



Conserve Water for Food

Digital Narratives

Background

Foodborne illness outbreaks have been associated with consumption of raw agricultural commodities contaminated with microbial pathogens. Pathogens found on raw produce have included bacteria, parasites, and virus such as *Escherichia coli* O157:H7, *Cyclospora cayetenensis*, and human norovirus, respectively. Foodborne illness is primarily characterized by gastroenteritis, although microorganisms and their toxins can also cause multisystem maladies that can range from short-term illness to long-term sequelae to even death depending on the organism, exposure, and host vulnerability. Many of these microbial pathogens can be found in the intestinal tract and fecal waste of infected humans and animals.

Pathogens can be inadvertently introduced to food products through infected food handlers, contaminated food contact surfaces, and contaminated environmental sources such as soil and water. To minimize risks of contamination, guidelines such as Good Agricultural Practices (GAPs) and regulations such as the Produce Safety Rule (PSR) of the Food Safety Modernization Act (FSMA) have been instituted for the production of produce. One of the regulatory requirements includes evaluation of the microbiological quality of water used to irrigate food crops.

Sources of irrigation water can include ground water and surface water (lakes, ponds, streams), although availability of these traditional water resources have become strained due to droughts and contamination. As a result, research efforts to safely and sustainably recycle water for food production has become a research priority.

In order to evaluate the quality of water to be used for irrigation of food crops, CONSERVE researchers collected environmental and nontraditional water samples and transported them to a laboratory to be tested for the presence of viruses and parasites. The scientific principles and techniques utilized in the laboratory setting for detecting parasites and viruses from water samples are presented by CONSERVE researchers in two digital narratives.

Digital Narratives

Digital narratives feature student researchers who describe and demonstrate the purpose and approach for testing water for microbiological safety. The principles and laboratory techniques for concentrating, isolating, and detecting waterborne parasites and viruses are presented. The digital narratives are less than 5 minutes each in length.

Education Content Standards Supported

- **Science (Next Generation Science Standards)**
 - Cell types of living things
 - Science and Engineering Practices
- **Social Studies**
 - Geography: Ecosystems, human modification and response to natural environment

Learning Objectives

The educational resources support cross-curricular instruction on issues surrounding the availability and safety of environmental water needed for food production. This resource will support student understanding of the following:

1. Water used for irrigation of food crops is derived from environmental and reclaimed water sources.
2. Scientific studies are conducted according to standard protocols that assure sample integrity and data accuracy.
3. Data are used to develop strategies to provide for safe irrigation water.

Lesson Essential Concepts

1. Water is critical for food production and is obtained from environmental water bodies such as streams and ponds as well as reclaimed water sources.
2. Contaminated and untreated irrigation water can transfer hazardous biological agents to human food.
3. Irrigation water must meet microbiological standards for use on food crops.
4. Environmental water is sampled and tested prior to use for irrigation of food crops.
5. Protocols for sampling and analyzing water are standardized to assure integrity of samples and accuracy of results.

Recommendations for Use

The digital narratives are part of a multifaceted set of educational resources that also include animations, a presentation, an interactive investigation, water sampling and testing simulations, infographics, and glossary to support learning styles and degrees of active learning of fundamental concepts and their application for addressing societal needs. The resources are complementary but can be used independently. It is recommended the students view the animations for an overview of issues surrounding water use and scarcity. A presentation provides more detail on microbiological safety of foods and the role of water for safe food production. Digital narratives feature researchers and the role of laboratory investigations and laboratory processes used to evaluate water quality. The simulations provide students the opportunity to work through the experimental procedures presented in the digital narratives. The interactive illness outbreak investigation is a problem-based and collaborative approach to understanding the connection between water and food safety, and more broadly, the interdependence of human, animal, plant, and environmental health.

Complementary Educational Resources

- Animations
<https://innovativemedia.nmsu.edu/consERVE.html>
- Presentation
Food and Water Safety for One Health
- Water Sampling and Testing Simulations
<https://consERVE.nmsu.edu/>
- Interactive Outbreak Investigation
<https://www.udel.edu/academics/colleges/canr/departments/animal-and-food-sciences/affiliated-centers/consERVE/outbreak-investigation/>

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