Nutrient Film Technique (NFT) Production of Lettuce

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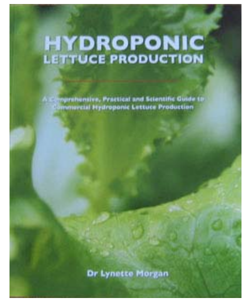
by Dr. Lynette Morgan



History
The nutrient film technique (NFT) was developed during the late 1960's by Dr Allan Cooper at the Glasshouse Crops Research Institute in the U.K. With the NFT system, a thin film of nutrient solution flows through plastic channels, which contain the plant roots with no solid planting media. The root mat develops partly in the shallow stream of recirculating solution and partly above it. It is extremely important to maintain this basic principle of a nutrient film because it ensures the root system has access to adequate oxygen levels. The key requirements in achieving a nutrient film situation are described by Cooper (1996) as being:

1. To ensure that the gradient down which the water flows is uniform and not subject to localized depressions, not even a depression of a few millimeters.
2. The inlet flow rate must not be so rapid that a considerable depth of water flows down the gradient
3. The width of the channels in which the roots are confined must be adequate to avoid any damming up of the nutrient by the root mat. If inadequate, it is to be expected that yields will be directly proportional to channel width.
4. The base of the channel must be flat and not curved, because there will be a considerable depth of liquid along the center of a channel with a curved base, merely because of the shape of the base (Cooper 1996).

A principal advantage of this system in comparison with others is that a greatly reduced volume of nutrient solution is required. This may be more easily heated during the winter months to obtain optimal temperatures for growth, or cooled during hot summers to avoid bolting and other undesirable plant responses.

Lettuce in NFT
Lettuce has been grown in NFT for many years. Some of the earliest systems used ordinary wide span greenhouses with concrete floors in which narrow gullies were cast for the NFT solution. Other early installations used selected profiles of long run roofing steel with baked epoxy finishes. Over recent years, systems have become more intensive. Some of these systems attempt to make better use of greenhouse space by using various vertically spaced gully systems or

horizontal systems with movable gullies to permit spacing to be adjusted as the lettuce grow. Rectangular PVC gullies are usual for these systems. One experiment compared gullies between 60 and 150 mm wide and found that 80 mm wide gullies, 40 mm deep with a slope of 1.5% were best. A flow rate of 0.2 liters/min was optimum when these gullies were 3.1 m long.

The slope of the channels in an NFT unit need not be severe. A drop of 1 in 50 to 1 in 75 appears suitable, although 1 in 100 is not sufficient. Depressions in the channel floors must be avoided because ponding of immobile solution will lead to oxygen depletion and growth retardation. Some NFT system designs are constructed with adjustable stands so optimum slope can be obtained for each stage of crop growth. Although this is effective in eliminating ponding, this design increases capital costs. In long run installations it is possible to introduce the nutrient solution at two or three different points along their length to ensure good aeration.

Types of NFT Systems and Gullies

There is a huge range of NFT system designs, with most incorporating the use of some type of PVC gully supported by benches in both outdoor and greenhouse situations. Many growers take advantage of both square and round diameter downspout and incorporate these into systems of their own design. Most large commercial growers purchase PVC gullies in bulk and can reduce costs in this way. The most commonly used type of PVC gully is the rectangular, white 150 x100mm channel (Figure 5). Over recent years there has been the development of a number of other, smaller types of channel designed specifically for lettuce and other small crops such as herbs and strawberries. Channels such as these usually have prepunched holes for planting seedlings into and removable lids which aid in cleaning of the system. The choice of gully system or material is often based on availability, cost and grower preference.

NFT and Rockwool

In this system, plants are established on small rockwool slabs which are then positioned in channels containing recycling nutrient solution. This system has the advantage of the rockwool block acting as a reservoir of nutrient solution in case of pump failure and helps to anchor the plants in the NFT channel.

Short Run Hydroponics

Despite what shape or size the NFT channel may be, the length of the "run" is of great importance. There has been a tendency to construct very "long runs" of gully to reduce the number of emitters required in a system. Excessively long run channels can cause a number of problems including temperature rise or fall of the nutrient solution over the length of the channel, reduction in nutrient and oxygen levels and a reduction in growth from one end of the channel to the other. Channel length can vary from 3 meters to well over 20 meters in some systems. The use of short run channels <3m is not widespread but is an alternative type of system to the traditional long run type of hydroponics.

The theory behind the use of short run channels is that even a small plant such as a lettuce, has a huge root surface area capable of absorption of oxygen and nutrients. Therefore, solution entering the top of a gully and flowing past even a small number of plants actually passes over several square meters of root surface. Nutrient flowing down a short run channel (less then 3 meters in length) will only pass a limited number of plant root systems before it is returned to the tank, remixed, oxygenated, temperature adjusted and returned back into the system. Therefore, no differences in nutrient, pH, temperature or oxygen loss will exist along the length of a channel as it might with very long run gullies.

Dr. Lynette Morgan holds a PhD from Massey Univerity's Plant Science Department in New Zealand. She is currently a partner in Suntec Hydroponics, which specializes in hydroponic product development and information transfer. She is the author of Hydroponic Lettuce Production, Hydroponic Capsium (pepper) Production, and many hydroponic articles.

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