

Welcome to Summer STEM!

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Summer STEM:

Smart Technology and Urban Agriculture



Introductions!



-  Introduce yourself with your name, your pronouns, and where you're from!

-  Why did you choose to join this Summer STEM class?

-  Do you have any experience with plants, hydroponics, or programming/IoT?

-  If you could be a fruit or vegetable what would you be? 

About Our Class!

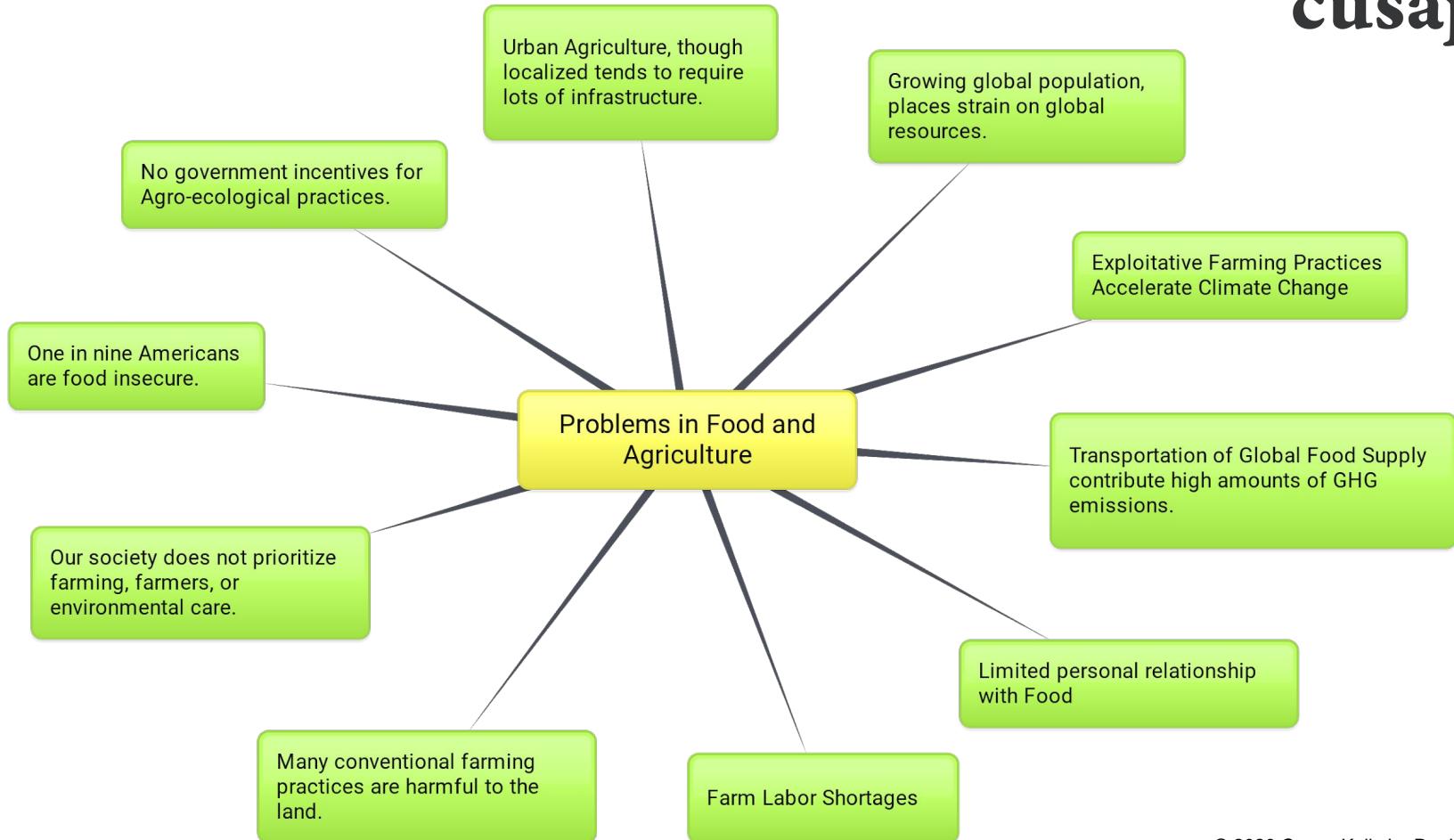


Today's Lesson!

- Discussion of agriculture
 - Urban agriculture
 - Food insecurity
 - Food “mile”
 - Innovations
 - Our educational kit
- Begin sprouting our seeds!
 - Hydroponics
 - Caring for plants

**Question: What issues are we facing
in food and agriculture today?**



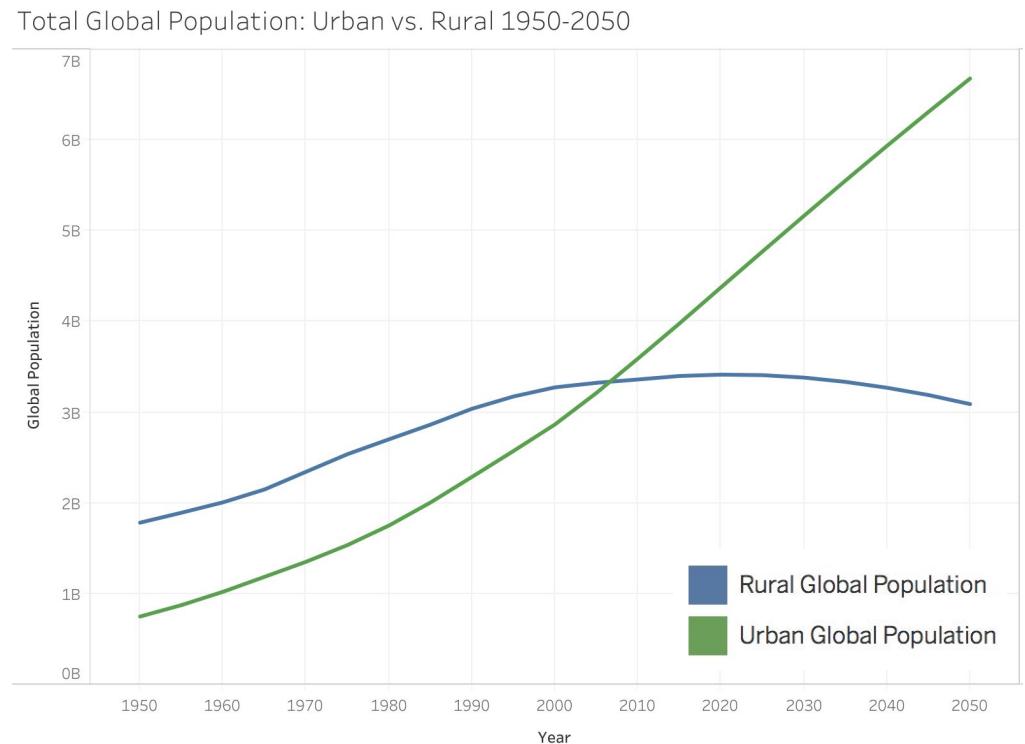


Growing Urban Populations

The projected global population in 2050 is 9.3 billion people.

This population is becoming predominantly urban.

In the United States, the total urban population is estimated to be 82.7%.

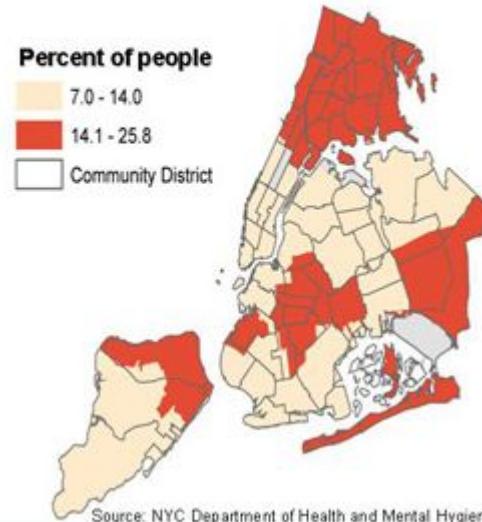


USA + NYC Growing Threat: Food Insecurity

Food security is a measure of the availability of food and individuals' ability to access it. Affordability is only one factor.



Percent of people reporting they consumed NO fruit or vegetables the previous day by the United Hospital Fund Neighborhoods



**Question: What comes to your mind
when we say “urban agriculture”?**



Importance of Urban Agriculture

Growing urban populations will result in strain on food supply chains.

About 60% of the world's total croplands exist on the outskirts of major urban centers.

Offers a chance to reassess how we develop and utilize urban spaces for independent and sustainable food production.



One of Brooklyn Grange's three rooftop sites in NYC

Question: Where does your food come from?



The Food “Mile”

Food typically travels very long distances before getting to your plate, accounting for part of its carbon footprint and creating a barrier for availability.

COVID-19 has demonstrated a need for local food production and sustainability

Locally grown food and gardens can also strengthen community and security.



Benefits of Urban Food Production?

Better Air Quality

Encourages Healthy Eating

Improves Mood

Relieve Stress & Anxiety

Promotes Responsibility



Farmer at work with plants, (left). Image courtesy of Farm.One. Farmers at Brooklyn Grange's rooftop farms, (center). Image © Brooklyn Grange. www.BrooklynGrangeFarm.com. Farmers at 117thSt. & St. Nicholas community garden in Harlem (right), Image courtesy of DCR.

<https://www1.nyc.gov/site/agriculture/index.page>

Hydroponics

Growing plants without soil!

Artificial growing conditions alleviate seasonal constraints.

Reduces required growing space by 20%.

Uses 20x less water than traditional growing methods.

Efficiency made possible through innovations in agricultural technology (AgTech)

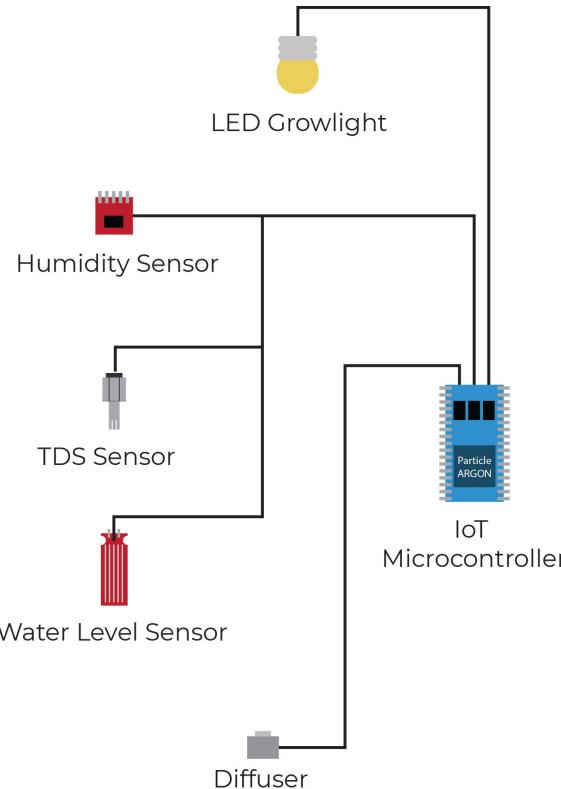


One of Gotham Greens' hydroponic greenhouses.



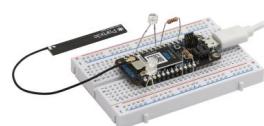
An indoor hydroponics facility operated by Square Roots

Electronics



- Internet Connected Microcontroller
- LED Lights, Pumps, Nutrient Dosers
- Numerous Sensors and Actuators

Many Possible Configurations



IoT Microcontroller



Water Level Sensor



EC Sensor

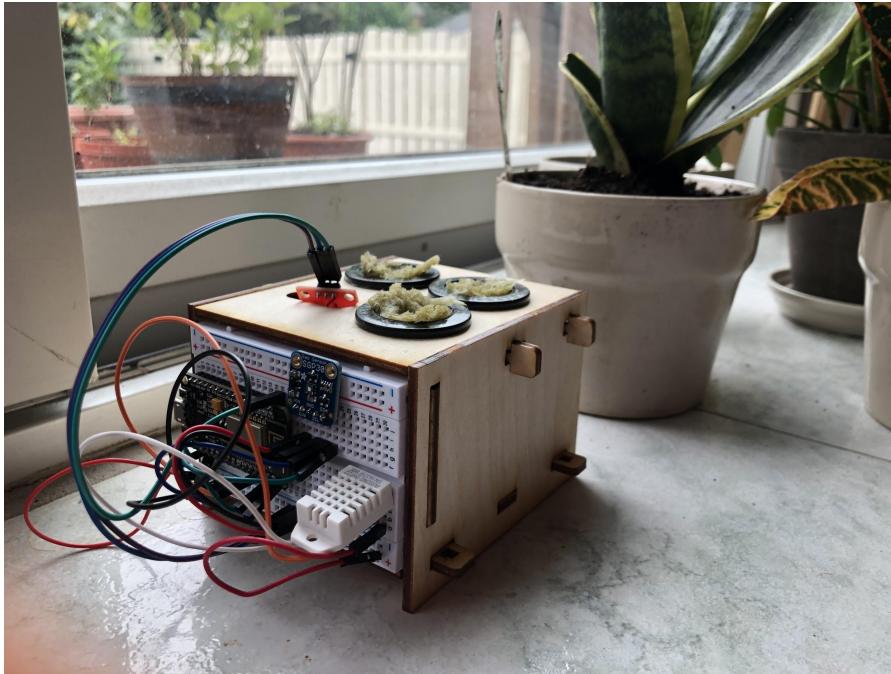


Humidity Sensor

Our Educational Kit!



Our Cube!



Plants and Sprouting!



Seed Starting Activity

What we'll do

- Soak rockwool for 20 minutes
- Mix our own nutrient solution
- Start/plant our seeds.

What we'll need

- Nutrient Solution (provided)
- Teaspoon
- Gallon container
- Shallow bowl or tray
- Rockwool (provided)
- Seeds (provided)



Soak Rockwool

What we'll do

- Fill a bowl or tray with water.
- Place rockwool in the bowl and let soak.

What is rockwool?

- Rockwool a lightweight hydroponic substrate, made from spinning molten basaltic rock into fine fibers which are then formed into a range of cubes, blocks, and growing slabs.
- Also known as stonewool.



Why are we soaking rockwool?

- Lowers pH.
- Rockwool will be our plants home. :^)

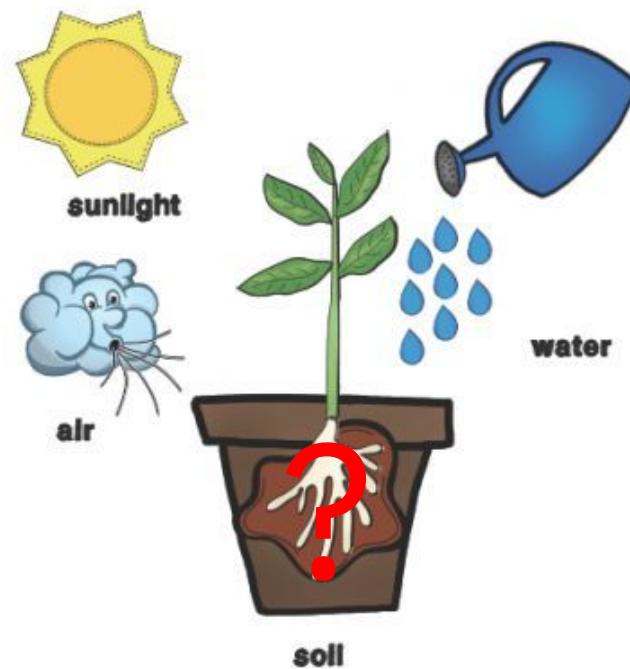
Plant Basics

Plants, like all living things, have certain requirements that need to be met for them to grow and thrive.

- water
- nutrients
- light
- air
- structural support for the roots

What about soil?

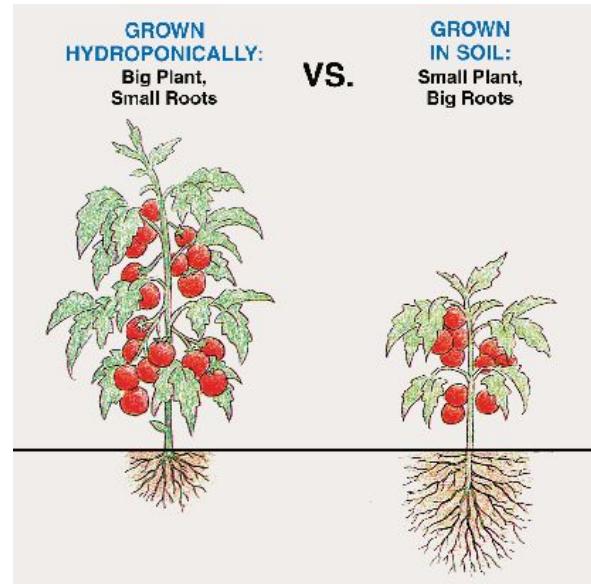
Plants don't feed on soil. They have roots that search the soil for nutrients, water, and air.



Why Hydroponics Works

No soil means that:

- water, nutrients, and air is provided directly to the roots
- plants spend less energy on root growth and more energy on leaf and fruit growth

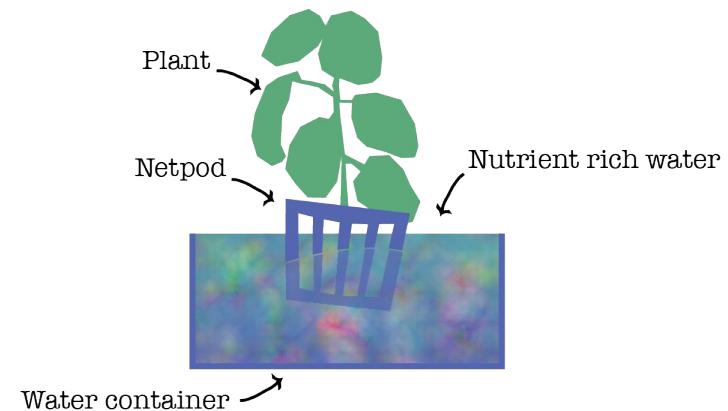


The Kratky Method

The Kratky method is a passive hydroponic technique for growing plants suspended above a reservoir of nutrient-rich water.



The Kratky Method
The simplest hydroponic system.



Growing Mediums

- Growing mediums support plants roots and keep plant from falling over.
- There are various types of growing mediums.
- Rockwool, vermiculite, perlite, clay pebbles, coconut coir

We are using rockwool because?

- Manufactured product = sterility, no pests or outside bacteria
- High moisture retention
- Provides great aeration for plants.



Nutrient Solution

What we'll do

- Fill your gallon container completely with water. Preferably lukewarm.
- Take a little under a teaspoon of the provided nutrient solution and pour into the water.
- Mix gently until dissolved.



Half Gallon				Half Gallon			
Quart		Quart		Quart		Quart	
Pint	Pint	Pint	Pint	Pint	Pint	Pint	Pint
c	c	c	c	c	c	c	c
u	u	u	u	u	u	u	u
P	P	P	P	P	P	P	P

Gallon = little under a 1 teaspoon

$\frac{1}{2}$ gallon or 2 quarts = under $\frac{1}{2}$ teaspoon

2 liters = under $\frac{1}{2}$ teaspoon

1 liter = under $\frac{1}{4}$ teaspoon

NPK?

- N = Nitrogen
- P = Phosphorus
- K = Potassium

Nitrogen is largely responsible for plant growth, specifically the leaves.

Phosphorus promotes the development of roots, flowers, and fruits.

Potassium promotes overall function of the plant, specifically the movement of water and nutrients throughout the plant.

N P K
10 5 14

N P K
5 15 14



Plant life cycle

Seed Stage

Germination

Growth

Reproduction

Pollination

Spreading Seed Stages



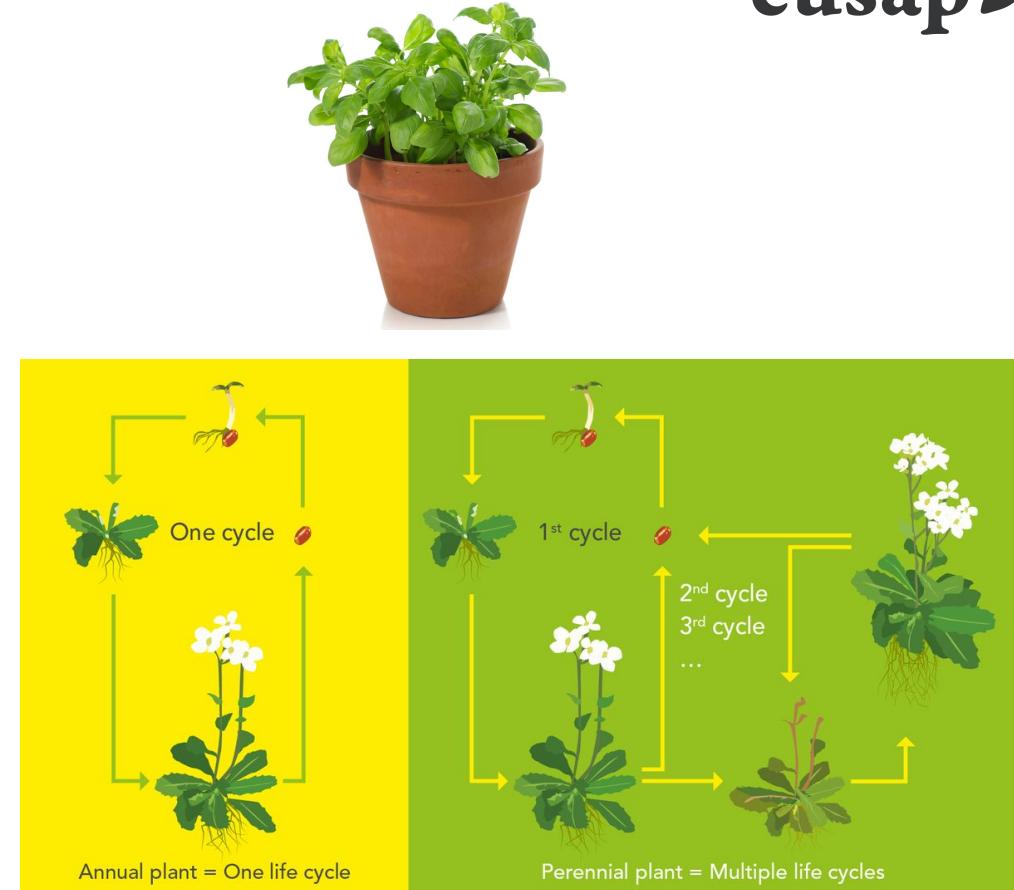
Basil

A little bit about basil.

- Basil is native to tropical regions from central Africa to Southeast Asia.
- Will take 7-14 to germinate.
- About 60-90 to harvest
- Basil can grow up to 1-2 feet tall.
- Basil is bushy annual.

Annual plants grow for one growing season and then die. As opposed to perennials, which regrow every spring.

- Basil is fast and easy growing, which makes it ideal for hydroponics.
- Life cycle can be extended through hydroponics.



Types of basil provided.

Italian Large Leaf basil

- Greta for Italian sauces and making pesto.

Lime basil

- Small compact leaves, with white flowers.
Smell like lime. Great for teas.

Dark opal basil

- Ornamental and edible, spicy flavor. Its Purple!

Plant each kind is and observe the their differences.



Plant Seeds!

What we'll do

- Empty your bowl or shallow tray of nutrient solution.
- Place 2-3 seeds in the rockwell. About $\frac{1}{4}$ deep.
- Place the rockwell in the bowl or shallow tray. This will be your plants home until they germinate and are ready to be transferred into a hydroponic system.



Plant care

Check on your plants everyday!!

Watering with a low pressure spray is my preferred way. :)

In 7-14, the seed will germinate.

Continue to water the seedling daily until the root structure can reach the water in the hydroponic system on its own. Depending on the seed and growing condition this may take 2 weeks or more.

Place by window or sunny spot in your home. Basil needs a full days sun 6-8 hours.



Questions?



HOMEWORK?

