

K-12 IYS Activity



Learning Objective

- To understand what a GMO is.
- To understand that there is DNA in the soil that comes from all the organisms that reside in the soil.
- To understand the soil-GMO interactions affect soil health and to be able to confront the contradictory information on GMOs effect and soil, ecosystem, and human health.
- To understand the soil-GMO interactions that affect soil health and to be able to confront the contradictory information on the effect of GMOs on soil, the ecosystem, and human health.
- To understand what DNA and RNA are.
- To learn how to isolate DNA
- To know what DNA looks like
- To understand the structure and function of DNA

Materials Needed

- One kit (one kit is sufficient for 36 students; order and download the 22-page guide at <http://www.edvotek.com/S-75>). The cost is \$55.00.
- Fresh onion, strawberry, and banana pieces
- 20-milliliter beakers
- Test tubes
- 70 % clear isopropyl alcohol
- Distilled water
- Ice

Celebrating the



2015
International
Year of Soils

soils.org/IYS

Soil health and Human Food Security: when Genetically Modified Organisms (GMOs) are Grown for Food

Ages

Middle School/High School
Adults

Recommended Group Size

20-36

Where could you offer this?

Your university
Local school
Library
Summer programs

What type of room do you need?

Lecture
Lab/work benches

Type of Lesson

- Hands-on (participants touch the stuff)
- Indoor
- Demonstration (scientist or teacher demo, outside professional)
- Experiment (follow procedure, get results, interpret results)
- Lecture (basic info, invited speaker)
- Small group exercise/discussion critical thinking
- Video
- Other

Time Needed:

1. Scientist prep time + clean up time: 1 hr
2. Participant/class time: 2-3 hrs

Summary

There is much contradictory information about the effect that GMOs have on soil health and subsequently human health. The soil has an influence on human health based

on the nutritional value it provides to crops. A soil's nutritional value is influenced by a wide variety of factors including sustaining soil organic matter and sustainably replacing nutrients removed in the crop. GMOs, such as Bt-modified corn (corn that has an enzyme for a toxin that kills certain insects that feed on corn) and wheat have been shown to not reduce soil fertility. Research has also shown that some lines of Bt-developed plants can affect the amount of fungi associated with the roots, which is a major determinant of how the plant can get some of its nutrients (mycorrhizal symbiosis). Likewise, such characteristics as resistance to the herbicide glyphosate allows less soil disturbance by less tillage and less use of herbicides, thus preserving the soil mechanisms that promote enhanced soil fertility, increased fertilizer efficiency and a better supply of nutrients to plants. GMOs have some good points and some points of concern and need to be evaluated on a case-by-case basis. It should also be understood that the soil has a great potential to produce food that affects human health, and this is an area for future research. This activity includes an experiment that helps students to learn about the physical nature of DNA and get hands-on experience in extracting DNA from real plants (an experimental kit named "Do onions, strawberries, and bananas have DNA" will be used).

Methods/procedures:

Follow the detailed methods that come with the kit.

Discussion questions:

- What is a GMO and how is DNA used to create a GMO?

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- How can the use of GMOs positively influence food quality and, subsequently, human health
- How can the use of GMOs negatively influence food and environmental quality and human health?

References:

http://www.liberidaogm.org/liberi/folder_file/GMO-SOIL-IMPACT-2005.pdf

An excellent review of the effect of GMOs on soil microbial communities.

<http://www.edvotek.com/S-75>

This is the source of the kit for measuring DNA

http://getbiotechsmart.com/sites/getbiotechsmart.com/files/student/agricultural_biotechnology_delivering_benefits_for_farmers_consumers_and_the_environment.pdf

Source for benefits of GMO crops and foods.

Source for effects of GMO crops on the soil environment.

<http://d1jkwgdw723xjf.cloudfront.net/wp-content/uploads/2014/05/Benefits-of-Plant-Biotechnology.pdf>

Source for benefits of GMO crops.

<http://www.fao.org/docrep/004/y3557e/y3557e09.htm>

Source for benefits, risks, and concerns about the use of GMO crops.

Describes controversies.

Animations/Videos:

<http://www.youtube.com/watch?v=gKO9s0zLthU>

GMOs

<http://www.youtube.com/watch?v=4PKjF7OumYo>

Molecular visualization of DNA

http://www.youtube.com/watch?v=_KCzOV8EMEc

YouTube animation of DNA

http://www.youtube.com/watch?v=BmDG_fkUTR8

Animation of how DNA works

<http://www.dnatube.com/video/3447/DNA-double-helix>

Animation of DNA double helix

<http://www.youtube.com/watch?v=uXdzuz5Q-hs>

You tube video on the basics of DNA

<http://www.youtube.com/watch?v=qoERVSWKmGk>

DNA and RNA - Part 1

<http://www.youtube.com/watch?v=W4mYwsr9gGE>

DNA and RNA - Part 2

<http://www.youtube.com/watch?v=27TxKoFU2Nw>

DNA replication

<http://www.youtube.com/watch?v=ArveLORBmbk>

Corn, the Dynamic Genome

Adapted from Dr. Dirt's Soil Crayons K-12 Teaching Resources page at

<http://doctordirt.org/soil-crayons>

Additional Resources

www.soils4teachers.org



Soil Science Society of America
www.soils.org