AQUAPONICS

GROWING SEEDLINGS
Teacher Guide

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Curriculum Connections

Science 14

Unit C: Investigating Matter and Energy in the Environment

- Describe the relationship between photosynthesis and cellular respiration in terms of biological energy storage
- Identify life functions common to living systems

Unit D: Investigating Matter and Energy in the Environment

- Assess the impact of modern agricultural technology on the natural pathways of recycling matter
- Explain how various factors influence the size of populations
- Describe the relationship between land use practices and altering ecosystems

Science 20

Unit D: Changes in Living Systems

General Outcome 3: Students will analyze and describe the adaptation of organisms to their environments, factors limiting natural populations, and evolutionary change in an ecological context.

Science 30

Unit D: Energy and the Environment

General Outcome 1: Students will explain the need for balancing the growth in global energy demands with maintaining a viable biosphere.

Answer Keys (25 points)

Fill In (13 points)

1. fish waste
2. purify
3. roots
4. leafy
5. two
6. lid (or dome lid) / heat mat
7. water
8. dome / grow light (or light)
9. three
10. 5 cm
11. 15 cm
12. top(s)

Match (7 points)

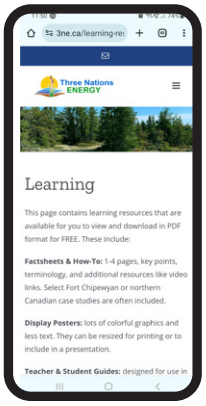
1. b
2. g
3. e
4. j
5. h
6. d
7. a

Short Answer (4 pts)

Answers will vary

Useful Resources

Please see the other Aquaponics resources available at
https://www.3ne.ca/learning-resources/



Aquaponics: Exploring Employment - Two articles discussing aquaponics as a possible home business and training opportunities.

Aquaponics: A Balancing Act - An aquaponics unit is like a mini piece of nature – it has to be in balance to be healthy. Discover the basics of this fine balancing act. Teacher guide, student fact and question sheet included.

Aquaponics: Fish Facts - In an aquaponics system, fish not only produce the natural fertilizers needed by the plants, but they also provide balance to this living system. This is an opportunity to learn close-up about these wonderful animals and how to care for them. ***More topics available.***

AQUAPONICS

GROWING SEEDLINGS

In aquaponics, plants are grown to make use of the fish waste - it is a source of nutrients for them, a natural fertilizer. The fish feed the plants, and the plants purify the water for the fish. It is a win-win system. And the big bonus is, you get to harvest the plants to eat!

Plants for aquaponic systems need to be strong and healthy with good roots. For this reason, they are started in trays and then transplanted into the aquaponic growbed.

What You Can Grow

Leafy greens are an excellent choice for aquaponics.

This is because the high amount of nitrates from the fish waste promotes leaf and stem growth.

They thrive in simple setups and don't need a lot of extra attention.

You can harvest the outer leaves as it grows, so you end up with a longer harvest.

- Romaine
- Bibb Lettuce
- Lettuce
- Spinach
- Kale
- Arugula
- Mustard Greens
- Watercress
- Swiss Chard
- Collards
- Parsley
- Basil
- Thyme
- Chives
- Mint
- Sage.

Fruiting crops can be grown in an aquaponic system but they will require more nutrients, more light and special care so we are not covering this information at this time.

What You Will Need

- 10" x 20" seedling tray with dome
- 1.5" Rockwool cubes (to fit in the tray)
- Electric seedling heat mat
- Seeds for lettuce, other leafy greens or herbs

Why Rockwool?

You don't want to germinate seeds in soil and then transplant into a aquaponic system, adding a bunch of dirt to the system.

- Bacteria can be passed on from the soil to your aquaponic system.
- The roots of your seedlings can be damaged when you try washing them before transplanting.

It is better to use a clean growing medium like Rockwool (made from spun molten rock) or coconut coir (fiber from the outside of coconuts that is steamed - shown below).

How To Get Started

Seeds require moisture, warmth and darkness to germinate (sprout).

1. Place the grow cubes into the seedling tray.
2. Place 2 seeds in the hole of each cube. (Not all seeds will germinate so this makes sure you have at least one plant per cube.)
3. Soak the grow cubes with water. (Depending on your water, you might want to use bottled or rain/snow water.)
4. Drain the extra water from the bottom of the tray into the sink.
5. Place the dome lid over the tray.
6. Place the tray in a dark area or cover it.
7. Place a seedling heat mat under the tray and plug it in.

Watering

- Use room-temperature water, pour gently so the seedlings are not damaged.
- Water the seeds once a day and drain the extra water from the bottom of the tray after each watering. Twice a day would be even better.
- Do not let the Rockwool sit in water, as this will kill your seedlings.
- To test if your Rockwool needs watering, simply touch it — if it feels wet, you don't need to water yet, but if it feels dry, you should give it some more water!

Sprouts To Seedlings

Most seeds will germinate (sprout) after 2-3 days (some seeds will take longer). You will see the small seedling beginning to show just above the grow cube hole.

- When the seeds sprout, you can remove the dome and place the tray under a grow light. Use a full spectrum grow light 18 to 23 cm above the height of the grow cubes.
- Continue to use the heat mat.
- Continue to water the seedlings once or twice day and drain the extra water after each watering.
- After about 3 weeks the seedlings will be ready to transplant into the aquaponics growbed.

Moving Day

To transplant your seedlings into the aquaponic growbed:

1. Dig a hole about 5 cm into the clay pellets with one hand
2. Push the seedling (with grow cube) into the hole. *Make sure the bottom of the grow cube is 5 cm below the surface of the clay pellets; the top 5 cm of the growbed does not get flooded with any water or nutrients.*
3. As a general rule, place each seedling in your growbed 15 cm apart.
4. Adjust the LED growlights so that they are 18-23 cm from the tops of the seedlings.
5. If you notice that your plants are starting to become 'leggy' (long, thin with few leaves), then bring the lights closer.

Watch What Plants Need

pH

- The most important part of water quality for plants is pH (how acidic or alkali the water is).
- This is because pH affects how easy it is for plants to take in nutrients from their roots.
- The ideal pH is between 6.5 - 7 which is just right for nutrients to dissolve into water.
- This pH also works for all living things (plants, bacteria, fish) in an aquaponics system.

Nitrate

- Nitrate is one of the main nutrients that plants need for growth.
- This gets measured often because it is a good way to know how many nutrients the plants are getting in general.
- Aim to keep nitrates in an aquaponic system at about 150 ppm (parts per million).

Light

- Light is required for plants to carry out photosynthesis.
- Use good full spectrum grow lights.
- Plants require 16 hours of light per day. Use a timer on the lights to help.

Dissolved Oxygen (DO)

- Like all living things in an aquaponics system, plants need a lot of oxygen.
- You can provide oxygen to your system by using air pumps with airstones that bubble air into the water.
- You can buy a dissolved oxygen meter to measure the exact amount of dissolved oxygen in your system. Levels of 5 - 8 ppm (parts per million) are ideal.

Temperature

- Plant growth slows down in very warm or very cold water. In extreme temperatures, photosynthesis slows down, too.
- Warmer water contains *less* dissolved oxygen than colder water.
- The ideal water temperature for all living things in an aquaponics system is 20-22 °C.

Time To Harvest

Once your plants are ready for harvest (about 6-8 weeks after transplanting) you have a choice depending on what you planted:

- Harvest just the outer leaves and let the centre continue to grow.
- Remove the entire growcube from each hole, along with each plant.

The rockwool cubes do not break down easily so throw them into the garbage.

It takes time for the nutrients to build up in an aquaponics system. As your system matures, you will notice that your plants begin to grow faster and better.

Name: _____ Date: _____

CHECKPOINT: Growing Seedlings (25 points)

Fill In The Blank (14 points)

1. In aquaponics, plants are grown to make use of the _____.
2. The fish feed the plants, and the plants _____ the water for the fish.
3. Plants for aquaponic systems are started in trays because they need to be strong with good _____.
4. The best kinds of plants to grow with aquaponics is _____ greens.
5. Place _____ seeds in the hole of each cube because not all seeds will sprout.
6. After planting the seeds, place the _____ over the tray and the _____ under it.
7. Do not let the Rockwool sit in _____, as this will kill your seedlings.
8. When the seeds sprout, you can remove the _____ and place the tray under a _____.
9. After about _____ weeks the seedlings will be ready to transplant into the growbed.
10. Plant the seedling so the bottom of the grow cube is _____ below the surface of the clay pellets.
11. Plant each seedling in your growbed about _____ apart.
12. Adjust the LED growlights so that they are 18-23 cm from the _____of the seedlings.

Matching (7 points) some letters not used

___ 1. The most important part of water quality for plants.
___ 2. pH affects how easy it is for plants to take these in from their roots.
___ 3. One of the main nutrients that plants need for growth.
___ 4. The number of hours of light plants need.
___ 5. You can provide oxygen to your system by using these.
___ 6. This is what plant growth does in very warm or very cold water.
___ 7. You can harvest the whole plant or just this.

a. outer leaves
b. pH
c. stems
d. slows down
e. nitrate
f. 10
g. nutrients
h. air pumps
i. speeds up
j. 16
k. water pumps

Short Answer (4 points)

Imagine you are planning to grow and sell the plants from the aquaponics system. Come up with a name and logo for your vegetable company. Draw or describe it below.