Indoor Vertical Farming with Hydroponics

Presented by Garden of Eden Urban Farming

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Session #1

CLASS OVERVIEW

Indoor farming with Hydroponics is expanding rapidly in cities around the world! And, now you can learn to grow in your home or learn about the exciting growing field of indoor farming in urban areas where little land is available for traditional farming.

We make farming without soil simple to understand and easy to accomplish. A major advantage of indoor gardening with Hydroponics is the elimination of common outdoor risk factors that threaten crop production - weather, stress, lack of water, pests, depletion of the soil, etc. Plants receive just the right amount of light, water, heat and nutrients to maximize production. Crops grow faster with 90% less water and stress - all year round.

This workshop-style (lab + lecture) course is designed to introduce students to indoor vertical farming. Taking place at the Indoor Farm Collaborative (IFC) facility in Tukwila, participants will work in groups of up to 3. These groups will operate cutting-edge technology to grow leafy vegetables and microgreens. In addition to take-home nutrition, students learn best practices for indoor farms, food safety protocols, and come to understand where they fit in this eco-friendly method that is becoming the future of farming.

Throughout the course we will provide students with lesson modules, a certificate of completion at the end, and resources to find the most cost-effective way to get started with vertical indoor growing at home on a budget. Come to the class to learn, leave with the resources to grow.

Whether you have no growing experience or were born with a green-thumb, we guarantee you will learn some new tricks and gain increasingly valuable skills for your own use or as the basis for a new career in indoor farming.

Learning Objectives

Learning Outcomes:
Upon successful completion of this course, you will be able to:

- Develop essential skills to take the IFC Entry Level Professional Development aligned with entry level positions within the commercial indoor farm industry
- Become confident in your ability to grow your own food year round, indoors, and without soil
- Understand how indoor farming is changing the world and how you can be a part of it.
- Understand the vocabulary associated with Hydroponics: Hydroponics, nutrient solution, pond, media, pH, Electrical Conductivity (EC), NPK
- Grow fruits and vegetables indoors all year round

Who Should Take This Class?

- Plant lovers and existing gardeners/farmers who want to grow 365 days a year, as well as, crops not grown in the PNW
- Anyone interested in sustainability and/or conservation
- Entrepreneurs looking for fast ways to grow expensive plants
- Anyone interested in a career in indoor farming

Prerequisites:
All skill levels are welcome; from the uninitiated to the experienced at-home hydro-grower.

Knowledge Areas Covered:

- Food Safety Handling
- Plant Physiology
- Pest Prevention
- Indoor Farming BMPs
- CEA (Controlled Environmental Agriculture) Technical Skills
- STEM (Science, Technology, Engineering, Math)
- Health
- Nutrition

Background & History of Hydroponics

Definition
Hydroponics refers to the practice of growing plants in nutrient solutions. This can be done either in liquid systems or in aggregate systems in which the plants are planted in a soilless media consisting of substances such as vermiculite, perlite, sand, coconut coir, expanded rock, gravel, rockwool or peat.

History of Hydroponics
Hydroponics is not a new idea. The hanging gardens of Babylon may have been a hydroponic system. The Aztecs grew vegetables in a quasi-hydroponic system because the area in which they lived was a swamp and unable to support field agriculture. They scraped soil out of the swamp and placed it on top of floating wooden rafts. The Aztecs planted their plants in this soil and allowed the roots to grow down through the raft into the water below.

Before a more scientific approach could be taken to hydroponics, many discoveries had to be made about how and why plants grow, and how they make use of various chemicals. In 1860, Julius Von Sachs published the first recipe for a nutrient solution in which to grow plants, and he called the growing system ‘nutriculture’. In the 1920s, Dr. William Gerizke from the University of California coined the phrase ‘hydroponics’ from the Greek words hydro meaning water and ponic meaning work, implying that the water does the work of providing the necessary nutrients to the plants for successful growth. In the same decade, one of the most famous recipes for the nutrient solution that is essential for plant growth in a hydroponic system was published by Hoagland. Called Hoagland’s solution, it is still in use today. Since the 1920s, much formal research has been performed on hydroponic systems, and many systems were developed that we are familiar with today (aeroponics, ebb and flood, deep flow or pond culture, drip or bucket culture, nutrient film technique or NFT and wick).

Background & History of Hydroponics

Advantages of hydroponics over growing plants in soil:

- Plant density may be greatly increased per unit of growing area compared to field production, allowing more product to be grown in a smaller amount of space.
- Yield per plant is often increased. (An important point if you want to sell the crop!)
- Nutrient solution can be reused, so less fertilizer can be used. (Good for the environment.)
- Using artificial lights, hydroponic systems may be stacked vertically, further increasing the plant yield per unit of floor space.
- Growing plants indoors allows greater control of temperature, light intensity, light quality (wavelengths of the spectrum that are used), light duration, nutrient composition and concentration, humidity, and gasses supplied to the roots.
- There is a shorter growing time (plants grow faster) compared to field grown plants.
- There is a smaller weed problem than in field grown plants.
- Plants do not need to have soil washed off, so they are ready to eat right away!

Disadvantages of hydroponics compared with plants grown in soil:

- Price – There are higher set-up costs than field grown or conventionally grown greenhouse plants.
- Time – You don't have the buffer of soil to provide adequate moisture and nutrients and temperature control if the plants need to be left alone for a long time. Different hydroponic systems are associated with different amounts of risk in terms of massive crop failure if something goes wrong (e.g. the pump breaks or the temperature gets too high or low, or the tank springs a leak).
- Resources – plants grown in the winter must be provided with light and heat, which typically are obtained indirectly through fossil fuels.

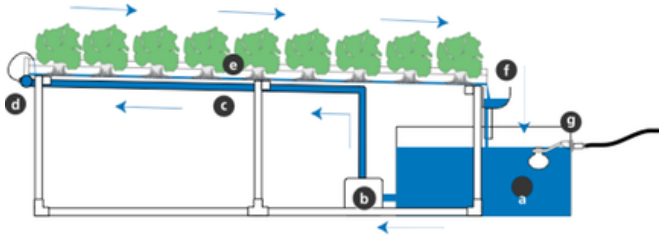
Anatomy of A Recirculating Hydroponic System

Introduction to Indoor Growing. Participants learn how and why the equipment
works, sanitation standards, and food safety on farms. Seeds and microgreens are
sown.

Welcome – Leveling of Expectations
Intro to Hydroponics; History
The Ponics: Hydro, Aero, Aqua

AEROPONICS – Tower Garden
What can we grow? What is NPK?
Preparing the growing solution
Planting Crop 1: The Tower Garden

Video: The Leafy Green Machine
https://youtu.be/1t-PUIXUPgw
Question & Answer



The Anatomy of a Recirculating Hydroponic System

a. Nutrient Reservoir: located at the lowest point of the system. Contains the correct amount of minerals in solution to feed plants exactly what they need.

b. Pump: continuously pumps nutrient solution to system.

c. PVC pipe: delivers solution to top of growing channel.

d. Microtube: emits exact amount of solution (one quart per minute)

e. Plant roots sit in mineral rich solution that gravity flows down sloped flat bottomed channel.

f. Collector: collects solution and drains back into reservoir to be recirculated.

g. Float valve: as water is transpired by plants, float valve lets in fresh water.

Session #2

Students use observation to manage their sprouting plants. Microgreens are upgraded, seed sprouts are assessed, and tower gardens are prepared for transplants.

Status of the Crop 1 – Week-2

What are Microgreens? Uses and Benefits?
Local Availability? Cost?
Soilless media and related benefits
Video: Growing your own at home
https://youtu.be/FCXWaHW55GM

(Review Microgreen at home kits)

What's Next?

Microgreens

Overview
The use of indoor farming technologies to produce a wide variety of fresh fruits and vegetables is the focus of this proposal. It includes curricula for education, training and business skills development. In addition to herbs and leafy greens like lettuce, arugula, spinach and kale, “microgreens” are featured as a crop that addresses the health and nutritional needs of the most vulnerable in our communities.

Education
“What are microgreens?” Microgreens are young seedlings of edible vegetables and herbs. Broccoli, arugula, cabbage, sunflower, radish, basil and many other herbs can be grown and harvested in less than 14 days after germination. They are usually about 1-3 inches long and come in a rainbow of colors, which has made them popular in recent years as garnishes with chefs; a nutritional addition to smoothies, juices, teas, soups and salads.

Microgreens are also lauded for their health benefits, which can vary depending on the plant species. Many chronic diseases affecting large segments of the population can be traced to nutritional deficiencies and lack of access to fresh fruits and vegetables (food deserts) including heart disease, diabetes, obesity, hypertension and cancers affecting the digestive tract to name a few.

Microgreens

Training

The lifecycle of microgreens (10-14 days/crop) makes the learning experience an effective organizing tool for training. “From seed to table” describes the learning experience.

The curriculum includes multiple learning opportunities for education, training and business skills development. The repetition of crop cycles facilitates the development of analysis and problem solving abilities. Participants have the opportunity to apply what they learn - good or bad - from actual hands-on experiences.

Researchers have found microgreens like red cabbage, cilantro, and radish contain up to 40 times higher levels of vital nutrients than their mature counterparts. Although nutritional claims about microgreens abound on the Internet, researchers in the first scientific evaluation of their nutritional content said they were astonished by the results.

Entrepreneurship

The small space required for growing microgreens makes them an ideal crop for indoor farming businesses. Indoor urban farming is a “new economic engine” designed to encourage the development of small, private farms engaging in a variety of urban farming opportunities. Even the most experienced growers may not simultaneously have skills in business, marketing, data management, technology, etc. We offer them a way to participate in urban farming; a growing, global nutritional enterprise that is not likely to vanish as long as people keep moving into cities.