

Solaris Garden Hydroponic Lesson Plan



SOLARIS GARDEN

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Germinating Seeds

What three main elements do seeds need to germinate successfully?

Temperature:

Depending on the type of plant, seeds generally need a ground temperature of at least 50-70 degrees Fahrenheit. If you live in a cooler climate and would like to start seeds year round in the Solaris Seed Starter, you can use a small heating mat underneath the growing tray.

Water:

Seeds need the right amount of moisture present to soften their outer coatings. Too much water (being water logged) will lead to rot and not allow enough oxygen to reach the seeds.

Oxygen:

Oxygen is needed to help the seeds produce the energy they need to break out of dormancy. The seeds also use oxygen as a source of energy for different cell functions.

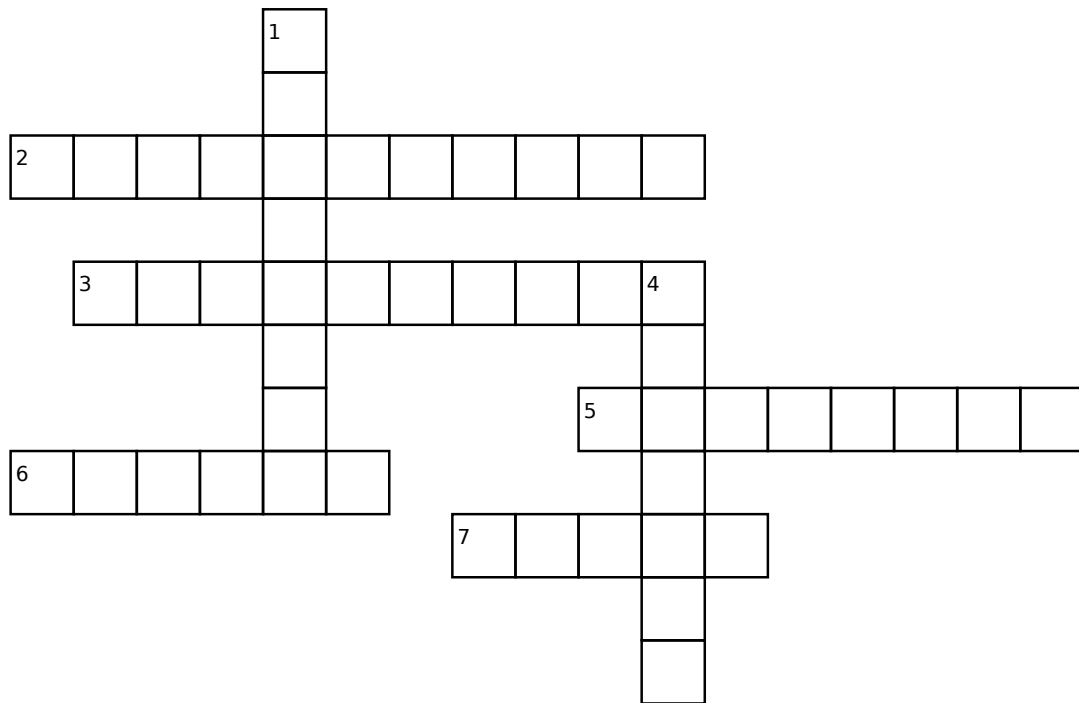
Pelleted Seeds

Pelleted seeds are coated with an even layer of fine clay. This gives them an added layer of protection, makes them easier to handle, and when planted outside it helps them to stay put when a gust of wind blows by.

Some pelleted seeds are also treated. This means that the layer of clay coating the seed also contains nutrients to help the seed germinate and grow strong through the very beginning stages of its life when it is most vulnerable.



Germinating Seeds



Down:

1. seeds need the right amount of this present to soften their outer coatings
4. this type of pelleted seed contains nutrients to help the seed germinate and grow strong

Across:

2. the process of a seed sprouting
3. if you live in a cooler climate, try using one of these under your BioDome to help the seeds germinate
5. these seeds are coated with an even layer of fine clay
6. this is needed to help seeds produce the energy they need to break out of dormancy
7. seeds generally need a temperature between _____ and 70 degrees Fahrenheit to germinate

Week 1 Guide and Checklist

1. Set up your BioDome!

First you will need a good place to start your seeds. This is where the BioDome comes in, as it creates the perfect germination environment. Be sure to set your BioDome LED lights to 12 hours on and 12 hours off. Refer to pages 2-4,7 in the Grow Guide and page 5 in the Assembly Guide.

2. Plant your seeds!

Pelleted Seeds = Seeds coated with a thin even layer of clay and nutrients to protect the seed and allow for easier handling.

Important Reminder: When planting your seeds, remember that only pelleted seeds or seeds that are at least as big as this dot ● should be placed inside the hole in the BioSponge. If your seeds are non-pelleted or smaller than the dot, place them on the edge of the BioSponge. This will ensure a successful germination. Refer to page 3 in the Grow Guide.

Pro Tip: Sowing bean seeds? Make sure when you place the seed inside the BioSponge, the radicle is pointing downwards. The radicle is the small dark or white spot (depending on the variety of beans) that you will notice on each seed.

3. Watch them sprout!

It is important to keep the BioDome lid on and the vents closed after planting your seeds. Check on your seeds daily and once you see that most of the seeds have sprouted you may open both vents on the BioDome lid. Then once most of the seedlings are about one inch tall, you may remove the BioDome lid (removing the lid will most likely take place in week two). Refer to page 4 in the Grow Guide.

Check out our website at <https://solaris.garden/guides> to view quick and easy videos on how to set up the BioDome, plant seeds, and how to open the BioDome vents.

Week One Checklist

- BioDome is set up
- BioDome LED lights timer is scheduled
- Seeds are planted
- Vents on the BioDome are opened after seeds have sprouted



Light

What does LED stand for?

Light Emitting Diode

Do LEDs produce heat?

Yes, however, LEDs produce a very small amount of heat because less electricity is used for the same amount of light.

What does full spectrum mean and why is it important for plants?

Sunlight is full spectrum, as it contains all the wavelengths within the visible electromagnetic spectrum. The two most important wavelengths of light for plants to thrive are at the two opposite ends of the spectrum, blue (ultraviolet) and red (infrared). Both plants and animals require different wavelengths of light to carry out specific cell functions.

Photosynthesis

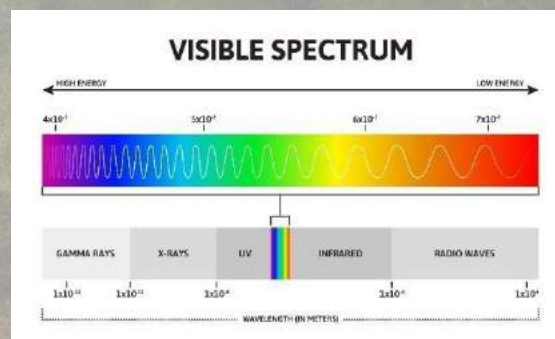
Photosynthesis is the process of turning light energy into chemical energy that can fuel the cells of plants and animals. This converted light energy is then used to carry out normal cell functions such as growth. During the process of photosynthesis plants create a byproduct, which is oxygen. This oxygen is then released into the atmosphere and breathed by us.

The Sun

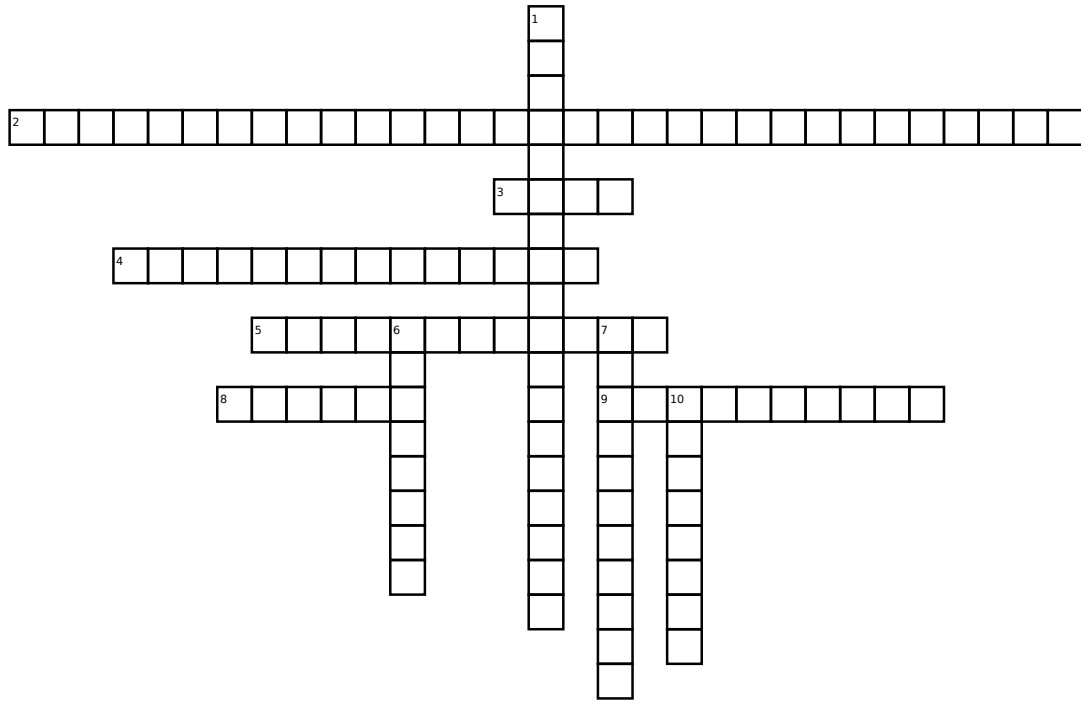
Plants absorb about 34% of the sun rays that reach them. The other percentage of light makes up the wavelengths that are too long for the plants to absorb and thus are lost to reflection or they pass right through. PPF (photosynthetic photon flux density) is the amount of light that lands on a square meter each second. The sun's PPF averages around 2,000 on a clear day, the Solaris Garden LEDs average approximately 1,600, and every day is a clear day.

Solaris Garden Vs. the Sun

There are no grow lights equivalent to the sun, but the newest generation of LEDs can simulate sunlight more effectively than ever before. Outdoor plants during a northern summer receive a maximum of 8 hours of full sun a clear day. The total amount of light received by your indoor plants is equivalent to sunlight because your timer is set to 14 hours of light a day, and it's always a clear, cloud free day in the Solaris Garden.



Light



Down:

1. this is what LED stands for
6. this source of light is naturally full spectrum
7. one of the two most important wavelengths of lights for plants to thrive and it is also shown as the color blue on the light full spectrum
10. one of the two most important wavelengths of lights for plants to thrive and it is also shown as the color red on the light full spectrum

Across:

2. this is what PPF stands for
3. a very small amount of this is produced because LED lights use less electricity than regular light bulbs
4. process of turning light energy into chemical energy that can fuel the cells of plants and animals
5. this type of light contains all wavelengths on the electromagnetic spectrum
8. this is a byproduct created by the plants during the process of photosynthesis
9. plants absorb this percentage of the sun rays that reach them

Week 2 Guide and Checklist

1. Seedling Maintenance!

During week two most of your seedlings will have sprouted and grown to about 1 inch tall, it's time to take the humidity lid off!

The styrofoam tray that holds the planting sponges your seedlings are planted in, should always be floating in water. As the seedlings start to drink up more and more water, you will need to add more pH balanced water. You can refer to page 7 in the Grow Guide if you need a refresher on how to prepare pH balanced water.

2. Set up your Solaris Garden!

It's the moment you've been waiting for! It's time to set up the Solaris Garden! Refer to pages 6-9 in the assembly guide.

Meet your new best friend, the Fertilizer Cheat Sheet. This handy cheat sheet comes laminated with your Solaris Garden included supplies. You may also refer to the one in the back of this workbook.

Important Reminder: Anytime you add water to the Solaris Garden, make sure to add the appropriate dose of fertilizers, hydrogen peroxide, and to also check and adjust the pH. Check the pH last when preparing your water, as the fertilizers and hydrogen peroxide may affect the number.

Pro Tip: When filling the Solaris Garden for the first time, a hose makes it quick and easy! If you have access to a hose, fill the top and bottom trays up (just below the drain holes) and then fill the reservoir up till about 5 inches from the top. This will be about 15 gallons and you can add the appropriate amount of fertilizer, hydrogen peroxide, and adjust the pH all within the reservoir.

3. Transfer your seedlings!

Transfer your seedlings into the Solaris Garden when they reach a height of about 1-3 inches. If needed, you can allow your seedlings to grow in the Solaris Seed Starter for up to three weeks. Choose 36 of the healthiest looking seedlings to transfer. Keep in mind you will want to plant the smaller varieties nearest the drain holes of the trays and taller varieties planted in the back or sides of the tray.

Push each planting sponge into the tray cover holes until about only $\frac{1}{2}$ of the sponge is visible. This allows the bottom of the sponge that contains the roots to be submersed into the water below. Refer to pages 11-13 in the Grow Guide.

Week 2 Guide and Checklist Continued

Check out our website at <https://solaris.garden/guides> to view quick and easy videos on how to set up the Solaris Seed Starter and plant seeds.

Week Two Checklist

Solaris Seed Starter tray is filled with pH balanced water

Solaris Garden is assembled

Solaris Garden reservoir is filled with fertilized and pH balanced water

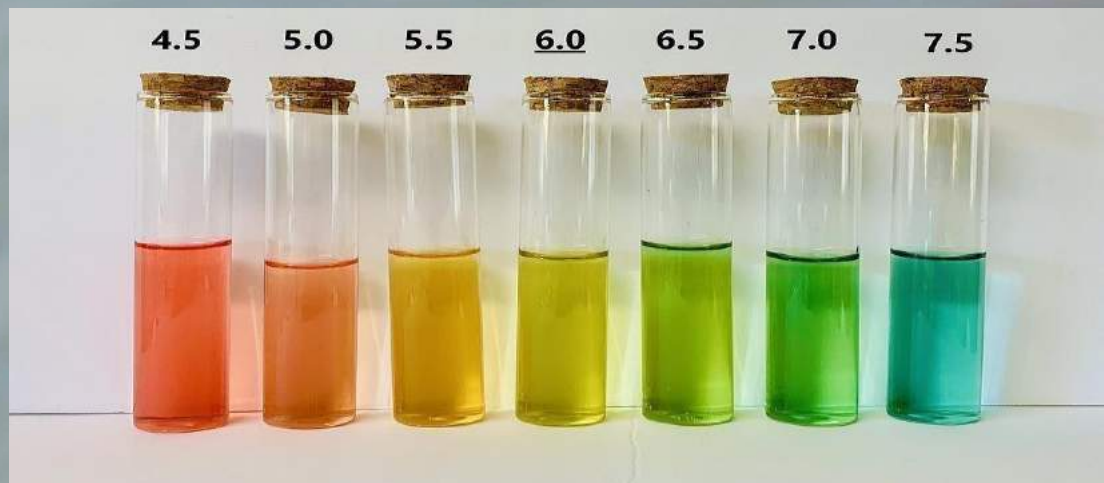
Seedlings are transferred into Solaris Garden



pH

Checking the Water's pH Level

1. Fill the small glass test tube halfway with the water you would like to check
2. Add three drops of "pH test solution" to the test tube
3. Place the lid on the test tube and shake for about 6 seconds
4. Match the color of the water now in your test tube with the provided pH scale chart
5. Determine what number pH your water is at



pH is too high, and you need to lower:

1. Add "pH down solution" to the water starting with small amounts (about 6 drops per half gallon), if adjusting a large amount of water start with half teaspoon per gallon
2. Check the pH level after adding required amount of pH down solution
3. Continue to repeat this process until you have reached the desired pH level between 5.5-6

pH is too low, and you need to raise:

1. Add half teaspoon of baking soda per gallon of water
2. Check the pH level after adding required amount of baking soda
3. Continue to repeat this process until you have reached the desired pH level between 5.5-6

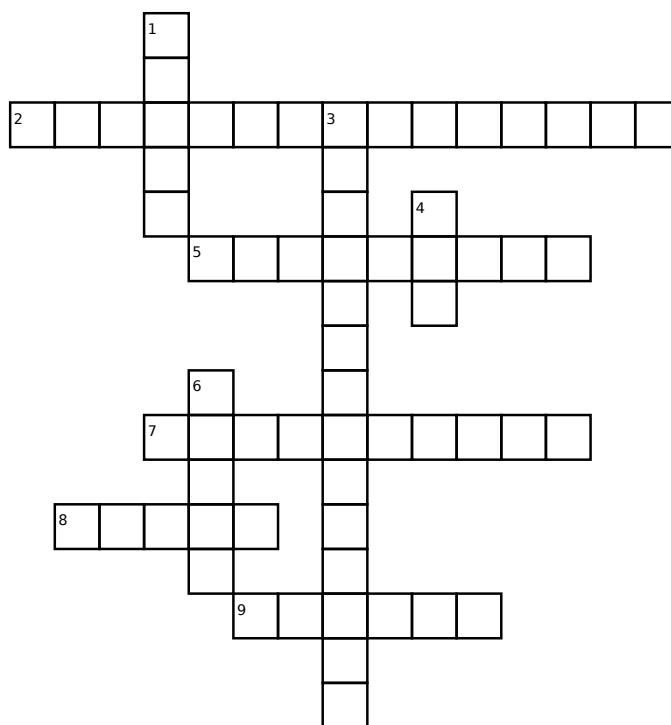
What does pH mean and why is it important to plants?

pH stands for the power of hydrogen. pH is very important to plants both growing in soil and in water because it determines and influences the availability of nutrients that are essential to a plant's growth.

What should the pH level be at for growing healthy plants?

Most plants prefer a pH between 6-7.5, however this varies between different species of plants and the nutrients they require to bloom or produce fruit. When growing plants hydroponically they prefer a pH level between 5.5-6.5 which is slightly more acidic. This is due to the medium (water) they are grown in and the roots ability to absorb the nutrients more readily.

pH



Down:

1. a pH of 7.0 will appear as this color when the water is tested
3. when growing plants this way, they prefer a pH between 5.5-6.5
4. a pH of 4.5 will appear as this color when the water is tested
6. growing plants in _____ makes it easier for the plants to absorb nutrients

Across:

2. this is what pH stands for
5. pH determines and influences the availability of _____ that are essential to a plant's growth
7. add this to your water if your pH is too low and you need to raise it
8. number of drops added to test tube to check pH value
9. a pH of 6.0 will appear as this color when the water is tested

Week 3 Guide and Checklist

1. Sit back, relax, and enjoy!

During week three your plants will begin to grow much faster and will start to develop more mature leaves, deeper coloration, and branching if applicable.

Important Reminder: If only growing lettuces, turn the Solaris Garden LED lights down to 80% strength. There is a small black dial on the front of the lights. This also applies to other light sensitive plants such as cabbage. Anytime you notice your plants developing yellow or brown spots, turn the light intensity down.

2. Time to top off the Reservoir!

By the end of week three your plants will have used up a couple gallons of water. Always maintain at least 1-2 inches of water above the pump. Sliding the reservoir lid to the side and checking the water level a couple times a week is best. Make sure to only add prepared water anytime you are topping off or filling the reservoir. Refer to the included Fertilizer Cheat Sheet or page 5-10 in the Grow Guide.

Prepared Water = Water that has been properly mixed with fertilizers, hydrogen peroxide, and is pH balanced.

3. Add the weekly dose of H₂O₂ to reservoir and check its pH!

This step is to be done weekly, before topping off your reservoir (if applicable). Use the included Fertilizer Cheat sheet to determine the amount of hydrogen peroxide to add to the reservoir. Then use the included pH test kit to check the pH level of the water in the reservoir (should be between 5.5-6.5). Then if needed, adjust the water pH with the included pH down solution. Refer to pages 5-10 in the Grow Guide.

Check out our website at <https://solaris.garden/guides> to view quick and easy videos on mixing prepared water and checking the pH.

(continued on next page)

Week 3 Guide and Checklist Continued

Week Three Checklist

- Reservoir topped off with prepared water*
- Weekly dose of hydrogen peroxide added to the reservoir*
- Check the pH of the water in the reservoir and adjust to maintain pH of 5.5-6.5*



Fertilizers and Nutrients

What do the numbers on fertilizer mean?

You will often see three numbers separated by dashes on all fertilizer packages (#- #-#). These numbers represent the percentage, by weight, of the three macro nutrients as they are found in that container.

These three numbers almost always represent the same three macro nutrients including Nitrogen, Phosphorus, and Potassium.

Depending on what plant you are growing, you will want to choose the appropriate fertilizer. The blends we use cover a wide variety of plants and give them everything they need to thrive.

FloraGro: 2-1-6

FloraMicro: 5-0-1

FloraBloom: 0-5-4

Nitrogen

Bacteria and archaea (single celled organisms) provide nitrogen to the soil which is then absorbed by the roots of plants. In hydroponic gardening there is no soil to house the bacteria and archaea, so we must supply the plants with a different source of nitrogen. Nitrogen, absorbed up by the roots, is then combined with amino acids, the building blocks of protein. The plant then uses these proteins to carry out cell functions and to have energy to grow.

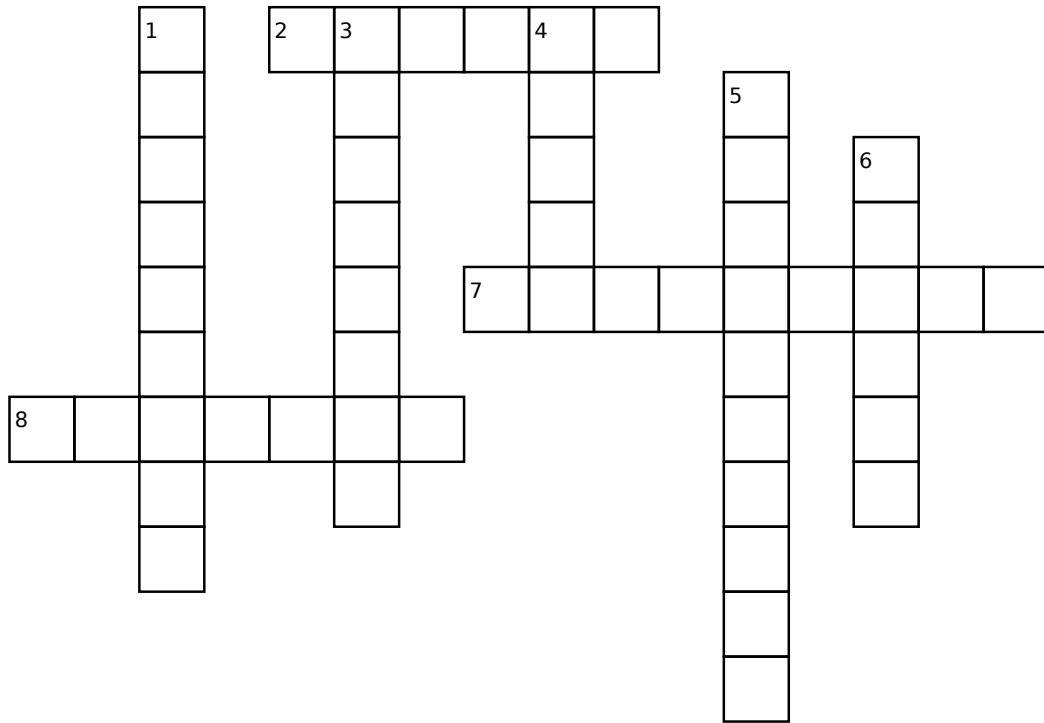
Phosphorus

Phosphorus is a mineral found naturally in bones, sedimentary rock, and throughout the soil from many other different sources. Plants need phosphorus to carry out a large variety of functions including photosynthesis, energy storage and transfer, and to breath. It also helps the plants maintain and repair their cells and tissues. Just like humans, plants also have a unique DNA per plant, and phosphorus helps form these special genetic building blocks.

Potassium

Plants absorb potassium that has been dissolved in water by using their roots in the soil. Natural sources of potassium include wood ash, feldspar (type of rock), and mica. Adding banana peels and coffee grounds to your compost also helps to provide plants with a source of potassium. By providing your plants with a good source of potassium, it allows them to easily distribute water, carbohydrates, and nutrients throughout their tissue. Its also plays a role in enzyme activation and aids with fruiting and flowering.

Fertilizers and Nutrients



Down:

1. nitrogen absorbed up by the roots is then combined with _____, the building blocks of protein
3. bacteria and archaea provide this to the soil which is then absorbed by the roots of the plants
4. this group of nutrients includes Nitrogen, Phosphorus, and Potassium
5. a mineral found naturally in bones, sedimentary rock, and throughout the soil from many other different sources
6. the three numbers on fertilizers represent the percentage of macro nutrients by _____ that is present in the container

Across:

2. potassium plays a role in _____ activation and helps with fruiting and flowering
7. natural sources of this element include wood ash, feldspar, mica, and bananas
8. single celled organisms

Week 4 Guide and Checklist

1. Another round of seedlings anyone?

After transferring your previous seedlings into the Solaris Garden, you can start another fresh batch of seeds in the Solaris Seed Starter. To maintain a successive harvesting routine, repeat this process.

2. Guardian of the garden!

Just a couple reminders for week 4:

- Add weekly dose of hydrogen peroxide to reservoir
- Check the pH of the water in the reservoir and adjust to maintain pH of 5.5-6.5
- Check the reservoir water level and fill with prepared water

Pro Tip: Choose your favorite day of the week. Then make this the day you conduct your weekly hydroponic maintenance. Besides checking the water level every couple days, all other maintenance can be done once a week.

3. Have you ever trimmed roots?

The drain hole located on the right of your top tray and on the left of your bottom tray will need to stay clear from roots to drain properly. About once a week, lift the lid of your trays slightly and trim away any roots that may be venturing into the drain! Along with trimming the roots, depending on what variety of plants you're growing, you may also want to trim any leaves or stems that are venturing beyond the frame of the Solaris Garden.

Week Four Checklist

*Fresh batch of seeds planted in the Solaris Seed Starter
Reservoir has at least 1-2 inches of water above the pump
Weekly dose of hydrogen peroxide has been added to reservoir
Roots, leaves, and stem trimming has been done if necessary*



Pollination

What are the three types of pollination?

Insects

We have all seen the bees buzzing around from flower to flower, butterflies drinking the sweet flower nectar, and beetles buried deep inside the center of a blossom. Insects pollinate flowers by carrying the individual granules of pollen that get stuck to them while feeding, to different plants, helping disperse the pollen between male and female plants.

Wind

As the wind blows, it takes with it the individual granules of pollen. It takes them on a journey to another plant near and far.

Self

Some plants contain all they need to pollinate their very own flowers. They rely on the production of both male and female flowers to ensure their success.

What is pollen and where does it come from?

Pollen is a tiny powdery microscopic grain that carries a plant's DNA. It is released by the male part of the flower and will travel to the female part of a flower to fertilize the female ovule of the plant.

What is pollination?

Pollination is when pollen grains from the male anther of a flower are transferred either by insects, wind, or self, to the female stigma of a flower.

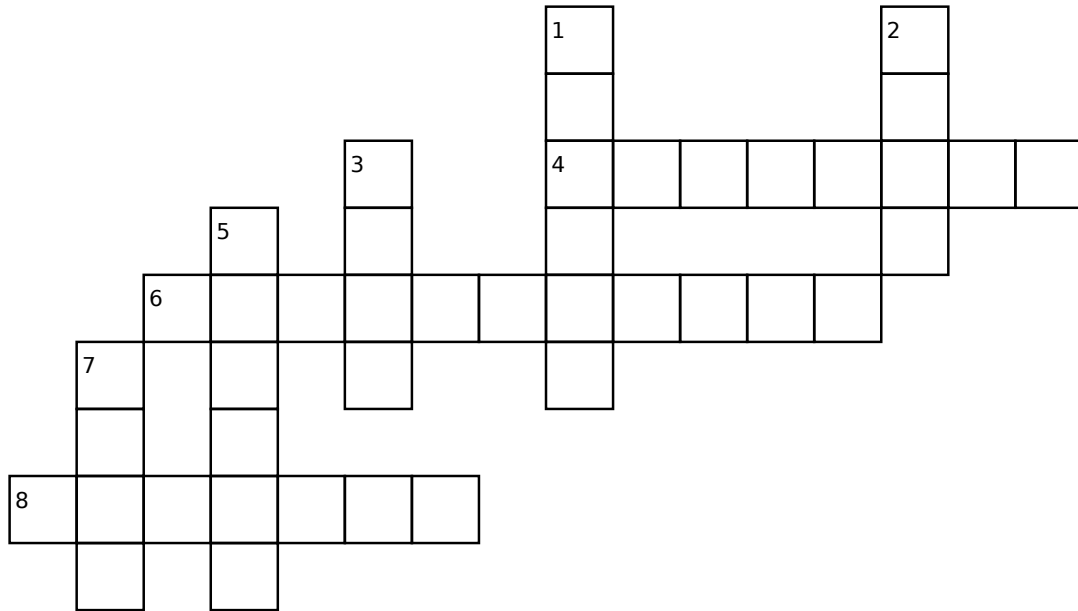
Why do different plants use different methods of pollination?

This all depends on location and the resources available. Plants have adapted very well over millions of years to play to their best advantage. Some plants producing sweet smelling or nectar rich flowers know that insects can't resist and will carry their pollen from flower to flower unknowingly.

Plants that may live in a more open or windy environment have adapted to having a flower that allows the wind to carry their pollen near and far. This type of plant that relies on wind pollination may also have tiny pollen granules that make it easy for the wind to carry them.

Self-pollination occurs when a plant can produce both male and female flowers on the same plant or what is called a "complete" flower. Complete flowers have both a female stigma and a male anther for fertilization.

Pollination



Down:

1. sweet smelling liquid flowers produce to attract insects
2. this insect is especially known for pollination and is the largest group of insects to do so
3. this type of pollination is done by the plant itself because they already have everything they need to pollinate their own flowers
5. a tiny powdery microscopic grain that carries a plants DNA
7. this type of pollination carries pollen through the air to different plants

Across:

4. type of flower that have both a female stigma and a male anther for fertilization
6. the transfer of pollen grains from the male anther of a flower to the female stigma of a flower
8. they pollinate flowers by carrying the individual granules of pollen that get stuck to them while feeding

Week 5 Guide and Checklist

1. Same as week four, only your plants are bigger!

Once you get the hang of things, it becomes easier and easier. You will get into the habit of checking on your green beauties and knowing exactly what they need. Whether it be a water top off, adding hydrogen peroxide, or a little trimming, it becomes second nature caring for your plants! Refer to week four's guide page.

Week Five Checklist

Reservoir has at least 1-2 inches of water above the pump

Weekly dose of hydrogen peroxide has been added to the reservoir

Roots, leaves, and stem trimming has been done if necessary



Harvest

Types of Harvest

Continual Harvest

Some plants can be harvested multiple times, such as many lettuces and herbs. They can grow back again and again as long as you leave the crown, or base, of the plant intact. Be sure to take the outer most leaves or most mature leaves off first, leaving the youngest or center most leaves to continue growing.

Full Harvest

This is when you remove the whole plant, such as a head of cabbage. When fully harvesting a plant, it is best to keep the roots intact, as this will keep it fresh in the fridge for up to two weeks.

Crop Harvest

When growing vegetables or fruits, you may harvest a couple of times, leaving the plant intact and only collecting the crop until the plant stops producing.



Green Beans make a great crop to grow in the Solaris Garden, as they are prolific producers. With only five bean plants, you can harvest over 200 green beans! Once they start producing beans, you can check in everyday to harvest the ones that are ready. This is a great example of a crop harvest plant.



Kohlrabi is a plant that allows for a continual harvest of the leaves as you let the vegetable continue to develop. Then when the kohlrabi bulb is about the size of a small apple you can fully harvest the plant.

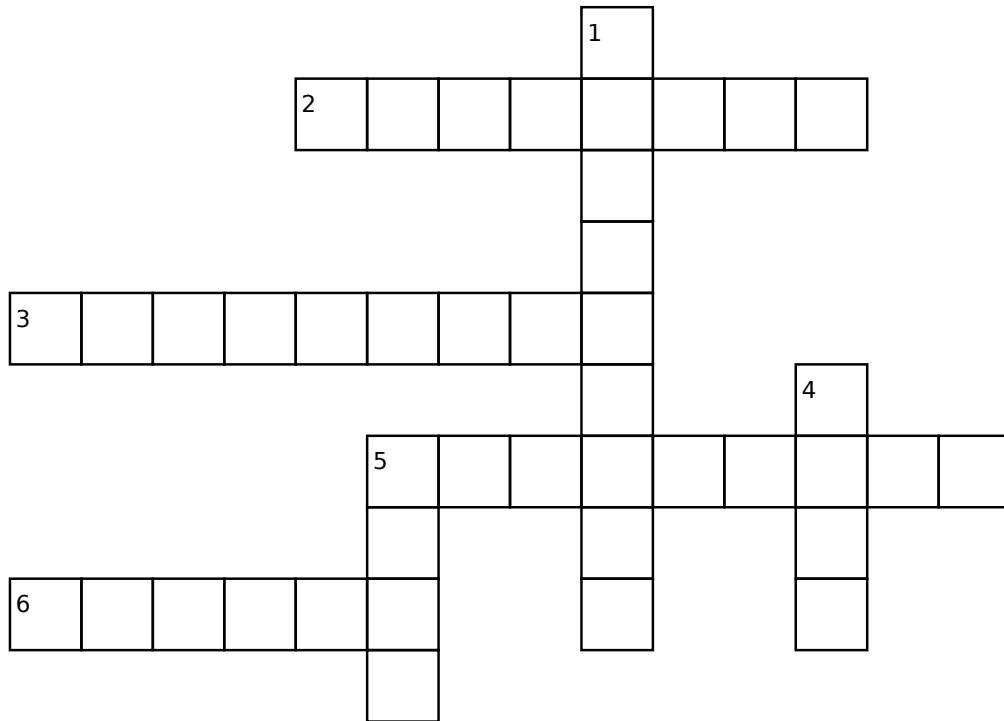


Genovese Basil is an herb that grows exceptionally well in the Solaris Garden, as do most herbs. You can keep your basil growing for many months as you continue to harvest the leaves. You may also take your basil out of the Solaris Garden and transplant it outside.



Green Star Lettuce takes just less than a month from seed to being harvest ready. You can do a full harvest keeping the roots intact or a partial harvest, eating the outer leaves along the way.

Harvest



Down:

1. this type of lettuce can be ready to harvest in as little as 30 days when planted from seed
4. this type of harvest includes using up the entire plant and even taking out the roots from the growing media
5. this type of harvest is used when growing fruits and vegetables

Across:

2. this type of vegetable plant grows a bulb that reaches the size of an apple, and the leaves are also edible
3. this vegetable plant is a prolific grower and can be checked daily for new ready to pic vegetables
5. with this type of harvesting method you can eat from the same plant multiple times, as the plant will continue to grow back when you harvest the mature or outer leaves first
6. this type of fruit plant can live up to a year and provide over 300 fruits

Week 6 Guide and Checklist

1. It's harvesting time!

That moment you've been patiently waiting for has finally arrived! Grab your sheers and get ready to harvest. Your kind dedication and care will be much rewarded!

As mentioned in the Harvest worksheet, there are a couple of ways to go about harvesting. Perhaps you've been nibbling on lettuce leaves since week four or maybe you've been picking bush beans everyday for the past week, whatever the case, it's probably time for a full harvest. However, please note, not all plants will be ready for a full harvest in six weeks. Fruiting plants such as tomatoes and peppers will need longer than 6 weeks.

2. Cleaning up after a harvest!

After your plants are harvested, remove any leftover roots or debris from both trays, wipe down the tray covers with Simple Green and clean the pump filter. Fill up the reservoir with prepared water and you're ready for another round of plants! Refer to pages 14-15 in the Grow Guide.

Check out our website at <https://solaris.garden/guides> to view quick and easy videos on how to maintain and clean the Solaris Garden in between crops.

Week Six Checklist

All plants are harvested

Roots and any leftover plant debris removed from plant trays

Pump filter cleaned

Reservoir filled with prepared water if preparing for another round of plants



Compare the benefits of Hydroponic Gardening and Traditional Outdoor Gardening

Hydroponic Gardening

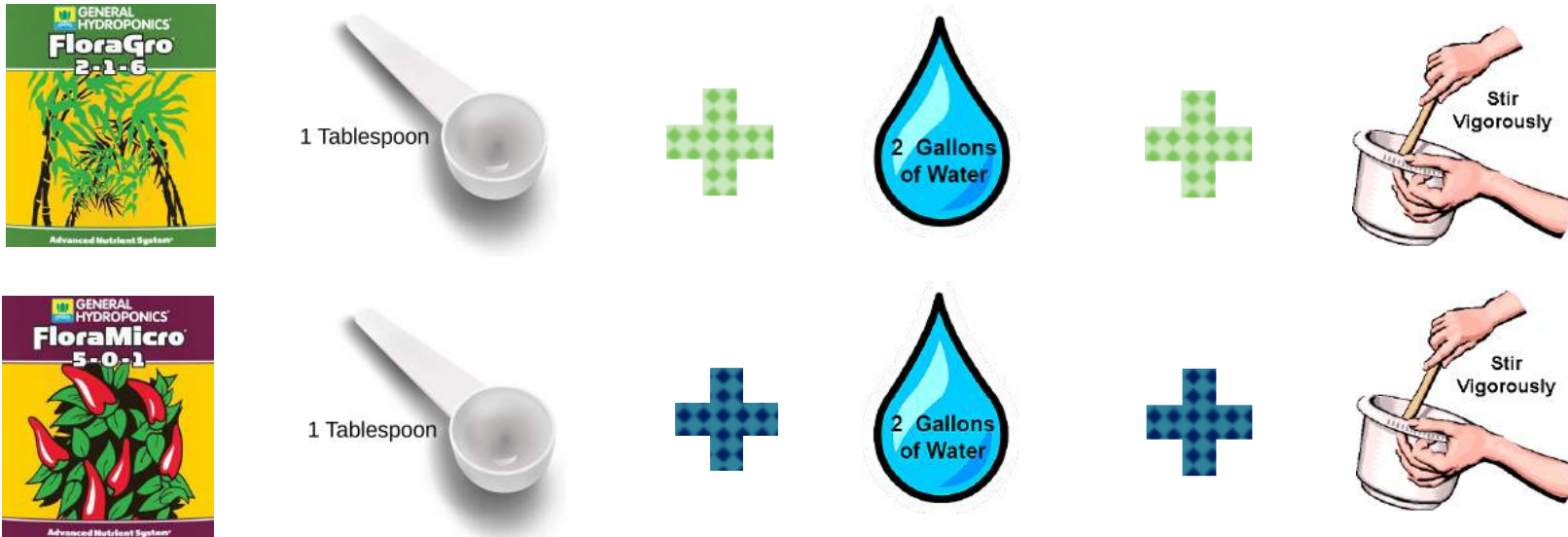
Outdoor Gardening

Benefits Word Bank – Write the number of each benefit in the correct category, either hydroponic gardening, outdoor gardening, or both. Check them off as you go!

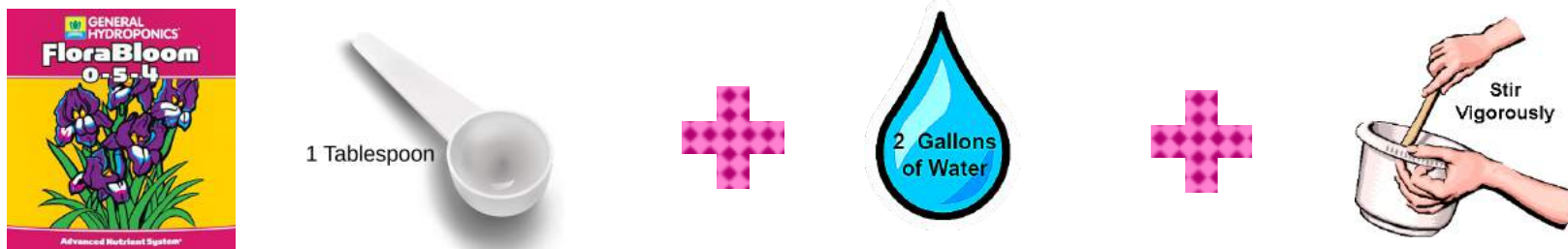
- 1. Much less water consumption
- 2. Low risk of plant diseases and fungus
- 3. No electricity used
- 4. Grow your own food
- 5. Customizable growing conditions
- 6. You can grow plants from seed
- 7. Spend time in nature
- 8. Natural pollination from insects
- 9. Plants need light, water, and nutrients to grow
- 10. Year- round growing season
- 11. No water run off
- 12. No insect pest
- 13. Earthworms convert organic matter into nutrients
- 14. Higher absorption rate of added nutrients
- 15. No plant size limit for what you can grow
- 16. Quicker growth rates
- 17. Less space needed per plant

(1) Fertilizer

Always use the FloraGro and FloraMicro liquid fertilizers, mixed in *one at a time*¹ with the following ratios:



When your plants begin to flower, and all throughout fruiting, also add FloraBloom with the same ratio:



¹ **DO NOT** add the FloraGro and FloraMicro fertilizer together undiluted. Add one tablespoon of FloraGro to two gallons of water and stir. Once diluted, add one tablespoon of FloraMicro and stir. Continue to repeat the process if adding FloraBloom.

(2) Hydrogen Peroxide 3%

Every 5-7 days, measure the depth of water in the reservoir, and add the amount of Hydrogen Peroxide as indicated in the chart. The ratio is 1 tablespoon per gallon of water.

Pro Tip: When filling the Solaris Garden for the first time, you can fill the reservoir with water just below the input/output holes and then add 1/2 cup of each fertilizer (mixing well in between) and then add a cup of hydrogen peroxide.

Water Depth	3% Hydrogen Peroxide to add Weekly	
	Tablespoons	Cups
10	25	
9	24	1½
8	22	
7	20	1¼
6	19	
5	18	

(3) pH Balance to between 5.5 - 6.5

Do this step to the newly added water, and once a week to the water in the reservoir.



Thank You

Dear fellow gardener,

*To download a PDF version of the Solaris Garden Lesson Plans, please
visit our website at <https://solaris.garden/video-print-guides>*

Contact us at support@solaris.garden if you have any questions.

Sincerely,

Solaris Systems



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