

# Early Start

From mid-January into March this Pennsylvania engineer grows lettuce, tomatoes, cucumbers and peppers in a grow room. After that he turns his attention to planning an outdoor garden

## Text and photos by Larry Walker

About 12 years ago I picked up a book on greenhouses and browsed through it. Towards the end was a section on hydroponic gardening, which I found intriguing. After reading the article, my thoughts ranged from growing gigantic tomatoes to operating a commercial greenhouse.

As I now understand, most of my early expectations were not totally realistic. However, a personal journey of learning and experimentation with hydroponics began. I initially constructed several outdoor systems, but it wasn't long before I wanted to enjoy hydroponics year-round, not just in the typical western Pennsylvania growing season. Consequently, I designed and built an indoor grow room. What follows is a description of my grow room, including the systems and plants used for my indoor gardening.

### Grow Room

A critical step in finalizing the plans for my grow room was identifying a suitable location for this project. Since space was limited, the room had to be relatively small, so I carved out a 5-by-10-foot area in my garage. I used two-by-fours for the walls, insulated and finished with drywall. A water-resistant flat white paint was used on the interior walls. This allows good light reflec-



*Above:* Larry Walker designed and built this 5-by-10-foot grow room in his garage. *Left:* Inside the grow room Larry takes a break from tending his plants.



**Above:** Larry Walker starts all his plants from seed in rockwool cubes. For several weeks the plants grow in rockwool in a covered and heated tray. Walker then moves them into the grow room. **Left:** It's the first day in the grow room for these tomato, pepper, and cucumber plants. **Right:** Plants after three weeks in the grow room. Lettuce growing in the smaller system on the shelf at right was started from seed about two weeks earlier. **Below right:** Tomatoes, peppers and cucumbers after seven weeks in Walker's grow room.

tion while minimizing the effects of humidity.

Two 160-watt fluorescent lights were located in the ceiling. A vent was installed in the garage-side wall to enable fresh air to be pulled into the room by a fan. To maintain the room's environment a 2000-watt electric heater, temperature/humidity controller and 190 cfm exhaust fan were incorporated. Other room features include eight electrical outlets, a cold water pipe, a nutrient solution drain line and plastic shelving for storage. I also installed a dedicated circuit breaker box outside the room which provides both 120 volts and 240 volts.

Room temperature during grow-light hours is generally in the range of 70-80 degrees and 60-70 degrees at night. Relative humidity can vary from 50%-80%, depending on the room temperature and stage of plant growth. These conditions allow productive plant growth.

## Grow Systems

I designed and built three separate grow systems for use in this room. These units were constructed from materials bought at a local home supply center. Metallic parts were used selectively since nutrient-to-metal contact can release toxic elements that may be harmful to the plants. All three systems employ a method of top plant feeding and recirculation of the nutrient solution (excess solution is drained back to the tank after each feed-

ing). I have found 3-minute feedings, 6 times a day to be sufficient. However, the feeding cycles can vary depending on the growing plants' needs. Electric timers are used to turn the pumps on and off.

The largest system uses a 10-gallon glass tank, which is painted black to prevent algae growth. This unit provides a growing area of approximately 2 feet by 3 feet, and it accommodates bigger plants such as tomatoes, cucumbers and peppers. Up to nine plant sites can be set up in this system, depending on the plant size. Plant lighting is provided by a 400-watt metal halide system hung from two chains. This enables the height of the light to be adjusted during the growing cycle. Lighting duration is controlled by a timer, typically set for a 16-hour day.

Plant containers are 6-inch plastic pots with bottom drainage holes. Growing media is perlite (horticulture grade) to anchor the plant roots and retain nutrients. Plants are directed to grow vertically through the use of twine and plant clips. Since the weight of maturing plants can be significant, I built a metal frame around the system for support. This frame also carries the weight of the HID light.

A submersible pump (205 gph at 5 feet) is used to circulate the nutrient solution. This solution is pumped through a vertical PVC pipe, containing small diameter tubing that extends to each plant site. There is also a valve and side discharge line in this pipe used for



draining the nutrient solution during replacement. This works by closing the valve, which redirects the pumped nutrient solution outside the room. Make-up and/or replacement water is then transferred from a plastic holding tank located adjacent to the system. This tank allows any replacement water to reach room temperature prior to use in the grow system.

The other grow systems are 1 gallon and 5 gallons in capacity, which are ideal for growing lettuce and/or herbs. These units contain two plant sites and four plant sites, respectively. Plants are grown in 1.5-inch rockwool cubes placed inside small net pots. Lighting is provided by an 80-watt fluorescent light, located directly above this system. Similar to the larger system, submersible pumps (50 gph at 2 feet) are used to move the nutrient solution to the plants. All other functions are similar to the larger system.

### See How They Grow

Tomatoes, peppers and cucumbers grow in the largest system. Tomato plants are typically of the determinate variety, which conserve space due to their limited growth. Cucumbers are gynoecious (all female, requiring no pollination). Peppers are either a sweet or hot variety. In the smaller units, I typically grow loose leaf and/or Bibb lettuce.

All the plants I use are germinated from seeds. For the larger plants, in early October I place seeds into 1.5-inch rockwool cubes that have been soaked in a weak pH-adjusted nutrient solution. These rockwool cubes are placed in a covered and heated tray until 3-4 leaves develop. Plants are then transferred into 3-inch rockwool cubes for an additional 4-5 weeks before moving them to the grow system. During this time the tray is uncovered and lighting is provided to the plants. These plants are ready to be placed in the grow system by mid- to late November.

Since lettuce has a shorter grow-



Larry's grow room is equipped with combination pH/EC meter, light meter, temperature/humidity indicators and programmable timer. There's also an intercom for communications within the house.

ing time, these seeds are germinated directly in the smaller systems about a week after the larger plants have been set into their containers. This allows most plants to mature at about the same time.

Nutrients are then dissolved in water and pH adjusted to about 5.8-6.0. If necessary, this adjustment is made by using either pH up (potassium hydroxide) or pH down (phosphoric acid). My water source is pH 7.6, which usually decreases to around 6.0 after mixing the nutrients. Typically, I use nutrients from CropKing or General Hydroponics. The electrical conductivity (EC) during plant growth is maintained in the range of 2.0-3.0, with a pH of 5.4-6.2. A combination EC/pH meter is used to measure these parameters every several days. The nutrient solution is replaced every two weeks.

Normally no major adjustments are required during this time, other than adding water. It is interesting to note that several gallons of water per day can be taken up by these plants during later stages of plant growth.

### Now the Fun Begins

During the time plants develop and mature some work is required, such as removal of side branches or suckers and pollination of the tomato and pepper plants. Pollination is achieved by mechanically shaking the flowers. I built a simple device using a battery-operated toothbrush attached to a dowel rod, which works very

effectively.

Continuous monitoring of the plants for any signs of insects or diseases is also necessary. My experience indicates that maintaining reasonable environmental conditions and following good housekeeping practices can minimize this type of problem. This includes keeping the floor clean, removing dead plant material and pruning leaves to allow good air movement around the plants.

In sum, I think almost anyone can find a way to enjoy hydroponic gardening, as I have done, and to realize the same enjoyment and relaxation it gives me. 🍃

*Larry Walker lives in Harrison City, Penn., and is a professional engineer.*

### Acknowledgement

I would like to thank CropKing, Seville, Ohio ([www.cropking.com](http://www.cropking.com)). CropKing has enabled me to be successful at hydroponics through the company's sharing of expertise, annual conferences, training workshops and products for the hobbyist and commercial grower. 🍃

### Resources

CropKing  
[www.cropking.com](http://www.cropking.com)  
General Hydroponics  
[www.genhydro.com](http://www.genhydro.com)