Agriculture	Grade 6 Biology

Lesson Plan

Safety Notes: Adult supervision and extra help is always appreciated!

Description

Students will learn about biodiversity and two different types of agriculture; monoculture and polyculture.

Materials

- A pencil or pen
- One die
- At least 6 pieces each of 5 different coloured items (LEGO, Smarties, Fruit Loops, etc)
- An extra piece of paper to draw your "farms"

Science Background:

Biodiversity refers to the variety of all living things on Earth or in a specific area like a habitat.When an area is changed by man-made projects, we also change the dynamics of the ecosystems which in turn, changes the biodiversity.

Agriculture is the practice used for farming crops and raising livestock. There are many types of agriculture to fit specific needs but today we will be focusing on two types: Monoculture and Polyculture.

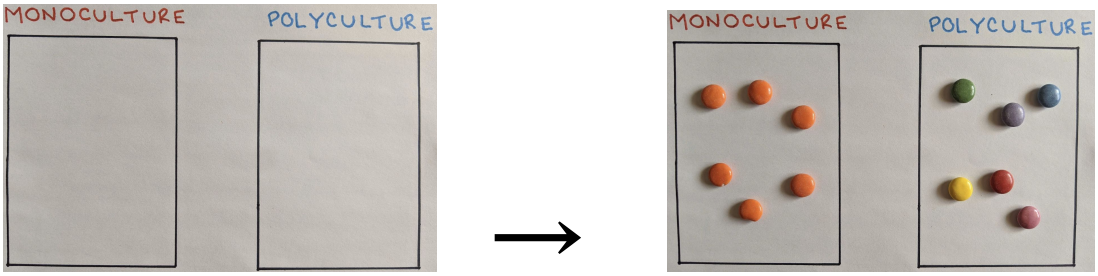
1. **Monoculture -** The cultivation of one species of the crop in one area. With having only one species, the biodiversity is quite low. This method is mostly for commercial use and is usually produced on a larger scale to meet demands.
    - *Pros:* Efficient for machinery. Able to meet the high demands of certain products.
    - *Cons:* The soil can't replenish in nutrients. A lot of pesticides are used.

2. **Polyculture -** Focuses on having multiple species to become self-sustaining or sustainable. This means that plants don't need to be replanted each year because it grows back. There is more biodiversity in this method since there is a variety of species.
    - *Pros:* Nutrients stay in soil. The plants form their own self-sustaining ecosystem.
    - *Cons:* Time-consuming/difficult to use machinery. Long process to obtain self-sustaining level.

Activity Procedure

For this activity we will be exploring and comparing monoculture and polyculture farming:

1. Gather your die and coloured pieces. Each colour represents a species of crop plant.
2. Draw 2 squares on another piece of paper. Label one square "monoculture" and the other "polyculture". These two squares will represent your two different farms.
3. Seperate all of your coloured pieces. Add 6 pieces of the SAME colour to your monoculture farm. Then, add 6 pieces of DIFFERENT colours in the polyculture farm. Do NOT put the colour you have in the monoculture, in the polyculture (keep the rest of the colours to the side since we will use them throughout the experiments).



4. **Refer to the accompanying handout for the scenarios (1 to 8)**
5. Start at Scenario One and roll the dice. Follow the steps based on what you rolled. Do this for both the monoculture and polyculture scenarios.
6. If you roll higher than the number indicated in the scenario, you will add one piece to your farm. If you roll lower, you will remove one piece from your farm. If you roll the same, roll again.
7. For example if you roll a 3 in Scenario One, you will remove one piece from your monoculture farm but add one piece for your polyculture farm.
8. Run through each step of the scenario at least 3 times and record your findings!
9. Complete questions 1- 4 on the handout.

Debrief

Both monoculture and polyculture techniques of farming have different benefits as well as different levels of biodiversity. Since we rely on agriculture for food and other products, thinking about sustainability and diversity of crops is important to ensure that we have what we need now, and for future generations.

Handout

Now you will conduct your own experiments to see which type of agriculture yields the most amount of crops. Gather up your different coloured pieces and a die to start!

1. Referring to the Activity Chart on page 2, you can begin the activity comparing monoculture and polyculture by working through scenarios 1 to 8. Write your results in the chart below: (**Bonus**: on another sheet, draw pictures of your farm crops before and after the scenarios!)

	The amount of crops at the end of Experiment #1	The amount of crops at the end of Experiment #2	The amount of crops at the end of Experiment #3
Monoculture:			
Polyculture:			

2. On average, which type of farming yielded the most crops in your experiments?
   _____

3. Why do you think it was more successful than the other?
   _____
   _____
   _____

4. Which method has a higher biodiversity? What are the pros and cons of each?
   _____
   _____
   _____
   _____

MONOCULTURE	POLYCULTURE
1. Bugs started attacking your crops because they are resistant to your pesticide ● **MONOCULTURE** ○ lower than 5 remove one ○ higher than 5 add one	1. You found a plant species that thrive when paired with another plant species. ● **POLYCULTURE** ○ lower than 2 remove one ○ higher than 2 add one
2. Your machinery started leaking oil which is polluting your soil. ● **MONOCULTURE** ○ lower than 5 remove one ○ higher than 5 add one	2. You added livestock to your property and this helps spread manure and fertilize your crops. ● **POLYCULTURE** ○ lower than 3 remove one ○ higher than 3 add one
3. Crows made a nest nearby and ate your planted seed. ● **MONOCULTURE** ○ lower than 3 remove one ○ higher than 3 add one	3. Some pesticides from the neighbouring farms got into your water supply and have affected some of your plants. ● **POLYCULTURE** ○ lower than 4 remove one ○ higher than 4 add one
4. You did not add mulch or topsoil on your field and your soil is drying up faster and you need to use more water ● **MONOCULTURE** ○ lower than 5 remove one ○ higher than 5 add one	4. Gophers started eating some of your crops. ● **POLYCULTURE** ○ lower than 4 remove one ○ higher than 4 add one
5. You have invested in a new irrigation system that helps water to your crops. ● **MONOCULTURE** ○ lower than 2 remove one ○ higher than 2 add one	5. Predators are hunting the gophers that are eating your crops. ● **POLYCULTURE** ○ lower than 2 remove one ○ higher than 2 add one
6. To increase nutrients in your soil, you use the crop rotation technique. ● **MONOCULTURE** ○ lower than 3 remove one ○ higher than 3 add one	6. Some of your crops are growing before other ones which shelter the seeds from being eaten by birds. ● **POLYCULTURE** ○ lower than 2 remove one ○ higher than 2 add one
7. A disease invaded your crops since you have all the same species of plant, this affected half of your field ● **MONOCULTURE** ○ lower than 5 remove one ○ higher than 5 add one	7. You set up a bat house and 6 pairs move in. This helps control the bug population. ● **POLYCULTURE** ○ lower than 2 remove one ○ higher than 2 add one
8. Kudzu vines, an invasive species, were introduced and are cutting off nutrients to your crops. ● **MONOCULTURE** ○ lower than 3 remove one ○ higher than 3 add one	8. You added beehives that are now housing thousands of bees, this pollinates your crops and gives you more fruits and vegetables. ● **POLYCULTURE** ○ lower than 2 remove one ○ higher than 2 add one

Handout (Answer Key)

Now you will conduct your own experiments to see which type of agriculture yields the most amount of crops. Gather up your different coloured pieces and a die to start!

1. Referring to the Activity Chart on page 2, you can begin the activity comparing monoculture and polyculture by working through scenarios 1 to 8. Write your results in the chart below: (**Bonus**: on another sheet, draw pictures of your farm crops before and after the scenarios!)

	The amount of crops at the end of Experiment #1	The amount of crops at the end of Experiment #2	The amount of crops at the end of Experiment #3
Monoculture:			
Polyculture:			

2. On average, which type of farming yielded the most crops in your experiments?
   Depends on what their experiments yield. Most likely polyculture.

3. Why do you think it was more successful than the other?
   (Assuming it is polyculture) Polyculture has different types of species so it has a higher resistance to impacts and is able to naturally self-sustain itself.

4. Which method has a higher biodiversity? What are the pros and cons of each?
   Polyculture has a higher biodiversity.
   Monoculture (*pros*): Efficient for machinery. Able to meet the high demands of certain products. Monoculture (*cons*): The soil can't replenish in nutrients. A lot of pesticides are used.
   Polyculture (*pros*): Nutrients stay in soil. The plants form their own self-sustaining ecosystem. Polyculture (*cons*): Time-consuming/difficult to use machinery. Long process to obtain self-sustaining level.

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