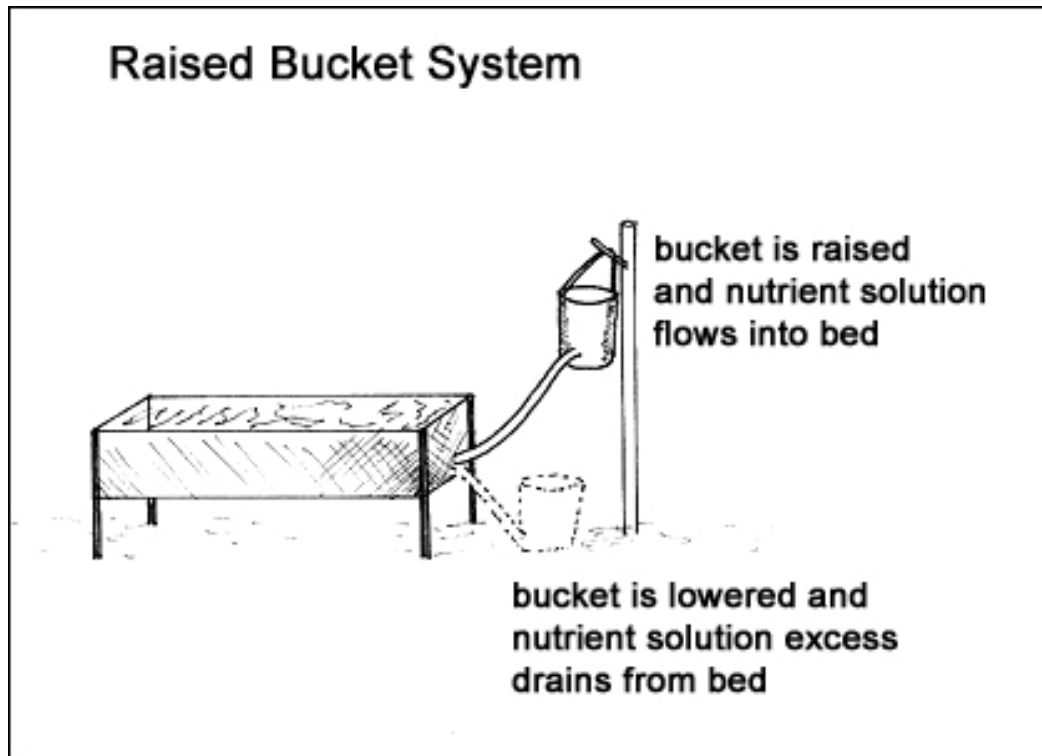
### Capillary Fed Pot

✓ The plant is planted into a pot of inert media. The pot is then placed inside a bucket or water holding container. Nutrient solution is then put into the container so the pot sits partially in the solution. The nutrient solution will be absorbed through holes at the bottom of the pot and sucked up (this is called capillary action).

The depth of nutrient solution will depend on how much the plant tolerates and requires water; and the type of media being used (ie If it is well aerated or more absorbent).



\*The **ebb and flow** is a versatile system that floods the grow tray with the nutrient solution for a short period and then drains the solution back into the reservoir using a submerged pump and timer. The timer cuts in several times a day and as it cuts in the nutrient solution washes onto the tray, then as it cuts out the solution drains back into a reservoir. The frequency is dictated by the type of plants being grown and the growing medium used. Several types of growing media such as perlite, rockwool, gravel or grow rocks can be used in this system. It is advisable to use medium with greater water retention abilities such as rockwool as the incidence of root dehydration during power outages is lessened.



\***Drip systems** are simple to operate, very widely used and the most popular system worldwide. A submersed pump is controlled by a timer: when the timer turns on the nutrient solution drips onto the base of each plant using a drip line. There are two types of drip systems: recovery and non-recovery systems.

- The recovery system is where the excess (drained off) nutrient solution is recovered in a reservoir and then recycled. This system uses a less expensive (and less precise) timer than the non-recovery system. It is more efficient in that it recycles nutrients and due to this does not need to be as precise as the non-recovery system. However this system needs to be carefully monitored to ensure the nutrient solution doesn't vary too much in pH and strength due to the recycling process.
- The non-recovery system does not collect or recycle the excess nutrient solution. It needs to be more precise than the former system to ensure that the plant gets the correct level of nutrient solution and that the runoff is kept to a minimum. This system does not have the same level of maintenance as the former system as the nutrient solution is not recycled so pH and nutrient levels should always be correct.

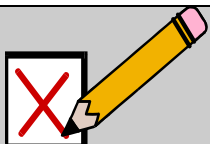


**\*N.F.T. systems** do not use a growing medium. Instead the plants are supported by a basket and the roots dangle in the nutrient solution. There is a constant flow of nutrient solution which means a timer is not required for the submersible pump. The nutrient solution is pumped into the growing tray using a tube it flows over the roots of the plants, and then drains back into the reservoir. This is an inexpensive method as it does not require the expense of replacing the growing medium for each successive crop. Roots dry out rapidly however during power outages or equipment failure when the supply nutrient solution is interrupted.



\*The **aeroponic system** is probably the most high-tech type of hydroponic gardening. Like the previous system, the plants are suspended in the air. The root system is periodically (every few minutes) misted with the nutrient solution using a timer and nutrient pump on a short cycle for a few seconds at a time. Due to root exposure in this system the roots can dry out rapidly during power outages or equipment failure.

*Example of aeroponics system*



### SELF ASSESSMENT

Perform the self assessment test titled ' Test 1.1

If you answer incorrectly, review the notes and try the test again.

## HYDROPONICS – A GLOBAL INDUSTRY IN THE 21<sup>st</sup> CENTURY

Commercial hydroponics is a successful and rapidly expanding industry. Industry growth has been particularly dramatic in the last fifteen years. In the early 1990s there were around 5000 hectares of commercial hydroponic production worldwide. By 2001 there were an estimated 20,000 to 25,000 hectares under hydroponic production, and now (2005) it is estimated 50-60,000 hectares are producing hydroponic crops. This strong growth in global commercial production is expected to continue over the next few years.

Production is focused in affluent countries such as the Netherlands, Spain, Canada, Japan, UK, US, New Zealand and Australia, and also to countries that have access to these markets such as Mexico and China.



Worldwide, there are a limited number of crops grown hydroponically. Tomatoes, cucumbers, lettuce, peppers, and cut flowers (including roses, gerberas, carnations, chrysanthemums and lisianthus) are the most important commercial crops.

In most countries the majority of hydroponic crops are grown in greenhouses, the exception being Australia where more than 50% of hydroponic production takes place outdoors (due to the high proportion of lettuce grown).

The major producer of commercial hydroponic crops in the 21st century is the Netherlands. Holland has a total hydroponic production area of 25,000 acres and accounts for 50% of the value of fruit and vegetable production in the country; the produce being mainly grown for the export market. Crops include cucumbers, tomatoes and peppers. In Holland nearly all greenhouses have converted to rockwool and NFT culture as a consequence of soil depletion, salinisation, a build-up of soil-borne diseases, high water tables and good economic returns.

Other major producers are Spain, Canada and France. Australia is ranked as the tenth major producer in the world, and the leading producer of fancy lettuce. Expansion in the US has been slower; in 1998 the US ranked as the sixteenth largest producer, although a recent surge in large commercial installations is likely to boost production.

The most popular systems worldwide are NFT and rockwool culture, although other systems are used for commercial production. In all countries systems are moving towards recirculation, due to the potential environmental problems caused by run-to-waste systems.

## **HYDROPONICS – IS IT AS GOOD AS GROWING PLANTS IN THE SOIL?**

There is no real difference as far as a plant is concerned in the nutrients it receives from hydroponics compared with normal soil gardening or organic gardening. For all three growing methods:

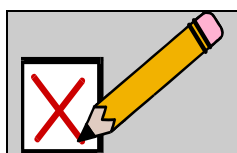
- \*the plant takes in and uses exactly the same molecules from the air
- \*the plant needs exactly the same temperature, light and moisture conditions
- \*the plant absorbs exactly the same plant nutrients into its roots.

The only real differences are in the way the nutrients are supplied to the plant:

a) With organic gardening, nutrients are supplied as complex chemical molecules, which are from the tissues of decomposing animals or plants (or their by-products). These complex molecules are broken down in the root zone to form much simpler compounds which are then able to be taken in by the roots of the plant.

b) With soil gardening, the soil contains both simple and complex compounds. Fertilisers applied are both simple and complex compounds.  
The simple compounds are absorbed directly. The complex compounds are broken down and then absorbed.

c) With hydroponics, nutrients are applied as the same simple chemicals that occur in soil, or which organic compounds in soil break down to form. They are in a ready-to-use state as soon as applied.



### **SELF ASSESSMENT**

Perform the self assessment test titled ' Test 1.2

If you answer incorrectly, review the notes and try the test again.

## **DIRECTORY**

Note: Businesses do close down and organisations change address. The following contacts may provide a starting point, but do not be surprised if some are no longer relevant.

Two of the best places to look for further contacts are:

a/ The Yellow Pages (Telephone Book) under Hydroponics

b/ Web Searches

### **International Society for Soil-less Culture**

An international organization of growers, hobbyists and scientists: active in hydroponic growing. It operates an information centre, conducts excellent international conferences and publishes information on hydroponics.

Write to: The Secretariat ISOC, P.O. Box 52, Wageningen, The Netherlands.

### **AUSTRALIA**

Chemgrow Industries 2 Glencourt St, Templestowe, 3106.  
Hydroponic City, crn Dynon Rd and Radcliffe St, Sth Kensington, 3031.  
Hydroponic Dist. Supplies, Old Murray Rd, Huntly, 3551  
Hydroponic Industries, Factory 4, Canterbury Rd, Braeside, 3195.  
The Hydroponics Shop, 270 Union Rd, Moonee Ponds, 3039.  
Growool (division of CSR), 159 Wellington Rd, Clayton  
Bulk Hydroponic Nutrients, 28/132 Hassall St, Wetherill Park, 2164.  
Fensmore Ltd, 18 Rosebery Rd, Kellyville, 2153  
Flora Revolution, 2 Grenfell St, Blakehurst, 2221  
Home Plant P/L, 28/132 Hassall St, Wetherill Park, 2164  
Leni Hydroculture, 3 Chilcott Ave, Mt Hutton, 2290  
R and D Chemicals, 1 Park Rd, Rydalmere, 2116  
Growool (division of CSR), 7 Percy St, Auburn. Ph: (02) 631 7007  
Barmac Chemicals, 14 Annie St, Rocklea, 4106  
City Garden Hydroponics, 1 Denham Tce, Tarragindi, 4121  
D.J.R. Hydroponic Agencies, 197 Duffield Rd, Kallangur, 4503  
Fensmore P/L, 19 Hasp St, Seventeen Mile Rocks, 4073  
Ace Chemical Co., 10 Wodonga St, Beverley, 5009  
Fensmore P/L, 1 Main Terrace, Richmond, 5033  
Adelaide and Wallaroo Fertilizers, Francis St, Port Adelaide, 5015  
Hydrogarden Products, PO Box 335, Armadale, 6112  
Fensmore P/L, 3/20 King Edward Rd, Osborne Park, 6011  
Surges Bay Plant Farm, P.O. Box 27, Geeveston, 7116

### **HYDROPONIC EQUIPMENT AND SUPPLIES (USA)**

Brady Manufacturing Co., Box 134, RD4, Jackson, NJ, 08527. USA  
Cardinal Systems Inc, Rt 61, RD 1, Schuylkill Haven, PA, 17972, USA  
Clover Garden Products, P.O.Box 874, VG7, Smyrna, TN, 37167, USA.  
CropKing Inc, P.O.Box 310, Medina, OH, 44258, USA.  
Honeyacre Corp, Suite 2, 21885 Highway 18, Apple Valley, CA, 92307, USA  
Hydro-Gardens Inc, P.O.Box 9707, Colorado Springs, CO, 80932, USA  
Hypro Division, Lear Siegler, Inc, 375 Fifth Ave,  
New Brighton, MN, 55112, USA.  
JPA, P.O.Box 338, West Chicago, IL, 60185, USA  
Rough Bros. Inc, P.O. Box 16010, Cincinnati, OH, 45216, USA.

### **SUPPLIERS IN THE UK and EUROPE**

[www.greenthings.co.uk](http://www.greenthings.co.uk)

[www.3countieshydroponics](http://www.3countieshydroponics)

[www.elementshydroponics.com](http://www.elementshydroponics.com)

[www.hydromall.com](http://www.hydromall.com)

[www.hydroponicequipment.com](http://www.hydroponicequipment.com)

B. V. Bastiaansen (Reko gutter system)  
Zanddreef 24, 4841 LD Prinsenbeek, The Netherlands.  
ICI Midox (nutrients)

Woolmead House West, Bear La, Farnham, Surrey, GU9 7UB, UK.  
Rossell Fluid Control (Dilution equipment)  
P.O. Box 123, Chepstow, Gwent, NP6 5YF, UK.  
Stapley Contracts Ltd (Dilution equipment)  
High House Farm, Kenardington, Ashford, Kent, TN26 2LZ, UK.  
Volmatic A/S (Irrigation)  
Rugmarken 35, Farum, 3520, Denmark.

## **SOCIETIES**

International:

Hydroponic Society of America

[www.hsa.hydroponics.org](http://www.hsa.hydroponics.org)

Hydroponic Society of Great Britain

The Hampshire Hydroponicum is the home for the above society

International Society of soil-less Culture (ISOSC), Wageningen,  
The Netherlands.

### **Australia:**

Hydroponic Society of Victoria,

c/- E. Best, 6/38 Maroo St, Hughesdale, 3166

Hydroponic section of RHS of NSW

c/- R. Frost, GPO Box 4728, Sydney, 2001.

Cairns Hydroponic Society,

c/- W. Meehan, 9 Marrett St, Stratford, 4870

Darwin Hydroponic Society Inc.

c/- B. Mund, 60 Hudson-Fysh Ave, Darwin, 5790

Hydroponic Society of South Australia

c/- B. Retallick, 12 Jikara Dve, Glen Osmond, 5064

## **SUGGESTED FURTHER READING**

Books and publications abound in the area of hydroponics. The following are just some of what exists. These and others are not necessary reading for the course, but if you want to look further into any subject, these are all publications of some worth:

- \* *Practical Hydroponics and Greenhouses Magazine* (6 issues per year)  
Caspar Publications P/L: P.O. Box 225 Narrabeen, NSW, 2101.  
Ph: (02) 9913 8855, Fax: (02) 9913 2300.
- \* *Growing Edge* (U.S. bi-monthly publication)
- \* *21st Century Gardener* (Canada – quarterly)
- \* ***Commercial Hydroponics, 2<sup>nd</sup> ed.* by John Mason (2005) Simon and Schuster**
- \* *Farm Management* by John Mason (1996) Kangaroo Press
- \* *Hydroponic Crop Production* by Joe Romer (1993) Kangaroo Press
- \* *Hydroponic Food Production* (4th Ed.) by Howard Resh (1989) Woodbridge Press

- \* *Hydroponic Gardening* (Lothian Aust. Garden Series) by Steven Carruthers (1993) Lothian
- \* *Hydroponics For Everyone* by S.K. Sutherland (1986, revised 1996) Hyland House
- \* *The Hydroponic Hot House* by James B. DeKorne (1992) Kangaroo Press
- \* *Simple Hydroponics* for Aust and N.Z. Gardens by A.C. Sundstrom (1989) Viking O'Neill

### ALSO CHECK THE INTERNET FOR RELATED WEBSITES

[www.amhydro.com/comm](http://www.amhydro.com/comm)

[www.hydroponics.com.au](http://www.hydroponics.com.au)

[www.blunt.co.uk/manual](http://www.blunt.co.uk/manual)

### SET TASK

Investigate the contacts you can find operating in hydroponics both in your region and beyond.

Begin compiling a RESOURCE file listing hydroponic contacts under the following headings, (and any other headings which you think might be relevant):

- \* Hydroponic consultants.
- \* Hydroponic media
- \* Hydroponic equipment
- \* Nutrient supplies
- \* Cut flower hydroponic farms
- \* Vegetable hydroponic farms
- \* Berry hydroponic farms
- \* Testing equipment (pH nutrient etc)
- \* Hydroponic societies, clubs, associations etc
- \* Experts - individuals who have expertise in hydroponics
- \* Seed suppliers (vegetables, flowers etc)
- \* Greenhouses
- \* Heating, cooling, environment control equipment.
- \* Hydroponic books and periodicals (list publisher please)
- \* Computers -hardware, software and advice for hydroponic controls

Each ENTRY should list names, addresses, phone numbers, and a short note on the services/equipment, etc supplied for each contact under that heading.

List all contacts you have or can find under each heading.

Entries may be stored on file cards or on a computer data base (whichever you prefer).



### ASSIGNMENT

Download and do the assignment called 'Lesson 1 Assignment'.