

The Ultimate Test

Grade 3-6

Objective

Students will learn the difference between three types of farming; aquaponics, hydroponics, and traditional soil. They will also learn pros and cons associated with each type of farming method.

Materials

- 3 Diagrams of Farms
- Farm Cards (16 lettuce, 16 basil, 16 flowers, 12 peppers, 8 squash, 8 fish)
- Chance Cards (24 cards)
- Money Cards (40 cards)
- 3 Magnet Board (optional, allows for a more visual “game”)
- 75 Magnets (optional, allows for a more visual “game”)

Advanced Preparation: Print Farm Cards double sided onto cardstock or other heavy stock paper. Print Chance Cards double sided onto cardstock or other heavy stock paper. Print 10 copies of Money Cards double sided onto cardstock or other heavy stock paper. Cut along outline to create cards.

Introduction

What are the things that plants need to grow? Do they need soil, or the nutrients found in the soil?

“Plants, in order to grow, need the macronutrients nitrogen, phosphorous and potassium (often referred to as NPK) along with many other micronutrients.”

“Nitrogen is the plant growth booster, phosphorous helps in plant maturity, and the potassium gives strength to the stalks and help plants to hold more water and resistant to drought.”

Among these three, Nitrogen is the most important.

“What are different growing methods we can use to grow our food?”

List on a white board all the examples said. If the three below aren’t mentioned then give some clues so the students get the answers or just add them to the list.

“So today we are going to focus on the following three methods of growing plants.”

Ask the student if they know what Aquaponics and Hydroponics are and their differences.

Hydroponics: is the raising of plants without soil using artificial fertilizer-enriched water. In hydroponics, often a media is used to support the roots of the plant. Examples of hydroponic media includes sand, gravel, coconut husks, saw dust, and rockwool. It is very difficult for hydroponics to be organic, as it most often uses artificial fertilizers.

Aquaponics: is the combination of aquaculture, the raising and farming of fish, and hydroponics, the raising of plants without soil. The fish produce nutrient rich waste that the plants then consume. Like hydroponics, a media is often used to support the roots. Aquaponics can be organic because it uses natural fish waste to feed the plants.

Traditional Soil: is farming done in the ground often in a field. This farming can be conventional, where artificial fertilizers and pesticides are used, or organic, where animal manure or compost and biological pest controls are used. Both types of traditional soil farming use soil as medium.

In discussion, ask the students where they think the NPK for the plants come from in each type of farming.

For hydroponics, the NPK is added to the plants in chemical forms like fertilizers.

For aquaponics, NPK comes from the fish waste.

For traditional soil, the NPK is often added to the plants in chemical forms like fertilizers. It can also be added in more natural forms like using manure. Sometimes companion planting is done where plants like legumes are planted with tomatoes, because legumes put nitrogen in the soil while tomatoes take it out.

Activity

1. Set up one farm of each farming method (e.g. write aquaponics, hydroponics, and traditional soil on three (3) different parts of a white or chalk board or on each individual magnet board)
2. Optional: assign one student to be the “banker”
3. Hand out the cards as follows:

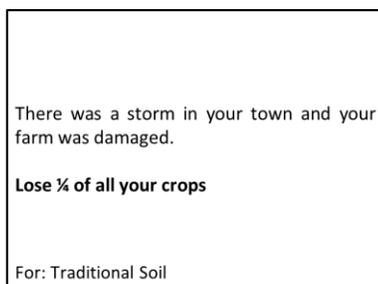
Each farm gets: 15 money, 4 lettuce, 4 basil, 4 flowers, 3 peppers, 1 squash

Aquaponics farm also gets: 5 fish

Remaining cards stay with the banker

4. Have the students take turns drawing a chance card, adding or removing plants and money as the cards dictate.

Example:



Student who drew this card would remove ¼ of all the crops currently at the Traditional Soil farm and return them to the banker.

Note: If a crop or fish cannot be evenly divided, round up to the nearest whole crop or fish.

5. The game ends when a farm runs out of money, they have lost all their crops, or time has run out.

Note: A banker is used to simplify the process of handing out and collecting crops, fish, and money.

Discussion

After activity, discuss what made each of the farming type better than the others and what made each of the farming types make it worse than the other.

“Why do you think X Farm earned more than the others?”

“Why do you think X Farm has less money?”

Discuss with the class differences of each type of farming and the benefits and negative sides of it.

Table 1: Farming Methods and Their Pros and Cons

Farming Method	Pros	Cons
Hydroponics	<ul style="list-style-type: none"> • Does not need soil (can be used anywhere in the world) • Very high yields • Indoor (isolated from bad weather) 	<ul style="list-style-type: none"> • Uses artificial fertilizers • Very hard to be organic • Simple to set up and start • Indoor (dependent on electricity) • Produces waste water • Limited varieties of plants can be grown • Not as flavorful plants
Aquaponics	<ul style="list-style-type: none"> • Does not need soil (can be used anywhere in the world) • Produces both plants and fish • Does not use artificial fertilizers • Very high yields • Organic • Indoor (isolated from bad weather) • Produces almost no waste water 	<ul style="list-style-type: none"> • Expensive to start • Requires a lot of training • If your fish or plants die, your system can struggle • Indoor (dependent on electricity) • Limited varieties of plants can be grown
Traditional Soil	<ul style="list-style-type: none"> • Requires less training • All varieties of plants can be grown • Can be organic • Artificial lights are not required 	<ul style="list-style-type: none"> • Requires fertile land (both expensive and limited) • Low yields • Susceptible to bad weather • Cannot be used year-round in colder climates • Uses a lot of water • Fertilizers and pesticides can leach into drinking water

Table 2: Ontario Curriculum Links

Grade	Subject Area	Ontario Curriculum Links
3	Science and Technology	<p>Growth and Changes in Plants</p> <p>Specific Expectation:</p> <p>1.1 assess ways in which plants are important to humans and other living things, taking different points of view into consideration and suggest ways in which humans can protect plants</p> <p>1.2 assess the impact of different human activities on plants, and list personal actions they can engage in to minimize harmful effects and enhance good effects</p> <p>3.1 describe the basic needs of plants, including air, water, light, warmth, and space</p> <p>3.4 describe how most plants get energy to live directly from the sun and how plants help other living things to get energy from the sun</p> <p>3.6 describe ways in which plants and animals depend on each other</p> <p>3.7 describe the different ways in which plants are grown for food and explain the advantages and disadvantages of locally grown and organically produced food, including environmental benefits</p> <p>3.8 identify examples of environmental conditions that may threaten plant and animal survival</p>
4	Science and Technology	<p>Habitats and Communities</p> <p>Specific Expectation:</p> <p>1.1 analyse the positive and negative impacts of human interactions with natural habitats and communities (e.g., human dependence on natural materials), taking different perspectives into account (e.g., the perspectives of a housing developer, a family in need of housing, an ecologist), and evaluate ways of minimizing the negative impacts</p> <p>1.2 Identify reasons for depletion or extinction of plant or animal species</p> <p>2.2 build food chains consisting of different plants and animals, including humans</p> <p>3.1 Demonstrate an understanding of habitats as areas that provide plants and animals with the necessities of life.</p> <p>3.3 Identify factors that affect the ability of plants and animals to survive in a specific habitat</p> <p>3.4 demonstrate an understanding of a community as a group of interacting species sharing a common habitat</p> <p>3.9 demonstrate an understanding of why all habitats have limits to the number of plants and animals they can support</p>

5	Science and Technology	<p>Properties of And Changes in Matter</p> <p>Specific Expectation:</p> <p>1.1 evaluate the environmental impacts of processes that change one product into another product through physical or chemical changes</p> <p>1.2 assess the social and environmental impact of using processes that rely on chemical changes to produce consumer products, taking different perspectives into account</p>
6	Science and Technology	<p>Biodiversity</p> <p>Specific Expectation:</p> <p>1.1 analyse a local issue related to biodiversity (e.g., the effects of human activities on urban biodiversity, flooding of traditional Aboriginal hunting and gathering areas as a result of dam construction), taking different points of view into consideration (e.g., the points of view of members of the local community, business owners, people concerned about the environment, mine owners, local First Nations, Métis, Inuit), propose action that can be taken to preserve biodiversity, and act on the proposal</p> <p>3.2 demonstrate an understanding of biodiversity as the variety of life on earth, including variety within each species of plant and animal, among species of plants and animals in communities, and among communities and the physical landscapes that support them</p> <p>3.5 describe interrelationships within species</p>