

NITROGEN & FERTILIZERS

OBJECTIVES:

After this lesson, students will be able to:

- Discuss different ways of providing usable nitrogen to plants.
- Predict how different sources of nitrogen for plant growth impact the environment.

ASSESSMENTS:

During this lesson, students will:

- Discuss the pros and cons of each type of fertilizer used in gardening and agriculture.

Warm-up (5 min)

- We have a glass of water and some salt.
- You're going to add salt to the glass of water and stir it to dissolve.
- What do you think will happen if you continue to add more and more salt?



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 - <https://phet.colorado.edu/en/simulation/concentration>

Warm-up

- We have a glass of water and some salt.
- You're going to add salt to the glass of water and stir it to dissolve.
- What do you think will happen if you continue to add more and more salt?
 - At a certain point, no more salt will dissolve and the excess salt will sit at the bottom of the glass.

Warm-up

- Recall: Nitrogen is an essential nutrient for plants, like carbohydrates or proteins are for us.
- However, there is a certain amount of nutrients that is appropriate.
- This is like the salt in the glass. Providing the right amount is important, but adding too much overloads the system and it won't dissolve.
 - Too much of a good thing can be a bad thing!

Garden Activities (15 min)

- Recall: Nitrogen-fixing bacteria convert atmospheric nitrogen into a form that plants can take in and use.
- However, there are other sources of nitrogen!
 - Fertilizers
- What are the different types of fertilizer?
 - Animal manure, synthetic fertilizers, and biofertilizers (nitrogen-fixing bacteria + legumes)

Garden Activities

- Now, we're going to look at different bags of fertilizer.
- Record your observations and make comparisons!



Garden Activities

- Like us, plants have a limit as to how much nutrients they can take in.
- What happens when you use too much fertilizer?
 - You overload the plant and it won't be able to use all of the fertilizer.
 - You can also harm the plant (burns).
 - This is similar to adding salt to water. There is a certain point that you cannot add any more because it will not be able to dissolve.

Garden Activities

- Where does all the extra fertilizer go? (*Hint: recall the video from the lesson on the nitrogen cycle*)
 - If there is heavy rain, it can pollute nearby water sources, such as lakes, rivers, and streams.



Types of Fertilizers

- Animal manure: animals obtain nitrogen by eating plants and release nitrogen as waste
- Synthetic fertilizers: adds the usable form of nitrogen directly to the soil
- Biofertilizers: add nitrogen-fixing bacteria to soil with legumes

Fertilizer Video



Fertilizer Video Question

- Why do we need fertilizers?

Fertilizer Video Question

- Why do we need fertilizers?
 - When we harvest crops, we remove the nutrients from the soil. We must add fertilizer, which is essentially plant food, so more crops can be grown.

Fertilizers and Agriculture

- In commercial agriculture, it is common to grow the same crop on the same land every year.
 - This is called *monocropping*.
 - This practice takes nutrients out of the soil faster than they can be returned.
 - This requires the use of *fertilizers* to return nutrients to the soil.



Fertilizers and Agriculture

- Benefits:
 - Act on the soil immediately
 - Are easy to use
 - Highly effective
- Drawbacks:
 - Kill beneficial microorganisms
 - Damage the natural soil ecosystem
 - If too much is used, it can contaminate water sources.

Eutrophication

- *Eutrophication* occurs because the nutrient-rich fertilizers allow the microorganisms and algae in water to grow to high numbers.
 - They use up large amounts of oxygen and can cause other organisms, such as fish, to die.



Eutrophication Video



Eutrophication Video Questions

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- What is a benefit of using nitrogen fertilizers?

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- What are some potential effects of using too much nitrogen fertilizer?
 - It can contaminate drinking water, kill fish, and pollute the air.
- What is a benefit of using nitrogen fertilizers?
 - It allows us to grow significant amounts of food.

Alternatives to Fertilizers

- One alternative is a practice called *crop rotation*
 - This returns nutrients to the soil ecosystem, improves soil structure, and increases biodiversity without requiring synthetic inputs.
- Legumes are great to include in crop rotations because they do not need to be fertilized and are efficient at fixing nitrogen.
 - Whatever is planted after the legumes will have a rich source of usable nitrogen available.

Crop Rotation Video



Crop Rotation Video Questions

- What types of crops are rotated? (*Hint: think roots*)

Crop Rotation Video Questions

- What types of crops are rotated? (*Hint: think roots*)
 - Deep rooted and shallow rooted plants. Soybeans and corn, as well as beans.

Sources

- [12.23 Nitrogen Cycle](#) (CK-12 Foundation)
- [Nitrogen Fixation Lesson for Kids](#) (Study.com)
- [Nitrogen Fixation by Legumes](#) (New Mexico State University)
- [Crop Rotations](#) (Rodale Institute)
- [Crop Rotation](#) (Sustainable Settings)
- [The Effects of Synthetic Fertilizers](#) (SFGate)
- Videos:
 - [Nitrogen Cycle](#)
 - [How Plants Fix Nitrogen](#)
 - [Ecosystems: Working with farmers to decrease Nitrogen pollution](#)
 - [Agri-Facts: nitrogen cycle](#)
 - [Carbon and Nitrogen Cycles](#) (start at 3:58 for nitrogen)
 - [The Nitrogen Cycle](#)
 - [Symbiosis](#)
 - [What is Crop Rotation?](#)
 - [What Are Fertilisers?](#)
 - [What Is Eutrophication](#)