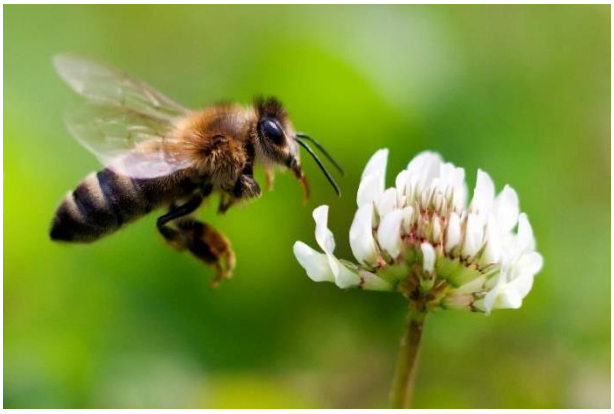
BUG "BEE" Gone

By Diedre Young, Soybean Science Challenge



Arkansas NGSS Standards Suggestions:

Integrated Biology:

BI-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

BI-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability and aesthetics as well as possible social, cultural and environmental impacts. (This can be a separate lesson or incorporated into this lesson).

Science Practices: Using Mathematics and Computational Thinking (BI3-ETS1-4), Constructing Explanations and Designing Solutions (BI-LS2-7), Engaging in Argument from Evidence (BI-LS2-6).

Disciplinary Core Ideas: LS4.C: Adaptation, LS2.A: Interdependent Relationships in Ecosystems. LS4.D: Biodiversity and Humans. ETS1.B: Developing Possible Solutions.

Crosscutting Concepts: Cause and Effect (BI-LS2-8, BI-LS4-6). Scale and Quantity (BI-LS2-1). System and System Models (BI3-ETS1-4)

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.9, WHST.9-12.2, WHST.9-12.7

Connections to the Arkansas Mathematical Standards: MP.2, MP.4, HSN.Q.A.1-3, HSS.ID.A.1

BI-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Connections to the Arkansas Disciplinary Literacy Standards: RST.11-12.1, RST.11-12.7, RST.11-12.8, RST.11-12.9

Connections to the Arkansas Mathematics Standards: MP.2, MP.4, HSN.Q.A.1,2,3.

BI7-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

Science Practices: Constructing Explanations and Designing Solutions (BI-ESS3-4). Engaging in Argument from Evidence (BI-ESS3-2). Asking Questions and Defining Problems (BI7-ETS1-1)

Disciplinary Core Ideas: Human Impacts on Earth Systems (BI-ESS3-3, BI-ESS3-4). Defining and Delimiting Engineering Problems (BI7-ETS1-1).

Crosscutting Concepts: Cause and Effect (BI-LS2-8, BI-LS4-6). Scale and Quantity (BI-LS2-1). System and System Models (BI3-ETS1-4)

Objective: Students will understand why honeybees are important to our ecosystems and the adverse impact various issues (such as disease, parasites, and insecticides) have had on honeybees, thus causing a decrease in bee populations in recent years. This lesson focuses on how to lessen the impact insecticides have on honeybees. Keep in mind insecticide usage is necessary with commercial crops; however, students are encouraged to come up with various solutions to decrease insecticide impact, using soybean plants as a source of food for local insects with the goal of finding viable alternatives to help lessen chemicals on crops.

Assessment: Students will do a gallery walk of their findings and will include costs/economic impact of alternative on commercial farming. Students will incorporate both PE into the presentation.

Key Points: biodiversity, human impacts, impact mitigation

Materials: Plastic containers (can be margarine tubs, yogurt tubs, cut 2L soda bottles, etc.), at least four per group of four students, soybean seeds, soil from the school yard (potting soil can also be used) and various products that students choose to use as a natural insecticide for plants. Soybean seeds can be ordered online; go to www.uaex.uada.edu/soywhatsup and click on the 'shop for seeds' link.

Note: Suggestions would be planting garlic or onions with the soybeans or even Chrysanthemums, using Neem Oil, etc.

Preparation: Soybean seeds take about eight to ten days to germinate in ideal conditions (kept warm and moist). Have the students do the planting/watering in anticipation of the lesson. By involving the students from the beginning, they will have time to brainstorm what insect deterrents they will use when the plants begin to sprout. Keep the plants indoors until sprouting then they need to go outside.

Time Duration: From planting to presentation, anticipate about four weeks although the daily time amount for plant care, checking the plants for insects/insect damage and photographing the plants will be about 10 minutes each day.

Elicit:

Do a KWL chart about what students know about plant growth and insect impact on plants (both beneficial and adverse). Honeybees should come up in the discussion so focus on why honeybees are important to most commercial crops.

Engage:

Show the video "The Death of bees explained" https://www.youtube.com/watch?v=GqA42M4RtxE to show students what is possibly happening to honey bees.

Go to https://www.youtube.com/watch?v=KZCTP3lyIDY to show that a loss of local honeybees means bees must be shipped around the country to pollinate important commercial crops. Shipping hives increases pest and disease on a bee population thus feeding into the overall loss of honeybees.

Explain:

Ask the class if anyone has not tasted honey and offer some for a taste (barring any allergen issues). You could also offer various varieties of honey as honey tastes differently based on the flowers the honeybees feed on.

European honeybees (*Apis mellifera*) are actually an invasive species to North America. They were introduced to North America in 1622. Honeybees not only pollinate plants but make honey, a valuable commercial crop itself. Refer to the role honeybees play in plant pollination and subsequent seed production of the pollinated plant. You can bring in commensalism, even mutualism between plants and honeybees. Based on the videos, pests, parasites, and insecticides have all taken their toll on honeybee populations. Bring in the ecological impact involved here along with the commercial impact on crops. Farmers can help honeybee populations by lessening the insecticide load without decreasing crop production. So how can this be done?

Elaborate:

Students are separated into groups and told they are going to brainstorm a proposal about how they can grow healthy plants with less insecticide. Tell them they are going to try their ideas on soybean plants. Give the groups as much time as needed to do research into what they can do to lessen insecticide loads. Proposal should include the research question, the background into the idea chosen, and the hypothesis.

Students should hand in proposals before planting as some students may be using beneficial side plants as their idea and will need to plant those seeds at the same time as the soybean seeds.

The experiment:

Students are given the four containers and soil and soybean seeds. Why four containers? (for controls and verification). Once the seeds are planted, tell the students they will need to water their pots daily and check for plant emergence. Once the plants emerge, they need to be put outside to be exposed to insects. Plants need to be checked daily, noting plant height, number of leaves, leaf color and leaf/stem insect damage on both the control and experimental plants. If insects are present on the plants, this needs to be noted also. Students can take daily pictures of their plants to add a technology bend to the experiment.

The results:

Students will need to put together a data table that has a comparison of the plant height, leaf number, leaf color and insect damage. Students can choose what they would like to compare based on that list between the experimental and control plants. Data point graphs should also be done to show differences in the plants over time. *

*If students do not know how to do a point graph, refer them to https://nces.ed.gov/nceskids/graphing/Classic/ and have them follow the prompts for making a graph.

Evaluate:

After experimentation, students should now have everything needed to do a gallery walk presentation about their insecticide alternative. The following should be included: a stated research question, the background on their alternative, hypothesis, how they conducted the experiment, a created data table and graph, and what their conclusion was based on their data.

Students need to also include a cost and application analysis. While using Neem Oil works well on getting rid of insects, is it really cost effective and can it be applied in a widespread manner?

Evaluation should be based on how well the alternative is addressed and data presentation.

Extend:

After all the gallery walk presentations are done, do a class discussion about which insecticide alternative is really feasible in a commercial crop setting. Maybe none are or maybe there are many options. Have the class come up with ways their chosen alternative could be presented to local farmers to consider using in their fields, keeping in mind cost and application issues. Have the students write a letter to a local farmer explaining what they have learned and why the farmer should consider trying the alternative, backing their thoughts up with their research and experiment results.