Hydroponics Systems
User Guide

The Plant Lab and Plant Producer Educational Hydroponics Systems allow you to grow production-level quantities of greens while addressing key plant science, STEM, and sustainability efforts.

To access your curriculum, visit:

https://www.realityworks.com/hydroponics-downloads

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Introduction to Hydroponics Educational Systems

Each system comes with curricula and slide presentations to teach students more about what hydroponics is. The curriculum addresses growing produce as well as accessory kit materials and a user guide to begin growing right away. Use them to engage more students in agriculture programs, incorporate STEM concepts into your curriculum, and teach relevant, in-demand skills that modern agriculture careers require.

Plant Lab includes:

- 33 plant sites
- LED grow lights
- Fans
- Water pump
- 2-gallon water tank/shelf (qty 3)
- Reusable grow cups
- Germination tray, seeds, and rockwool
- 1-year limited warranty

Plant Producer includes:

- System control panel with sensor monitoring
- 42 plant sites
- LED grow lights
- Fans
- Water pump
- 7-gallon water tank
- Reusable grow cups
- Germination tray, seeds, and rockwool
- 1-year limited warranty

Additional Resources:

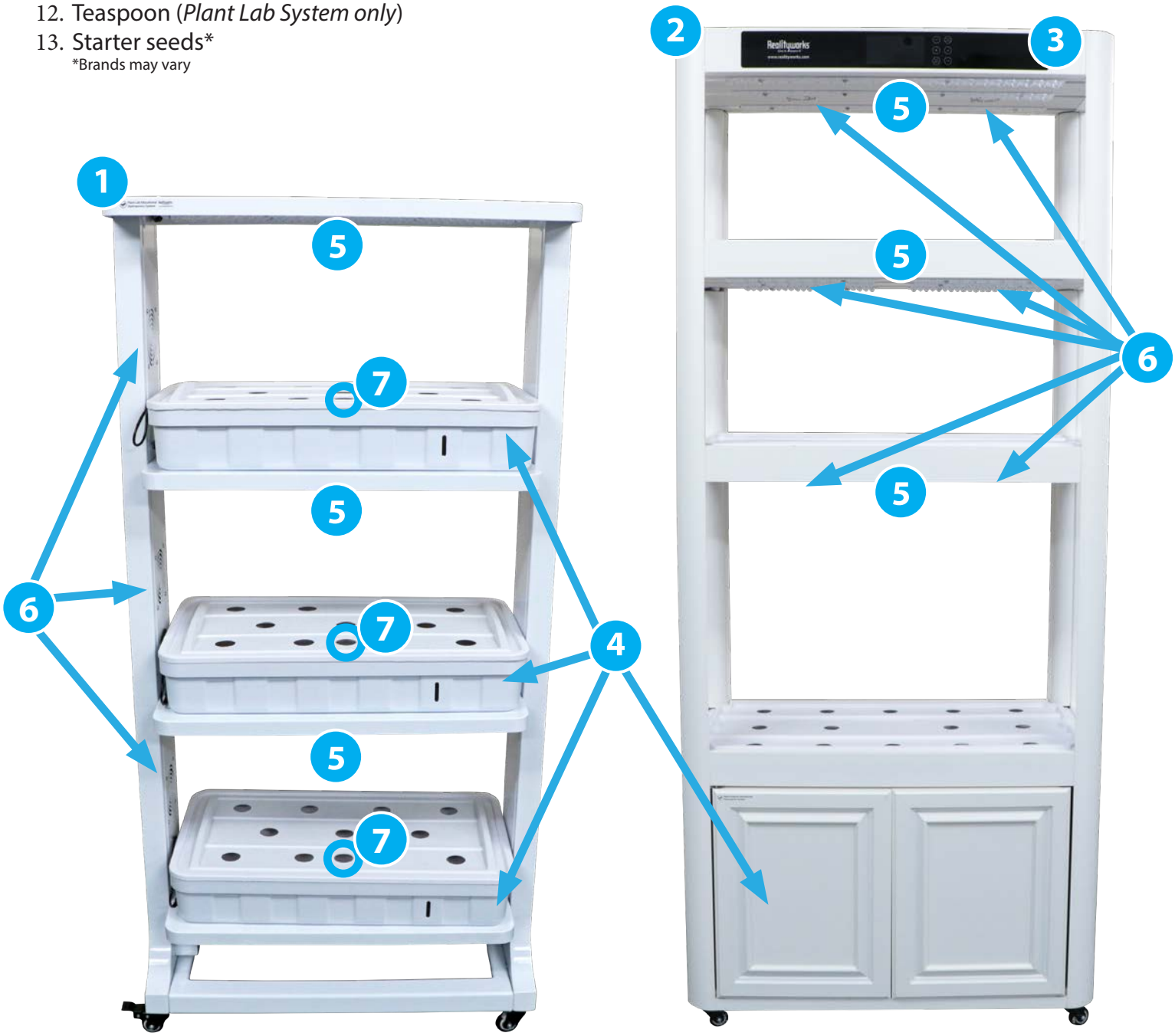
www.realityworks.com/hydroponics-downloads

1. User Guide
2. Curriculum
3. Product Support tutorials and documents

Parts identification

1. Plant Lab Educational Hydroponics System
2. Plant Producer Educational Hydroponics System
3. System control panel
4. Water tank
5. Lights
6. Fans
7. Water and nutrient access hole
8. Germination tray
9. Humidity dome
10. Rockwool
11. Reusable grow cups
12. Teaspoon (*Plant Lab System only*)
13. Starter seeds*

*Brands may vary



Assembly Instructions

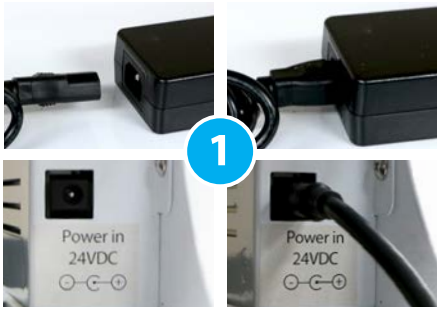
Unboxing

1. Use a box cutter, cutting on the corner from the top and down to the bottom on opposite corners to remove the box from the unit.
2. Use a two-person lift to move the unit out of the box.
3. Use the wheels of the unit for movement once it is removed from the packaging.
4. Remove the plastic protective film.
5. Make sure the hydroponics system is on a level surface.

Plugging in the Unit

Plant Lab System

1. Assemble the power cord by plugging the cord into the power brick, then plug the other end into the system. The outlet is located on the back of the unit, near the power switches.
2. Plug the power cable into a electrical wall outlet.
3. Use the suction cups on the back of the pump to secure it to the inset in the bottom of the tray.



4. Plug the pump power cord into the corresponding power cable on the shelf.

Plant Producer System

1. Assemble the power cord by plugging the cord into the power brick, then plug the other end into the system. The outlet is located on the back of the unit, below the bottom shelf.
2. Plug the power cable into a electrical wall outlet.

3. Make sure the pump is in the fully-open position as shown

4. Use the suction cups on the back of the pump to secure it to the bottom of the tray.

Accessory Kit

A starter kit is included to start planting right away. This is a sample of the products that can be sourced after initial usage from many different retail and online stores.

- 1 pack of starter seeds
- Rockwool
- Germination tray with humidity dome for seed development

Water

1. Fill each of the tanks to the appropriate capacity.
   - Plant Lab System: fill each of the three tanks with 2 gallons of water
   - Plant Producer System: fill the tank with 7 gallons of water
2. Add the nutrients (see **Step 4**, page 9, for more details) and let the water circulate for 24 hours. This will allow the water to reach room temperature and will leach any chlorine out of the water.
   - Plant Lab System: use teaspoon to fill system with nutrients through the water and nutrient access hole, then place spoon over hole to prevent algae growth

3. Turn the system on.
   - Plant Lab System: flip the power switch on the lower left-hand side of the unit
   - Plant Producer System: flip the power switch on the upper right-hand side of the unit

4. Add water regularly to prevent water levels from dropping too low, letting water sit for 24 hours prior to adding to the tank as noted in the above step.
5. Units will beep once every 50 minutes when the water levels drop too low.
   - Plant Lab System: beeping begins when the water levels drop to 0.5-1 gallon in the 2-gallon tanks
   - Plant Producer System: beeping begins when the water level drops to 2-3 gallons in the 7-gallon tank

Standard Settings

Water Pumps

The water pumps circulate the water so that vital nutrients can move to the plant roots.

Plant Lab System:
- Water pumps run on a 50-minute schedule that begins when the water pump is first turned on
- Each water pump follows this schedule: 20 minutes on, 30 minutes off

Plant Producer System:
- The water pump runs on a 50-minute schedule that begins when the water pump is first turned on
- The water pump circulates through all three shelves and follows this schedule: 20 minutes on, 30 minutes off

Lights

The LED light array mimics sunlight (including the red-and-blue light spectrum) to help the plants grow.

- Plant Lab (PL) System
  - The lights run on a 24-hour schedule that begins when they are turned on: 10 hours on, 14 hours off.
  - Use the LED power switch next to the standard power switch to turn the lights on.

- Plant Producer System: the lights run on a 24-hour schedule based on the selected settings:

Light Settings	Lights ON	Lights OFF
Slow Growth	8 hours	16 hours
Normal Growth	10 hours	14 hours
Fast Growth	12 hours	12 hours

  - The grow light start time can be changed by pressing the grow light button until it beeps, then pressing + or - to adjust
  - Press the grow light button again to advance to the next hour/min digit
  - The grow light stop time cannot be changed; it runs for 8, 10, or 12 hours from the start time depending on the growth setting (see **Grow Screen Instructions**, page 7, for more details)

Fans

The fans help strengthen and reduce injury and disease to the plants. They always run at a consistent speed.
- Plant Lab System: the fans follow the pump schedule (20 minutes on, 30 minutes off)
- Plant Producer System: the fans follow the set light schedule

Grow Screen Instructions (Plant Producer System Only)

- **DISPLAY:** Display is automatically on when the lights are in AUTO mode. Press any button for 3 seconds to turn the display on when the lights are off.
- **TIME:** Change the clock to the correct time by pressing time for 3 seconds and using the **+** or **-** to adjust each digit. Press time to change between digits until all are set to the correct time.
- **TEMP:** Shows the current temperature of the room where the system is located.
- **GROW SETTING:** Choose from Fast Growth, Normal Growth, and Slow Growth by pressing the Grow Setting button (**Lights,** page 6, for more information).
- **GROW LIGHT:** Press the Grow Light button to adjust which shelves are lit. Shelf lights will rotate in the following order:
  - All three shelf lights on without auto next to icon on screen
  - All lights are off, display is off and can be viewed by pressing any button for 3-5 seconds
  - All shelves lit with auto icon on screen
  - Bottom shelf lights on, middle and top shelves off
  - Top and middle shelf lights on, bottom shelf off
  - Top and bottom shelf lights on, middle shelf off
  - Top shelf lights on, bottom and middles shelves off
- **FANS:** turn the fans off and on; cannot change the speed of the fans.
- **WATER FLOW ICON:** spins when the pump is running.
- **GROW LIGHT ICON:** reflects which shelves are turned on. Will state AUTO when it is on the growth setting schedule.
- **WATER LEVEL ICON:** flashes when reservoir is low.
- **FANS ICON:** spins when the fans are on and stops when they are off.

To perform a factory reset, press the + and - buttons together for 5 seconds and listen for it to beep.

Guide to Growing Plants

There are many ways to grow plants using hydroponics systems and many different variables to consider. This guide is a recommendation of an 8-step process to prepare and use the hydroponics system. Read through all 8 steps prior to starting the growing process.

Step 1: Prep and Growth Understanding

- Plan on what plants to grow based on the goals of the program. Some recommendations are cabbage, cucumber, green beans, kale, leaks, lettuce, radishes, swiss chard, and tomatoes
- Below is a sampling of seed companies that offer online ordering and direct shipping of seeds. Larger retailers like amazon.com, homedepot.com, walmart.com and other chain stores are also available. Local, regional, or national seed suppliers are also resources for seeds.

1. Johnny's Selected Seeds Winslow, ME www.johnnyseeds.com
2. Seed Savers Exchange Decorah, IA www.seedsavers.org
3. Baker Creek Heirloom Seeds Mansfield, MO www.rareseeds.com
4. Burpee Seeds and Plants Warminster, PA www.burpee.com
5. Territorial Seed Company Cottage Grove, OR www.territorialseed.com
6. Seeds of Change Rancho Dominguez, CA www.seedsofchange.com
7. Ferry-Morse Seed Company Fulton, KY www.ferrymorse.com

8. Southern Exposure Seed Exchange Mineral, VA www.southernexposure.com
9. High Mowing Organic Seeds Wolcott, VT www.highmowingseeds.com
10. Fedco Seeds Waterville, ME www.fedcoseeds.com
11. Nichols Garden Nursery Albany, OR www.nicholsgardennursery.com
12. Botanical Interests Broomfield, CO www.botanicalinterests.com
13. Renee's Garden Seeds Felton, CA www.reneesgarden.com
14. Peaceful Valley Farm & Garden Supply Grass Valley, CA www.groworganic.com

- Nutrients need to be purchased prior to growing plants. There are many different nutrient types that can be purchased. Recommended options are detailed below:
  - General Hydroponics Floraduo A & B Fertilizer – 1 quart MFG recommendations:

Type of Growth	Floraduo A	Floraduo B
Mild Grow Blend	2 tsp/gallon of water	1 tsp/gallon of water
Strong Grow Blend	3 tsp/gallon of water	1 tsp/gallon of water
Transitional Grow Blend	2 tsp/gallon of water	2 tsp/gallon of water
Mild Bloom Blend	1 tsp/gallon of water	2 tsp/gallon of water
Strong Bloom Blend	1 tsp/gallon of water	3 tsp/gallon of water

  - General Hydroponics Flora Bloom Fertilizer – 1 Quart MFG recommendations:
    - Maintain pH at 5.5 - 6.5
    - Measure accurately

Type of Growth	FloraGro	FloraMicro	FloraBloom
Seedlings/cuttings	¼ tsp/gallon of water	¼ tsp/gallon of water	¼ tsp/gallon of water
Mild Growth	1 tsp/gallon of water	1 tsp/gallon of water	1 tsp/gallon of water
Aggressive Growth	3 tsp/gallon of water	3 tsp/gallon of water	3 tsp/gallon of water
Transition to Bloom	2 tsp/gallon of water	2 tsp/gallon of water	2 tsp/gallon of water
Blooming/Ripening	1 tsp/gallon of water	1 tsp/gallon of water	1 tsp/gallon of water

- Be aware of the average germination times for plants. Start the germination tray, then set up the hydroponics system while the seeds are germinating. Below is a list of average timelines for growth of popular plants.

Planting and Harvesting Cheat Sheet			
Plant	**Direct Light Needed**	**Germination**	**Days to Maturation**
Cabbages	Yes	4-10	65-85
Cucumbers		6-10	55-65
Green Beans		7-14	80-100
Kale	Yes	3-10	55-80
Leeks	Yes	7-12	80-90
Lettuce	Yes	4-10	35-65
Radishes	Yes	3-10	50-60
Swiss Chard	Yes	7-10	55-65
Tomatoes		6-14	55-90

BEFORE HARVEST: Start growing new seeds 7-10 days before harvesting the plants in the hydroponics system. This will allow movement of new plants from the germination tray directly to the hydroponics system without many or any days between harvest and new growth.

Step 2: Germination Tray and Rockwool

Once seeds are chosen, it is important to make sure there is time to start the plants in a germination tray before moving them into the hydroponics system. The germination tray includes the following: germination tray, humidity dome, a package of rockwool, and a package of lettuce.

Rockwool is a natural fiber made from basalt and chalk and heated to a high temperature. It is then spun in a chamber to create fibers, much like how cotton candy is made. Chalk is naturally high in pH and it is important to soak the rockwool in water to lower its pH level.

- Prepare the rockwool:
  1. Match the number of rockwool pieces with the number of seeds being planted.
  2. Soak the rockwool in water for 15-20 minutes, then drain the water from it for 1-2 minutes.
  3. Place the rockwool into the germination tray.
  4. Put one seed into the small divot of each rockwool piece.
  5. Place the germination humidity dome onto the germination tray.
  6. Put the germination tray in a location that has sunlight like a sunlit windowsill or the hydroponics system with the grow lights on.
  7. Check daily and use a water mister to spray the rockwool when it looks dried out.
  8. Check standard germination time for the seeds being used.
- See **Step 5** (page 10) for more information on seed planting
- Reusing rockwool:
  1. Rockwool can often be reused 2-3 times if cleaned properly.
  2. Wash off the rockwool in a sink after the plant has been removed and remove any roots or algae that may have formed from the nutrients and moisture.
  3. Do not squeeze the cubes of rockwool when wet. If you need to remove some of the water from the cubes, simply shake them gently. If squeezed, the rockwool will compress which would hinder the benefits of water holding capacity and oxygen movement.

  NOTE: Rockwool will not break down in a landfill. Rather than throwing rockwool away, it's recommended to break it up into pieces and work it into your garden or potting soil to help increase water retention.

Step 3: Preparing the Hydroponics System

It is important that the following steps are completed in order when first opening the hydroponics system:

1. Make sure the hydroponics system is on a level surface.
2. Prepare the hydroponics system at least 2-3 days before adding plants to the system.
3. Plug the system in (please reread **Plugging in The Unit**, page 5)
4. Add water and nutrients to the tank(s), and let the water circulate for 24 hours before adding plants.
5. Inspect around the system for any leaks, as unforeseen damage may occur from shipping.

NOTE: The Plant Producer Hydroponics System tank holds 7 gallons (56 pounds) of water. Do not lift the full tank when filling and removing water. Before removing the tank, disconnect the water float and remove the pump from the reservoir. Remove the water with a pitcher or pump. Once it is to a weight that is movable by a dolly or a cart, lift the tank using proper lifting technique.

Step 4: Nutrients

Mix nutrients into the water reservoir at least 24 hours before adding plants to the hydroponics system. Water should be checked for pH and for EC (Electrical Conductivity). EC measures the potential for electrical current to be transported by water. It is measured in Seimens (S) and allows nutrients to move to plants more easily.

Test these two variables by using meters that can be purchased online or at a hydroponics store. These are the general recommended levels for the EC and pH when testing the water:

pH

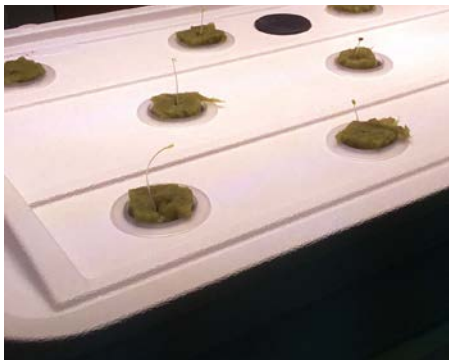
- LOW pH: If the pH is below the level needed by the plant, it is time to add new water into the system. Please reread the **Water** section (pg 5) before adding any new water.
- HIGH pH: If the pH is above the level needed by the plant, add nutrients to raise the acidic levels of the water. Nutrients are acidic, so it is a good solution to bring the water back down within the recommended range. If EC is also high, the tank should be drained and filled with fresh water and nutrients.

EC

- LOW EC: If the EC is low, the plants have consumed the nutrients in the water and more nutrients should be added to the tank.
- HIGH EC: If the EC is high, too many nutrients were added and more water needs to be added to the tank.

The next page has a reference chart to help with a more exact recommendation for many different types of hydroponic plants. For all nutrients, the manufacturing company is the best reference for pH recommendation and the amount of the nutrients to use. Check both pH and EC together.

EC and pH Values for Different Hydroponic Crops		
Plant	**pH Range**	**EC (uS)**
Cabbages	6.5-7.5	2500-3000
Cucumbers	6.0-7.0	1700-2500
Green Beans	5.5-6.0	2000-4000
Kale	6.0-7.5	800-1800
Leeks	6.0-6.8	1400-1800
Lettuce	6.0-6.5	800-1200
Radishes	6.0-7.0	1600-2200
Swiss Chard	6.2-6.8	1800-2300
Tomatoes	5.5-6.5	2000-5000



Step 5: Seed Planting

When the roots of the germinating seed begin to emerge from the bottom of the rockwool, it is time to move the germinated seeds to the hydroponics unit. Germination should begin to happen about 3-4 days after the seeds are planted in the rockwool. Wait about 4 more days until the roots emerge from the bottom of the rockwool before moving plants to the hydroponic trays. Place one rockwool piece into each grow cup.

Try and put the roots near or through the grow cups when placing the rockwool and plant into the cups. This will help the roots access the water more easily once in the hydroponics system.

Step 6: Checking Levels

Once all plants are in the hydroponic grow cups, it is necessary monitor the growth of the plants and check the levels of the water and nutrients. Water levels will begin to decrease as water evaporates. As the plants grow, they will consume increasing amounts of water and nutrients.

There are some recommendations to follow:

Type of Growth	Growth Description	Level Check Timing
Early Growth	Plant is just placed into the hydroponics system	1-2 times per week
Late Growth	Plants are growing but not quite to harvest	2-3 times per week
Harvest	Plants are ready to harvest or will be within a week's time	3-4 times per week

It is important to check on the plants periodically to ensure that they are growing as expected. Monitoring and checking on the plants in a systematic format (record-keeping or journaling) will help to keep optimal growth.

The following is a recommended schedule per tank being used:

Water Levels

- 2 times a week with under half of the plant spots being used
- 3 times a week with over half of the plant spots being used

EC and pH Balance

- 2 times a week with under half plant spots being used
- 4 times a week with over half plant spots being used

Step 7: Harvesting

When it is time to harvest, start to remove the plants from the water and the baskets they have been growing in. Start by taking plants from the front and working backwards. It is best to have a tray, bowl, or holder of the plant material being harvested. Having a trash can or compost bin to put the waste of the plant is also good for easy cleanup.

Tips to harvesting:

- Start with the front plants and move back on each shelf
- Take the grow cups out, then clip the base of the leaves/plant (edible portion) with a knife or scissors, or tear off by hand
- Once the plants are harvested, pull the roots out of the rockwool and throw them or place into composting bin
- Clean off the rockwool for reuse if desired

Step 8: Cleaning Prior to the Next Planting

Once the crop is harvested, clean up the hydroponics unit to start another planting. Remember that seeds should be planted about 7-10 days before harvesting the current crop to make sure they are ready to put into the hydroponics system.

To clean up the hydroponics system:

1. Turn off the power and unplug the cord from the wall outlet.
2. Clean up the rockwool for reuse (optional) or purchase new rockwool.
3. Drain water from the system:
   - Plant Lab Hydroponics System: Disconnect the water pump in each tray before removal.
   - Plant Producer Hydroponics System:
     a. Remove the tray covers from all three shelves.
     b. Beginning with the top tray and working down, use a paper towel to push the water into the drain.
     c. Disconnect the water float and remove the pump from the reservoir.
     d. Remove the water with a pitcher or pump. Once it is to a weight that is movable by a dolly or a cart, lift the tank using proper lifting technique.
5. Clean the tank(s) and tray covers with warm soapy water from a bucket. Do not pour soap/bleach directly into the reservoir. Bleach can be used to clean the hydroponics system, but it is suggested to use less than a ¼ capful of bleach for every 1-2 gallons of water. If bleach is used, wait an additional 24 hours before filling the tank with water.
6. Rinse thoroughly to remove the soap and bleach (if used).
7. Remove all visible green algae that may have accumulated from the previous harvest.
8. Cloth dry or let air dry before adding new water.
9. Once clean and dry, new water can be added. The recommendation is to let water sit/circulate for 24 hours before adding any plant life to the hydroponics system.

Need More Help?

Additional Help and Information

Visit: ***www.realityworks.com/hydroponics-downloads***

1. Hydroponics curriculum
2. Product Support tutorials and documents

Online Product Support

We're here to help! Our online product support features video tutorials, downloadable documents, frequently asked questions and product notices, all of which make it easy for you to get support for products, software and more, day or night. Find our online product support area here: ***https://www.realityworks.com/knowledge-base/***

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