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About This Curriculum

This curriculum introduces advanced middle school or high school students to Bt crops, such as corn and cotton, into which DNA from the naturally-occurring soil bacterium *Bacillus thuringiensis* has been incorporated to produce resistance to certain insects.

This unit is intended for use with students and educators in science, nutrition, agriculture, or family and consumer sciences. Teachers are encouraged to involve language, math, speech, and other instructors in the interdisciplinary activities. Extension educators may find these materials useful for their youth and adult audiences.

Through four lesson modules, participants in the activities learn about

- the biotechnology science behind Bt crops,
- specific Bt crops,
- production issues for farmers and processors, and
- ethical, legal, and social issues related to Bt crop production.

Using an inquiry-based approach and the experiential learning model illustrated below, participants conduct “See For Yourself” activities that reinforce the science principles being taught. The Teacher/Leader information for each activity includes the science content and how it relates to the National Science Education Standards, as well as the science process skills.

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**Experiential Learning Model**

1. **Experience**
   - the activity; perform, do it

2. **Share**
   - the results, reactions, and observations publicly

3. **Process**
   - by discussing, looking at the experience; analyze, reflect

4. **Generalize**
   - to connect the experience to real world examples

5. **Apply**
   - what was learned to a similar or different situation, practice

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*Iowa State University Extension and ISU Office of Biotechnology*
National Science Education Standards and Associated Concepts and Principles

All activities in this curriculum relate to Content Standard A, Science as Inquiry, as developed by the National Research Council. Some activities also relate to Content Standard B, Physical Science; Content Standard C, Life Science; or Content Standard F, Science in Personal and Social Perspectives. To help educators locate the standards and underlying concepts and principles cited for each activity, the page number and first sentence or two of the applicable principle are cited in the “Science Education Standards” section of the instruction pages for teachers and leaders. All page numbers refer to the seventh printing of the National Science Education Standards, November 1999. The National Science Education Standards are also available on the Internet at http://books.nap.edu/html/nses/pdf/index.html.

Content Standard A – Science as Inquiry
As a result of activities in this curriculum, students in grades 9-12 should develop

• abilities necessary to do scientific inquiry
  – identify questions and concepts that guide scientific investigations
  – design and conduct scientific investigations
  – use technology and mathematics to improve investigations and communications
  – formulate and revise scientific explanations and models using logic and evidence
  – recognize and analyze alternative explanations and models

• understanding about scientific inquiry
  – scientists conduct investigations to
    1. explain new discoveries
    2. test conclusions
    3. explain observed phenomena

Content Standard B – Physical Science
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of chemical reactions.

Content Standard C – Life Science
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of

• the cell
• the molecular basis of heredity
• interdependence of organisms
• biological evolution
• matter, energy, and organization in living systems
• behavior of organisms

Content Standard F – Science in Personal and Social Perspectives
As a result of activities in this curriculum, students in grades 9-12 should develop an understanding of

• personal and community health
• population growth, specifically natural populations of insect pests
• natural resources
• environmental quality, specifically natural ecosystems
• natural and human-induced hazards
• science and technology in local, national, and global challenges