

### Activity 1: Panels→ Transplanting

Here we have some panels from the Freight Farm. They consist of a wicking strip down the middle of each column with two foam pieces anchoring it in place. The cotton wicking strip is used to bring the nutrient solution down the panel to water the plant roots. The water is then recycled back into the tank. This type of irrigation uses vertical grow walls, gravity, send pumps, and drip emitters to water the plants in the system.

We also have some seed trays with seedlings ready to transplant. They grow about two weeks (can be up to 4 weeks) in the seed station before they are ready.

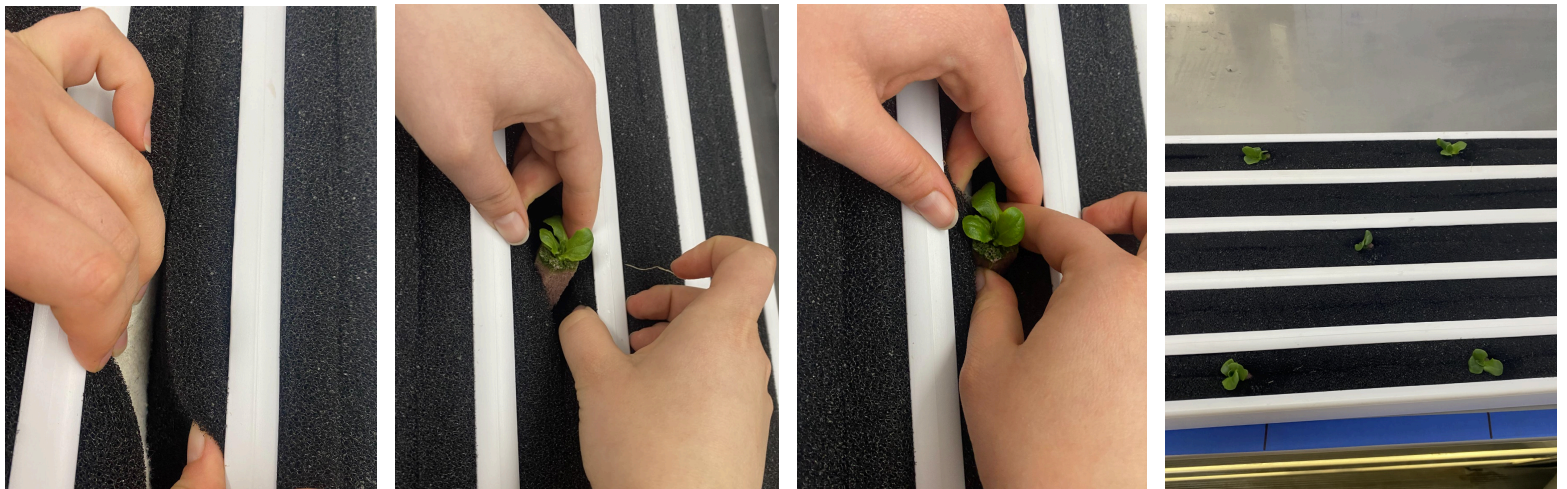
In this activity you will practice transplanting seedlings into the panel, making sure to properly place the plugs. They need to be inserted at a 45 degree angle with the bottom of the plug against the back of the panel, touching the wicking strip. If they are incorrectly placed, water will flow over and/or around the plug and leak.

#### Notes:

- Because the plants need room to grow, we alternate and space the transplants depending on their needs
- We transplant  $\frac{1}{2}$  a wall per week (11 panels) and harvest  $\frac{1}{2}$  a wall/week
- Different plants require different spacing and time on the wall. For example, we transplant radishes in between the columns of lettuce and harvest them after 2 or 3 weeks whereas the lettuce and other produce we harvest after 4 or 5 weeks

#### Possible application to students:

- Attention to detail
- Seedling to transplant to adult plant stages (they will learn at what stage the seedlings are ready to be transplanted and why/how they need to be spaced)
- Types of irrigation systems
- Hand-eye coordination→ Working with fragile plants



## Activity 2: Seed Trays & Plugs

Here we have some empty and full seed trays. The full seed trays will be showing the different stages of growth for the seedlings, the empty seed trays will be used to demonstrate seeding at the farm. We also have the seeds and plugs we use. These plugs are from a company out of the Netherlands that uses crude oil processing waste to create inorganic, compostable plugs for hydroponic farming.

In this activity, you will observe and compare seedling stages and practice seeding into the trays.

Looking at the seedlings in their varying plant stages, can you differentiate between cotyledons and true leaves? Do the cotyledons vary depending on plant type?

For seeding, first we soak the plugs in water, then we put one plug in each seed tray opening, excluding the outer row. Once all the plugs are in the tray and pushed down gently, we add the seed(s):

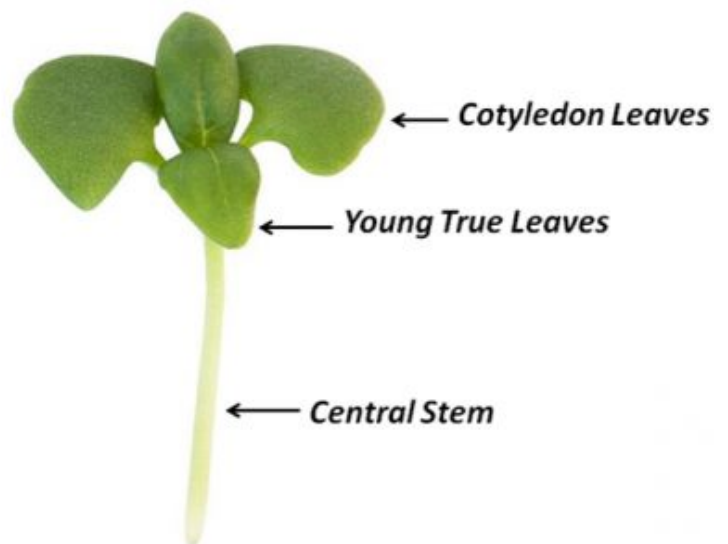
- For lettuce, cabbage, kale, swiss chard, radishes: One seed/pod
- For arugula and herbs such as basil, cilantro, and parsley: 2-4 seeds/pod

Notes:

- We seed around 4 trays/per week, each trays has 288 spaces
- We do not seed the outer row of the trays due to the dip of the tray in the seed station trough→ the middle rows get extra water while the outer rows may go dry
- The seedlings take about 1 week to germinate (with lids to hold humidity) and then 1 week to stabilize without the lids
- Some seeds are extremely small and come in pelleted versions for ease of seeding→ in our case, we use pelleted lettuce seeds
- Our seed station has a water tank, seed troughs, pumps, and uses an ebb and flow watering system

Possible applications to students:

- Seed-seedling life cycle
- Germination requirements
- Plant anatomy-- cotyledons vs true leaves
- Pelleted vs non pelleted seeds
- Showing examples of sustainable innovation
- Ebb & Flow hydroponics
- Hand-eye coordination
- Patience



### Activity 3: Hydroponic Maintenance

Here we have some supplies used to maintain correct hydroponic conditions. At the end, we will be comparing the scale of maintenance between large systems such as the FF and smaller systems such as grow towers. Both systems need pH and nutrient testing and adjustments as well as routine cleaning and dosing practices.

In this activity, you will practice measuring nutrients and working with the pH and EC readers used in hydroponic farming.

Use the scale to measure the weight of various nutrient granules. *Don't forget to tare the scale!*

- 2 oz of nutrient A
- 2 oz of nutrient B
- 1 oz epsom salt

Use the pH and EC readers to test the provided liquid solutions and answer the following questions. The pH reader is orange and gray and the EC reader is blue and white.

- What is the pH of the water?
- What happens to the pH of the water when you add pH up? Does it get more acidic or basic? What about when you add pH down?
- What is the EC of the tap water?
- What happens when you add 2 oz nutrient B to the tap water?

Notes:

- pH 7 is neutral
- pH above 7 is basic
- pH below 7 is acidic
- EC stands for electric conductivity. When we test the EC of water, we are measuring the charged particles released when the nutrients dissolve in the water.
- We use a 3 part mix of nutrients to get the proper N-P-K ratio for our leafy greens (nitrogen-phosphorus-potassium). These 3 nutrients are essential for proper plant growth.
- Nutrient A is MasterBlend Lettuce Formula (8-15-36)
- Nutrient B is Calcium Nitrate (15.5-0-0)
- Epsom Salt is Magnesium Sulfate and provides necessary micronutrients

Possible applications to students:

- In-person chemistry applications
- Understanding pH: What is acidic, what is basic
- Understanding EC: What it means and how it works
- Using a scale: How to tare, reading units
- Connecting optimal pH and nutrients needs to proper plant upkeep
- Hands on experience using hydroponic technology/tools

**Comparing large scale to small scale hydroponic maintenance:**

Freight Farm (large scale):

- Monthly water turnovers
- Daily pH maintenance & EC maintenance
- Daily cleaning of farm
- Weekly pruning & water level adjustments
- Weekly algae management→ cleaning troughs and spraying drip emitters, dosing tanks with hydrogen peroxide every other day
- Weekly cleaning of filters
- Post harvest cleaning: brush off panels, remove left over plug pieces
- Yearly panel and strip cleaning

Flex Farm (small scale):

- Monthly or bimonthly water turnovers and tank clean
- Weekly pH maintenance & EC maintenance
- Weekly pruning & water level adjustments
- Weekly root checks→ making sure there are no root caused clogs
- As needed algae management→ wiping algae away, dosing tank with hydrogen peroxide periodically if needed
- Post harvest cleaning: clean and flush drip holes, wipe tower panels