



Nutrient Film Technique in The Hobby Greenhouse

By James W. Brown

Many people want to have a small production system with which to grow fresh, leafy vegetables that they can enjoy year round. The nutrition of freshly harvested plants is superior to similar plants purchased at your local market. Plus, by growing your own, you have complete control over the treatment of any pest and disease that may occur. The control program that you implement in your hobby greenhouse can be one with which you are comfortable. You will know exactly what has been used on your own crops, eliminating the concerns over what chemicals or other products might have been used on commercially purchased produce while it was grown at a foreign production location or during its transport to your market.

The NFT system is a good choice for this purpose, since it's relatively easy to set up and operate. Using this fairly simple system to grow plants from seedling to harvest size, and then quickly planting them with new seedlings for future harvests, provides you with a continuous supply of produce.

What will grow in a Nutrient Film Technique system?

Small, relatively fast growing plants are the most suitable for an NFT system. They start in the channels a few weeks before they are harvested and are replaced or cut back and allowed to re-grow. Vegetative plants like various leaf, Bibb and Cos type (Romaine) lettuces can be grown along with mustard greens, kale and many oriental vegetables. Any of the fast growing herbs can also be grown in the same NFT system at the same time. A couple herb plants of each kind will produce quite a quantity of herbs. It is very easy to get too many herb plants for your use.

A few edible flowers such as nasturtiums and pansies can also be grown in NFT channels. These can add interest to many salads and other food presentations.

What is the Nutrient Film Technique System?

Nutrient Film Technique system involves a thin layer or film of nutrient solution flowing over the roots of the plants in the system. The only solid media used in the system is the

small piece of media in which the seed was sown to start the plant, which is necessary to keep the seed from floating away during the early stages of plant growth.

All the plants' nutrient needs are met through the air and water solution washed through the plants' root system. Soluble fertilizers are dissolved in the solution that re-circulates through the system to supply the minerals and other elements the plants need for optimal growth.

In addition to nutrients, the plants need light. A small greenhouse is the ideal location for the system being described here. However, a large south-facing window or a basement equipped with artificial light are alternate locations for this type of system.

Components of the NFT System

Plants in an NFT system will be grown in channels. Normally, these are flat-bottomed runways that are positioned on a slope so that the nutrient solution can be fed at one end and drained, collected in a return pipe and returned to the reservoir tank. The amount of slope should be between one and three per cent. Channels are often very slightly v-shaped so that the solution will run along the center of the channel. The length of the channels is dictated by the planned size of the system. Channels can be as short as two to three feet in a small-sized system or as long as 13 to 15 feet long in a large commercial-sized system. Channels longer than 15 feet in length present a couple of issues: they are difficult to move and manipulate in the production system, and the plants near the drain end of a long channel will often not do as well as those nearer the feed end of the channel.

Channels are usually arranged in a parallel setup in the greenhouse. It is usually better to position the length of the channel at right angles to the length of the greenhouse. This way, both the system and the rest of the greenhouse space will be more accessible.

Special NFT Channels are available from several hydroponic equipment suppliers. A few pre-made NFT kits are also available. Although some hobbyists and even a few commercial growers think that the use of drilled PVC pipe offers a satisfactory, cheaper alternative to the designed NFT channel, there are several disadvantages to the use of PVC pipe systems.

The first disadvantage is probably the most important and may be the least obvious to the novice hydroponic grower. The rounded bottom of the pipe does not create an even depth film of nutrient solution on the roots. As the solution pools along the lowest point in the round pipe, the roots positioned at the rising curve of the round channel are exposed to a much shallower depth of solution than those in the middle of the pipe. This inconsistent environment in the pipe does not generate as vigorous a growth as the environment in a flat, or almost flat bottomed NFT channel where the nutrient solution is evenly distributed along the bottom of the channel. This does not mean that the pipes will not work; many people use them. The issue is that production is not as consistently good in a pipe compared to an NFT channel.

NFT channels are usually extruded using a compound that includes an ultra violet light protectant. PVC material that is exposed to light for long periods of time will become brittle and will break more easily. UV-protected channels will last longer than will PVC pipe when exposed to sunlight in a greenhouse environment.

Additional disadvantages of using PVC pipe is the extra work involved in the drilling of holes in pipes, which may be quite extensive even in a larger hobby system. In addition, the table or bench supporting the system must be designed so that the pipes do not roll and displace the plants and the nutrient solution during the operation of the system.

The base and cap construction of many of the extruded NFT channels make cleaning of the channels between crops much easier for the grower. Fertilizer deposits can collect on the sides and bottom of the channels over time, and enough light can get into the channel to generate the growth of some algae. These deposits should be cleaned out of the channel after the plants in it have been harvested and before the new crop of plants is introduced. The removable channel makes the cleaning of the channel much easier and faster, creating less of a disruption in the growing schedule.

Reservoir

Since the NFT system is a recirculating system, a reservoir is needed to hold the nutrient solution. A plastic container is adequate. Some people use heavy duty plastic garbage containers, and plastic livestock watering troughs can be used for larger NFT systems. Galvanized steel or any metal container should not be used as a reservoir, since this material is reactive. The fertilizer is very corrosive to the metal and can pick up components from the reservoir in quantities that can be harmful to the growth of the plants in the system.

The size of the reservoir is determined by the number of plants to be grown in the system. A small system with a plant capacity of 40 - 50 should have a reservoir with a minimum five gallon capacity. An additional gallon of capacity should be added for each additional 20 to 25 lettuce sized plants in the system. It is always better to have a little more volume capacity than is needed rather than to be a little short. During warm days, the plants use more water. The extra water usage concentrates the remaining fertilizer in the solution too much, and the stress of the overly-concentrated solution can reduce the growth rate and quality of the plants in the system.

The Re-circulating Pump

The re-circulating pump must have the capacity to pump enough fluid to keep the system operating. It must be designed to handle the corrosiveness of the nutrient solution. A non-corrode pump will usually be adequate.

In small NFT systems, a fountain pump is often used with success. Although a fountain pump is not designed to take much in the way of back pressure, it can be used in a small

NFT system which has minimal back pressure in the delivery system. The amount of lift required by the system should be three feet or less, which means the level of the nutrient solution in the reservoir should be no more than three feet below the level of the feed end of the NFT channel.

It is always better to have a pump that is a little larger than what is needed, rather than one which is marginal or too small in capacity. The capacity of the pump (as stated on its packaging) should be about five times the amount in gallons per hour than is needed. This is because you want a little extra capacity and because of the lift required to get the solution from the reservoir tank up to the level of the feed end in the channel.

If needed, extra volume can be released or bypassed through an in-line valve located just after the outlet connection of the pump, yet still below the surface of the nutrient solution in the reservoir. Locating there will also circulate the nutrient solution in the reservoir tank, keeping the nutrients mixed. In this type of NFT system with plants in the lettuce-size range, the nutrient solution can be circulated through the channels 24/7. This means that there is no need for a timer to turn the pump on and off. This simplifies the setup and operation of the system. It also eliminates one of the potential costs in the system.

Irrigation Lines and Emitters

Flexible poly pipe, of the kind used for irrigation applications, is used to deliver the nutrient solution from the pump to the emitters that deliver a controlled volume of solution to each NFT channel. The advantage of the flexible poly pipe is that it allows you to directly insert an emitter into the poly pipe without separate connections. It also allows an emitter to be placed where it is needed along the length of the pipe. Rigid PVC pipe is often used in larger NFT production systems between the pump and the flexible poly pipe of the nutrient delivery system. Larger PVC lines are used to deliver the larger volumes of solution to different zones of an NFT system. Although this can be done in small systems, it is not necessary and is usually avoided because of the cost of the connectors compared to a few extra feet of poly pipe.

Emitters for a small NFT production system using small fountain type pumps should be non-pressure-compensated emitters. Small fountain type pumps do not produce the pressure needed for uniform delivery when using pressure compensated type emitters. Only larger systems with higher flow rate requirements that use centrifugal type pumps can utilize pressure-compensated type emitters. However, even larger systems seldom use pressure-compensated emitters. With a properly designed system with a balanced flow rate that runs continuously, there is no need to use pressure-compensated emitters for even delivery. It would only be an unnecessary extra expense, and in some instances may possibly cause nutrient delivery inconsistency to some or all of the NFT channels.

Drain Line

The drain line catches the nutrient solution after it has left the NFT channel and returns it to the reservoir to be re-circulated. The drain line can be made out of three or four inch PVC pipe and the necessary fittings. Polyethylene sewer and drain line is used by some growers because it is white on the outside and black on the inside. The black color blocks out light that can support algae growth on the inside of the return line. The white exterior reflects some of the light and heat to minimize temperature increase in the fertilizer solution in the return line.

The way the drain line is cut for receiving the solution from the NFT channels depends upon the design of the channels and the overall system. Some NFT channels have drain end caps and channel the solution out through PVC fittings that will slip through holes drilled in the drain line. Other channels just end without a cap and drop the nutrient solution into a cut in the return line or an open gutter. The downside of this method is that some of the solution may not drop into the hole or cut in the return line, and will be spilled and lost.

Fertilizer

Soluble fertilizers must be used in the NFT system. The fertilizer solution is the only source of the needs of the plants other than the air. In this system, if it will not dissolve in water, it will not be available to the plant through the roots.

Most water is usable in an NFT system. The exception is water that has been run through a water softener, which should not be used because of its elevated sodium content. It is better to use the same water before it is run through a softener. If the water has an electrical conductivity of greater than 0.5 millimhos/cm, it should be tested at a water quality laboratory before it is used in any hydroponic plant production system.

Many hydroponic fertilizers are available. They arrive as soluble powders or liquids that need to be mixed with water before being supplied to the plants. Since the plants that will be grown in this system will probably all be grown only in the vegetative stage, many different kinds of plants can be grown on the same fertilizer program.

Electrical Conductivity (EC)

Pure water conducts virtually no electricity. Ionized impurities in water support the conduction of electrical currents. The impurities in the source water as well as the fertilizer ingredients supplied in the fertilizer contribute to the conductivity of the solution. The Electrical Conductivity (EC) is used to monitor the strength of the fertilizer solution being delivered to the plants. A conductivity meter should be considered an essential part of every NFT system. A reliable instrument-quality conductivity meter should be chosen. It will cost a little more, but is far superior to any of the “toy” conductivity meters on the market.

pH

pH is a measure of the acidity or alkalinity of a water solution. This information is important in a fertilizer solution because it affects the solubility and the availability to the plant of the different fertilizer components. Therefore, it's important to keep the pH of the recirculating nutrient solution in the correct range. The pH range for the optimal availability of nutrients in a solution culture is in the 5.5 to 5.8 range, which is in the moderately acid range. pH control can be achieved by adding acid or base to the fertilizer solutions. Most people will need to add acid. Although vinegar or citric acid can be used, these acids support the growth of mold in the nutrient solution. Battery-strength sulphuric acid can be obtained at an auto parts store. It can be used in small quantities to lower the pH of the nutrient solution.

Measure the pH with a color indicator kit or a pH meter. The re-circulating solution should be checked at least once a day. A pH meter needs to be calibrated regularly in order for it to be reliable. The probe unit of a pH meter is usually only guaranteed for a year or two, and it may only last that long or a little longer. The probe should be replaced if the meter is giving unrealistic or inconsistent readings. Be prepared to replace the probe at the end of its guaranteed life.