Aero-Hydroponics
The Method of the Future

by Lawrence L. Brooke

A Brief History

The aero-hydroponic method was developed in Israel in the early 1980's. Dr. Hillel Soffer, senior researcher at the Volcani Institute at Ein Gedi developed the aero-hydroponic method to overcome the challenges presented by the hot, arid conditions at Ein Gedi. The discoveries that followed the development of aero-hydroponics offer great benefits to all hydroponic growers.

During a two-year period from 1986 to 1988, Dr. Soffer performed extensive research using the aero-hydroponic method at the University of California at Davis, where he had received his Ph.D. in the early 1970s. The specific area of research was in quantifying the effect of various levels of dissolved oxygen on root growth, especially in the propagation of plants from cuttings.

The findings of his research were published in the Journal of the American Society for Horticultural Science, and HortScience. Both studies were co-authored with David Burger at UCD. In addition, Dr. Soffer presented his findings at the annual conference of the Hydroponic Society of America in 1988.

Except for the papers mentioned above, very little has been printed up to now on the aero-hydroponic method. The method was patented internationally, though few licenses for the production of equipment have been granted. Without aggressive commercial support, the aero-hydroponic method has remained largely a research tool, known mostly to university researchers.In the meantime, the rockwool method was becoming available internationally following 12 years of exhaustive research and a strong marketing program with lots of investment in advertising, production and distribution, first in Europe and later in Japan.

Following nearly a decade of rockwool use, the Dutch contacted Dr. Soffer to request permission to develop and use the aero-hydroponic method. The reason for the sudden interest of the Dutch in the aero-hydroponic method has implications for the development of hydroponic cultivation worldwide.

For rockwool cultivation to work efficiently in most commercial operations it is preferred to a use a non-recirculating nutrient solution. Nutrient solution is sent on a one-way trip through the rockwool and is then discarded. The real cost advantage of rockwool cultivation over other hydroponic methods was that the nutrient did not have to be recaptured and recirculated, reducing the system complexity of reservoirs, plumbing, pumps and pH and conductivity controllers. The once-through nutrient system also reduces the problem of nutrient solution becoming imbalanced due to erratic uptake of minerals by rapidly growing plants; plus the build up of dissolved minerals from slowly dissolving rockwool.

The discharge of enormous amounts of spent nutrient solution has become a major problem in Holland, contaminating surface and ground waters. Consequently, the Dutch government has prohibited the dumping of nutrients resulting in renewed interest in recirculating systems such as aero-hydroponics.

As leaders in both horticulture and commercial hydroponics, the Dutch have recognized the value of a method, which enables rapid and trouble-free cultivation and eliminates the problems of disposing of spent nutrients and exhausted media.

The Aero-hydroponic Method

Aero-hydroponics is not a simple method to understand. The equipment required is

somewhat more complicated than other hydroponic methods, but there is a great advantage in that once an aero-hydroponic system is set up, it will run almost indefinitely without additional investment in such disposable components as growing media and non-recirculating nutrients.

What is most surprising about aero-hydroponics is not how it works, but why plants grow better. The key is dissolved oxygen at the root boundary zone.

The essence of Dr. Soffer's work at UCD was in quantifying root growth in proportion to dissolved oxygen. Only the green parts of the plant can form oxygen from carbon dioxide - roots require a supply of oxygen for metabolism and growth. Plant growth in oxygen deficient conditions, such as those found in many soils, is limited. Dr. Soffer found the enhanced oxygen at the root zone produced enhanced growth.

In aero-hydroponics, the nutrient solution is sprayed through the air in order to infuse the nutrient with dissolved oxygen. The method differs from classic aeroponics in that most of the plant's roots are not suspended in air and fed by a spray of nutrient solution; rather, the majority of the roots are submerged in oxygen-infused nutrient which is in constant motion in order t maintain high levels of dissolved oxygen at the root boundary zone where oxygen and nutrients are taken in by the plant.

The result is a propagating tool of unsurpassed performance. Dr. Soffer was successful in propagating plant varieties at UCD that had never been propagated before. He took particular delight in propagating varieties of conifers and even pistachio trees (pistachio cuttings required 90 days to generate roots). Moreover, he found that cuttings could be rooted aero-hydroponically in purified water without using rooting hormones such as IBA or NAA. This is because plant tissue already contains the natural rooting hormone IAA (Indole Acetic Acid).

Aero-hydroponic Systems

Aero-hydroponic systems can be built using quite a variety of materials and in numerous design configurations. The Ein Gedi "Mini Unit" which was used at UCD for dissolved oxygen studies is a stand-alone module which supports four plants in 10 liters of nutrient solution.

An electric motor mounted on the top of the unit spins a nutrient sprayer, which lifts nutrient solution and sprays it onto the "aerial roots." Additionally, the rotation causes the nutrient within the unit to stir, moving it constantly over the submerged roots.

Large-scale aero-hydroponic systems follow the design of the commercial installation at Ein Gedi. These commercial systems consist of "canals" or growing chambers with plant sites on top. A pump provides the pressure to drive a system of sprayers to supply the aerial roots, while the submerged roots hang into the flowing nutrient in the canal.

Both of these systems share fundamental characteristics, which define the aero-hydroponic method. The plants are supported above the flowing nutrient. The roots hang down through an air gap in which nutrient is sprayed, then into the moving nutrient solution below the air gap. The nutrient sprayed through the air gap is not so much intended to feed the plant, but rather to infuse oxygen into the nutrient solution wherein the feeder roots remain constantly submerged. It is these submerged roots in oxygen rich nutrient that provides most of the nutrition and oxygen for the plant.

Home Installation

The AeroFlo system is designed and built by General Hydroponics following the Aero-hydroponic method. It consists of a reservoir placed below the growing chambers, which support the plants. The nutrient in this system is changed every two weeks and the pH is adjusted to 5.5 to 6.5 and nutrient conductivity is maintained at about 800 to 1200 ppm.

Since there is no growing medium except a handful of "GROROX" at each plant site, pH remains very stable and only requires an initial adjustment when mixing fresh nutrient, if the

water supply is of good quality.

The AERO-HYDROPONIC METHOD is without doubt the most advanced hydroponic method that has been developed to date. The cost of constructing and installing systems, plus the complications of obtaining licensing, have been deterrents to widespread commercial application. This is changing as commercial growers, researchers, serious hydroponic gardeners and manufacturers become aware of the capabilities and value of aero-hydroponics.

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