

'Save our Plants' Activity



Teaching notes

This activity is designed to help teach students about the various issues surrounding food production and the control of plant diseases. It looks at the benefits and risks associated with three different methods for controlling plant diseases: use of pesticides, bio-control agents and genetically modified crops. Students debate the benefits and risks of these methods and then come to a group decision about how best to 'Save our Plants'.

Note: This activity aims to stimulate informed debate around the issues of plant disease control. The BSPP does not advocate any particular type of plant disease control method or any of the views presented in the resources linked to this activity.

KS3 Biology Curriculum (June 2014) Links

This activity provides resources and activities to help teach about the following areas of the [GCSE curriculum](#).

Health, disease and the development of medicines

Communicable disease

- Explain how communicable diseases (caused by viruses, bacteria, protists and fungi) are spread in animals and plants
- Explain how the spread of communicable diseases may be reduced or prevented in animals and plants, to include a minimum of one common human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS.

Scottish Higher Curriculum Links

Course Support Notes for [Higher Biology Curriculum](#).

Sustainability and Interdependence

Food supply, plant growth and productivity.

- (A) Food supply. (i) Food security and sustainable food production.
- (F) Genetic technology. Genetic transformations in plant breeding include Bt toxin gene for pest resistance, glyphosate resistance gene for herbicide tolerance and golden rice, a cultivar that contains a precursor of vitamin A.

Crop protection

- (A) Weeds compete with crop plants, while pests and diseases damage them all, reducing productivity.
- (B) Control of weeds, pests and diseases by cultural means. The advantages of plant protection chemicals which are selective or systemic.
- (C) Problems with plant protection chemicals may include toxicity to animal species, persistence in the environment, accumulation or magnification in food chains, producing resistant populations
- (D) Biological control and integrated pest management. Risks with biological control.

Aims and Objectives

- To learn about the challenges associated with producing food.
- To learn about how plant diseases affect our ability to produce enough food.
- To learn about the different ways farmers can control plant disease, and their potential benefits and risk
- To understand the importance of the decisions made about plant disease control and work towards a consensus in the class.

Summary of this activity

- 5 mins: Starter questions to get students thinking about plant diseases and their importance.
- 20 mins: Powerpoint presentation (Appendix 1) introduces key plant disease and control concepts.
- 30 mins: In groups of three, ask students to read the A4 Information Sheets on: pesticides (Appendix 2), bio-control (Appendix 3) and GM (Appendix 4) methods to control plant diseases. Each student should then represent one control method in a debate. Students prepare answers to questions to give structure to debate.
- 20 mins: In their groups of three, students debate the benefits and risks for control methods. Tell students that although they are representing a particular method, they should keep an open mind, as they will need to vote for which they think is actually the best way to 'Save our Plants'.
- 10 mins: Have full class discussion to summarise what the students have learnt and what their personal opinions are.
- 5 mins: Give each student three tokens to vote for either one control method or a combination of control methods.

Summary: Explain that deciding how to control plant disease is a very complicated process. Some people believe that a combination of using pesticides, bio-control and GM techniques could be used to produce enough affordable food, whilst reducing environmental damage. Note: We have created A3 version of the resources, which you may find useful for classroom displays (see Appendix).

Background Reading

Food security and the ‘perfect storm’

Today the world is faced with a huge problem; how to produce enough food for everyone. It's not just enough to produce calorie-rich food. To be healthy we also need food to be nutritious; rich in vitamins and minerals.

Already there are approximately 900 million people living in extreme hunger and many more who are not getting enough vitamins and minerals¹. The global population is set to rise from 7.2 billion in 2014 to 9.6 billion in 2050². With an extra 2.4 billion people to feed, we'll need to grow much more food. To produce enough food, it's estimated that global agricultural production needs to increase by 60% from 2005 – 2050³. If this production is going to be sustainable, we'll need to avoid using more land and fossil fuels to reduce environmental damage.

Food costs are already increasing; in 2008 a price spike led to increases of 130% for wheat and 74% for rice and causing riots in 36 countries⁴. As food gets progressively more expensive, there is an increased likelihood of food riots and global unrest.

Damage by plant pests and pathogens

Currently up to 40% of crops are lost to pests and diseases⁵; these include insects, fungi, bacteria, viruses and other plant pathogens. Fungal diseases such as rice and wheat rust are of particular concern. In 1999 a new strain of wheat rust disease, capable of causing disease in most wheat varieties grown globally, was discovered in Uganda. It has already spread to Ethiopia and across the Red Sea to Iran. If this disease were to spread to Pakistan, a large producer of cereal crops, there could be a global food crisis⁶.

Control of plant diseases

People have been controlling plant disease since the birth of crop cultivation in Egypt around 11,000 years ago. Today a combination of farming techniques, chemicals, biological control and plant resistance, including GM are being used. These methods will be discussed within the activity. To protect our crops and produce enough food, it's vital to inspire people to develop skills and knowledge in this area.

Further reading

- A key paper for this debate is: Seufert, V., Ramankutty, N., & Foley, J.,A., 2012. Comparing the yields of organic and conventional agriculture. *Nature*, 485, p. 229-234 ([read here](#)).
- An overview of plant science in the UK: UK Plant Sciences Federation Current Status and Future Challenges Report ([read here](#)).
- A guide to GM practices and policies ([read here](#)).

1. Starter Questions

To get students thinking about plant diseases and their importance, ask them:

- Do they think plants can get diseases?
- Have they ever seen a diseased plant? If so, where and what were the symptoms?
- Why do they think plant diseases are important?
- What impact do they think plant diseases have on our global food security and forests?

Key points: Try to get students to think about where they may have seen plant diseases. For example they will have noticed that fruit goes mouldy, which is very often due to the fungus *Botrytis cinerea*. They may have also seen the fungus rose black spot in their gardens, or cankers on tree trunks in the park, which are caused by bacteria

Explain that plant diseases have a massive impact on the amount of food farmers produce and transport to feed the global population. Plant diseases also affect our forests, woodland and natural areas. For example ash dieback is currently threatening UK ash trees, which form a major part of our landscape.

2. Powerpoint Presentation

Go through the Powerpoint presentation (Appendix 1) to discuss why plants are important, introduce the different types of microorganisms that infect plants, why they're important and the different options for controlling plant diseases. Explain that in this lesson they will be focusing on three different plant disease control methods: pesticides, bio-control and genetically modified crops.

3. Preparing for the debate

Ask students to read the three A4 Information Sheets on: pesticides (Appendix 2), bio-control (Appendix 3) and GM (Appendix 4) methods to control plant diseases and to each represent one control method in a debate.

Once they have read the information, ask the students to prepare answers to the questions below. This should help structure their debates.

1. How does your control method benefit the environment?
2. How is your control method cost effective?
3. How will your control method help plants to resist damage from plant pathogens/diseases?
4. How will your control method help produce enough food sustainably?

5. What are the weaknesses in the other two control methods?
6. Which benefits and drawbacks do you think are the most important for your control method?

Extension:

Students may wish to find other resources to help develop their arguments. Below are links to a few resources that may be useful. Students can search the internet for other resources, but should be cautious and be aware that some resources may be opinion-based rather than based on peer reviewed scientific findings.

- '[Neonicotinoids ban makes pest control harder for Oil Seed Rape](#)'. Farmers Weekly. 24/01/2014.
- '[Pesticides and Food: Health Problems Pesticides May Pose](#)'. U.S. Environmental Protection Agency.
- '[Opinion: Does farm technology make us smarter?](#)' Farmers Weekly. 02/03/2014.
- '[Council for Science and Technology letter to David Cameron, advising on GM Technologies in the UK](#)'. 21/11/2013.
- '[India puts GM crop trials on hold](#)' The Guardian, Environment Blog. 31/07/2014.
- '[Speckled beetle key to saving crops in Ethiopia](#)'. Phys.Org. 22/08/2014.
- '[Study of Wasps Imported to Hawaii Shows Risks of "Biocontrol"](#)'. National Geographic. 21/08/2001.

Debate

Ask students to work in their groups of three to debate the benefits and risks of each plant disease control method, using their arguments they have prepared. Tell students that although they are representing a particular method, they should keep an open mind, as they will need to vote for which method(s) they think are actually the best to 'Save our Plants'.

Once students have had a chance to go through a full debate, have full class discussion to summarise what the students have learnt and what their personal opinions are.

Vote

Give each student three votes, which they can mark on the board next to each control method. Once every student has had a chance to vote, see whether votes are evenly spread or if there is a clear preferred method. Explain that in reality, growing crops is very complicated. Different control methods are chosen depending on many factors, such as: the type of plant, the local area, legislation, availability of resources, weather conditions and much more. Combinations of methods can also be used, for instance GM crops are still sprayed with pesticides.

Summary

In summary, the students have learnt about how important plants are and the vital food, oxygen and materials they provide us with. There are lots of problems with growing crops, including pests and pathogens which reduce the amount of food we can grow and eat. Farmers use a range of methods to control plant diseases, including: pesticides, bio-control agents and genetically modified crops. There are benefits and risks associated with these methods and lots of consideration and discussion should go into deciding which method should be used for certain situations.

6. Extension Activity

Ask students to write a newspaper article for the 'Farmers Weekly' magazine to talk about why they've chosen to invest in their chosen control method(s).

7. Appendix Resources

1. Powerpoint Presentation
2. Pesticides Information Sheet (A4), (A3).
3. Bio-control Information Sheet (A4), (A3).
4. GM Information Sheet (A4), (A3).
5. Introduction Poster (A3).

These resources can be found on the page: [BSPP secondary school education resources page](#).

8. References

1. The State of Food Insecurity in the World Report (2012). Food and Agriculture Organisation, United Nations.
2. World population prospects: the 2012 revision, highlights and advance tables (2013). United Nations, Department of Economic and Social Affairs, Population Division. Working paper ESA/P/WP.228.
3. Alexandratos, N., and Bruinsma, J. (2012). World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO.
4. The cost of food: Facts and Figures. BBC News (2008): <http://news.bbc.co.uk/1/hi/world/7284196.stm>.
5. OECD-FAO Agricultural outlook 2012-021. OECD Publishing and FAO (2012).
6. Food and Agriculture Organisation Wheat Rust Disease Programme: <http://www.fao.org/agriculture/crops/core-themes/theme/pests/wrdgp/en/>

9. Contact

We would really like to hear your feedback on this activity. Please get in touch: outreach@bspp.org.uk and visit: www.bspp.org.uk/outreach/education.php for more resources.