ACTIVITY 1

HOW DO CERTAIN PRODUCTS AFFECT PLANTS?

EXPERIMENT OBJECTIVES AND CONTENT

In this activity, students learn that certain products affect the growth of plants.

> THESE EXPERIMENTS CAN BE SPREAD OVER A NUMBER OF DAYS, WEEKS OR EVEN MONTHS.

ESSENTIAL KNOWLEDGE

Matter:
- Characteristics of living things: metabolism of plants (nutrition and growth)

Energy:
- Sources of energy for living things: agricultural and food technologies

Systems and interaction:
- Environmental technologies

Techniques and instrumentation
- Use of simple measuring instruments

Appropriate language:
- Terminology related to an understanding of living things
- Drawings, sketches

SUGGESTED MATERIALS

Perishable non-scientific materials:
- Young, fast-growing potted plants (sunflowers, spider plants, broad beans, string beans, tomatoes)
- Compost
- Chemical fertilizer
- Herbicides
- Water

Household materials:
- Plastic or latex gloves

School supplies:
- Measuring tapes

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

In early spring, those who have gardens or who work in parks are on their knees to "play" in the dirt. They stir up the soil and sometimes add granules. As you watch them a question comes to mind: Do the products they put in the soil make the plants grow faster? You ask yourself what effects these products might have on the plants.

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The students do some vocabulary research to learn certain terms such as "fertilizer," "composting," "pesticide," "granule," and "herbicide." Students who do composting at home could talk about it to the rest of the class. The teacher could also lead a brainstorming session on questions such as: Why is the water we use to water plants sometimes colored. What is fertilizer? What is compost? Can we put chemicals in soil or water? Are some products better than others for growing plants?

INITIAL IDEAS AND HYPOTHESES

Here are a few examples of hypotheses the students might formulate based on their initial ideas:

Example 1
I predict that if I add fertilizer to a plant, it will grow faster and have more leaves. I predict this because my parents grow plants at home and add a special powder to them.

Example 2
I predict that if I put herbicide in the soil where a plant is growing, it will die. I predict this because herbicides are made to prevent weeds from growing, so they should have the same effect on plants.

Example 3
I predict that if I add compost to the soil, the plant will grow very well and will not need artificial fertilizer. I predict this because at my house we make compost to mix with potting soil, and the plants grow normally.

WORK PLAN AND EXPERIMENTATION

Here are a few examples of experiments the students can carry out to verify their hypotheses:

Example A
The students compare the growth of a young plant grown using chemical fertilizers with one grown without fertilizer. The students draw or measure the length of the main stem at regular intervals and observe the appearance of new leaves.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

CAUTION: KEEP ALL DANGEROUS MATERIALS OUT OF THE REACH OF STUDENTS AND PREPARE MIXTURES YOURSELF IF STUDENTS ASK YOU TO. USE GLOVES WHEN HANDLING THESE PRODUCTS.

Example B
The students compare the growth of a young plant grown with herbicide to one grown without herbicide. They observe the two plants for several weeks and record how the plants react. Does the color of the leaves change? They draw or measure the length of the main stem at regular intervals.

Example C
The students compare the growth of a young plant grown in ordinary potting soil to that of a young plant grown in soil enriched with compost.

EXPERIMENTAL FACTORS
To ensure scientific rigor, the students should evaluate the experimental factors that might influence the experimental results.

- Watering of plants
- Amount of fertilizer or herbicide used
- Type of product used
- Plant species
- Size of plant at beginning of experiment
- Health of plant at beginning of experiment
- Amount of light
- Proportion of product added compared to amount of water

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

Students will better understand the effects of certain products on plants if they pool their results. Were they able to verify their hypotheses? Did they observe differences with the various products tested? Together, they try to find problems or experimental errors that occurred and find ways to improve the experiments.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

The students conduct more thorough research into the whole range of pesticides and fertilizers used at home or in farming. It would also be highly enriching to organize a fieldtrip to an environmental complex.

SCIENTIFIC CONCEPTUAL CONTENT

The importance of soil

Plants take nourishment from the soil by way of rootlets (small roots) that absorb water and minerals dissolved in water. If chemical fertilizers or natural fertilizers (compost, manure) are added to the soil, plants grow more quickly and are stronger. On the other hand, if the soil is contaminated by chemicals spilled by humans (pesticides, metals), the plant is slowly poisoned and will eventually die.

Compost and natural and chemical fertilizers

Compost is a natural fertilizer made from biodegradable waste that is decomposed by micro-organisms, earth worms and insects in an oxygenated environment. Natural fertilizers come from organic sources (seaweed, manure) or mineral sources that have not been chemically or synthetically transformed by humans, unlike chemical fertilizers, which are synthesized artificially, often from petroleum.

Pesticides

A pesticide is a chemical that is used against animal and plants that are deemed harmful to crops. These may be insecticides (e.g., DDT, which is still used in some tropical countries against mosquitoes), fungicides (used against harmful fungi), rat poison, or herbicides (used to kill weeds).

Unusual fact

Since April 2003, the use of pesticides has been strictly controlled to protect the health of people and the environment. However, according to Agriculture and Agri-Food Canada, from 1970 to 1995, spending for agricultural pesticides increased by 411%.

CULTURAL REFERENCES

Forests in danger

Show images of clear-cut forests along with others that have been reforested. Watching the documentary *Forest Alert* (English version of *L'erreur boréale*) could be used as a starting point for discussion. To replace the trees cut by large pulp and paper manufacturers in Northern Québec, small trees are grown in greenhouses, which are planted one by one in our wide open spaces.

Risks

Fertilizers are used in farming as supplements to minerals in the soil to make crops grow faster and improve their health. (This use sometimes leads to excesses.) Conduct research into the dangers of using chemical fertilizers. You could also discuss the contamination of rivers and the increasingly widespread presence of blue-green algae in lakes.

FOR MORE CULTURAL REFERENCES, VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:

www.eclairsdesciences.qc.ca

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PROCESS OF ACTIVE DISCOVERY

GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY (IN ELEMENTARY SCHOOL)

Context related to everyday life

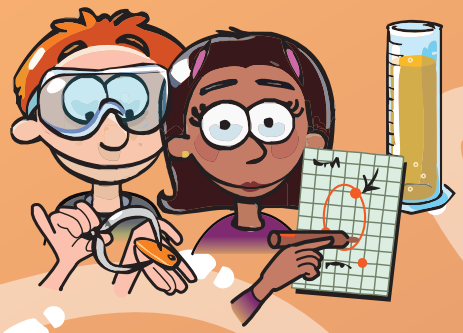
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

Initial ideas and hypothesis

My initial ideas:
- I share my own ideas.

My hypothesis:
- I predict that... I think that because…
- I imagine my prototype.
- I think it works like this…

Planning and carrying out



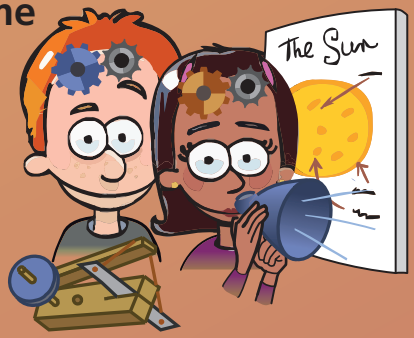
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

Carrying out my process:
- What will the steps be?
- What precautions should I take?

My actions:
- I carry out the steps of my protocol.
- I note or draw what I observe, what I do and what I discover.

My results:
- What is my answer to the problem, question or need?

Outcome



My outcome:
- Do my results confirm my hypothesis or not?
- Are my results similar to those of the other teams?
- Can the other teams' results help me to find answers to my problem, my question or my initial need?
- What could I communicate concerning my discoveries?

New question?

What I learned:
- What do I retain from this activity?
- What could I communicate concerning my results or my discoveries?

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