

LEARNING EXPERIENCE FOUR

Guiding Question: What needs do crop plants have?

This **Learning Source** and accompanying **Build Competencies** activities explore the importance of understanding life cycles for crop production, looking at the growth stages of canola and dry bean plants. The concept of limiting factors in crop environments are used to examine growing requirements – nutrients, water, and soil and the inputs that farmers use such as fertilizers and herbicides.

This Learning Source provides starting points and information to investigate: • The importance of cycles • Case in point: canola • Case in point: dry beans • Case in point: wheat Challenge students to hypothesize and illustrate the connections they think exist between the life cycle of a crop plant and a crop production cycle. Have them use a cycle diagram to illustrate these connections. Although students focused on one crop plant in their examples, explain that this is not the only practice that farmers use today. Discuss the concept of monoculture – growing one crop by itself, rather than with a diversity of crop plants that mirrors the diversity found in natural ecosystems. Many farmers now grow different types of crops in rotation. Pose discussion questions such as the following: • What do you think some of the consequences of having only one type of crop growing in an area could be? • What benefits does plant diversity provide to natural ecosystems? (Note that biodiversity – the variety of species in the same agricultural ecosystem – can help with pest management, soil fertility and other growing needs.) • How do you think a crop field would get the same benefits if different crops are grown?	Build Competencies: Interpreting Growth Factors Students explore the use of a growth staging guide as a context for assessing the life cycle of a crop plant; examine the concept of limiting factors to build understandings of the suitability of crops to specific growing environments and design a lab to explore the use of inputs like fertilizers. This handout includes activities that support competencies, literacy and numeracy, and weblinks to online resources that can support student learning. 	  Assess Look for evidence of understanding of the following concepts: • Crop production • Life cycles • Growth stages • Growth factors • Limiting factor • Fertilizer • Herbicides • Invasive plants For a formative assessment, assess the growth staging guides they complete in the Build Competencies activity for understanding of plant life cycles and the impact of growing environments and conditions. The labs that students have the option to design in the Build Competencies handout can also be assessed for understandings of the connection between soil conditions and crop plant life cycles. Students can also revise or add to the cycle diagrams they complete to illustrate what a crop production cycle could look like in the future. Students can alternatively choose to demonstrate their understanding of crop plant life cycles in different ways, including a cartoon strip, skit or model.
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Additional Research or Background Sources

Consult teacher or student background sources such as the examples that follow to further explore, enrich or expand activities for this guiding question. Student research sources are also provided in **Build Competencies** handouts.

The Let's Talk Science website includes a lesson on Plant Life Cycles that can provide a review for students at <https://letstalkscience.ca/educational-resources/lessons/plant-life-cycle>. Students can be encouraged to make comparisons to the life cycles of crop plants.

The Let's Talk Science website also provides a series of photos that show some stages of lettuce growth from planting to growth to harvesting at <https://letstalkscience.ca/educational-resources/picture-collections/plants-growth>. Students can be challenged to create a similar display, along with captions, as they explore crop growth stages and crop production cycles.

Alberta Pulse Growers provides detailed information about the growth stages and growing conditions of pulses in Growing Pulses at <https://albertapulse.com/growing-pulses/>. The Canola Council of Canada provides detailed information in the Canola Encyclopedia: Growth Stages at www.canolacouncil.org/canola-encyclopedia/growth-stages/.

The information in both Growing Pulses and the Canola Encyclopedia is suitable for teacher background or for guided student exploration. Students could also be asked to select and use this detailed information about crop plant growth stages to create an image storyboard showing its growth and a corresponding storyboard that demonstrates its processing into a food product.

Alberta Farmer Express provides an interesting article that discusses visions of crop production for the future – in Visions of the future: Canada's crop sector looks ahead, accessed at www.albertafarmexpress.ca/crops/visions-of-the-future-canadas-crop-sector-looks-ahead/. Quotations such as the following from this article could be shared with students as discussion starters and to help set context for exploring sustainability and growing needs of crop plants as well as the soil diversity in Alberta.

"In our area of the province, there's a lot of farms that just have a wheat-canola or a barley-canola rotation," said the Alberta Pulse director, who farms northwest of Edmonton. "I don't think that's sustainable. We're seeing more disease issues popping up like clubroot and blackleg in our canola and fusarium head blight in wheat. I think we just need to have a little bit more diversity."

"The [wheat] varieties we're growing now are capable of some yields that were unheard of a decade ago."



Additional information and discussion questions are provided in the carousel slide for this guiding question in the **food DIVERSITY** section of the **LEARN** webpage.

Click on the carousel slide to open and explore the following content.

- Using growth staging guides
- Growth factors
- Farming stories
- Growth decisions
- Fertilizer choices
- Resisting weeds

CBC News provides the article Win-win: Better fertilizer use by farmers saves money and the environment at www.cbc.ca/news/canada/saskatchewan/green-farms-fertilizer-environment-crops-farming-1.5224089. Work with students to identify points that illustrate the benefits of using fertilizers sustainably.

Students can find information on research conducted with pulse crops in southern Alberta in the article, Keeping a Pulse on the Soil at www.no-tillfarmer.com/articles/5722-keeping-a-pulse-on-the-soil. The article discusses the nitrogen-fixing ability of pulses and their impact on soil quality, as well as reduced tillage and cover crops practices.

> ACCOMMODATE AND/OR EXTEND LEARNING

Plan to have students work in groups to grow bean plants to demonstrate the stages in a crop plant's life cycle. Provide options for testing how fast the bean plants grow in different soils, with different amounts of water, and if appropriate, with the addition of fertilizer. Document the growth of the bean plants with photos and descriptions. Create an area in the classroom or on a digital bulletin board to create a **life cycle and growth factor display**.

- Gather three or four different types of soil from different locations – potting and topsoil can be used and a soil mixture that includes sand or small rocks can be made. Measure the same amount of different types of soil in planting cups and plant each bean seed in the same way and ensure each plant gets the same amount of water. Establish observation logs for students to record the plants' growth weekly.
- Use bean seeds planted in the same soil type in three or four different pots to experiment with the effects of different amounts of water. Have students research and identify the optimal amount of water for the plant. Use varying amounts of water weekly for each plant. Keep observation logs to record the amount of water provided and how the plant grows.
- Experiment with different amounts of fertilizer on another group of bean seeds planted in the same soil type and with the same watering schedule.
- Compare the growth of different bean varieties planted in the same soil type and with the same watering schedule. Use dry pea, lentils and faba beans to compare growth rates and life cycles.

Encourage students to make connections to the decisions that farmers make about crop production. As a collaborative class activity, focus students on these decisions by asking them to brainstorm questions or statements on digital or paper sticky notes and identify those that could lead to further research.



Find **Science 7** learning outcomes supported by this learning experience on the following page.

Use this activity to focus on the connections between the life processes and structures of crop plants and their growing environments, including the practices that farmers use to monitor crop growth and make decisions about the use of fertilizer and pesticides. Encourage students to assess the advances made in farming practices that have resulted in higher crop yields using fewer resources.



LEARNING EXPERIENCE FOUR: LEARNING OUTCOMES AND COMPETENCY MAP

project AGRICULTURE Activity	GRADE 7 SCIENCE	
	CONCEPTUAL KNOWLEDGE	PROCEDURAL KNOWLEDGE
LEARNING SOURCES What needs do crop plants have? BUILD COMPETENCIES Interpreting Growth Factors 	Grade 7 Unit B: Plants for Food and Fibre 1. Investigate plant uses; and identify links among needs, technologies, products and impacts - investigate practical problems and issues in maintaining productive plants within sustainable environments, and identify questions for further study (e.g., investigate the long-term effects of irrigation practices or fertilizer use) 2. Investigate life processes and structures of plants, and interpret related characteristics and needs of plants in a local environment - investigate and interpret variations in plant structure, and relate these to different ways that plants are adapted to their environment (e.g., distinguish between plants with shallow spreading roots and those with deep taproots; describe and interpret differences in flower form and in the timing of flower production) - describe life cycles of seed plants, and identify example methods used to ensure their germination, growth and reproduction (e.g., describe propagation of plants from seeds and vegetative techniques, such as cuttings; conduct a germination study; describe the use of beehives to support pollination) 3. Analyze plant environments, and identify impacts of specific factors and controls - describe methods used to increase yields, through modifying the environment and by creating artificial environments (e.g., describe processes used in raising bedding plants or in vegetable production through hydroponics) - describe and interpret the consequences of using herbicides, pesticides and biological controls in agriculture and forestry 4. Identify and interpret relationships among human needs, technologies, environments, and the culture and use of living things as sources of food and fibre - investigate and identify intended and unintended consequences of environmental management practices (e.g., identify problems arising from monocultural land use in agricultural and forestry practices, such as susceptibility to insect infestation or loss of diversity)	Grade 7 Unit B: Plants for Food and Fibre Ask questions about the relationships between and among observable variables, and plan investigations to address those questions - identify questions to investigate arising from practical problems and issues (e.g., What methods will help limit moisture loss from plants and soil? What reduction in the loss of soil moisture can be achieved through the use of a plastic ground sheet or through the use of a plastic canopy?) - rephrase questions in a testable form, and clearly define practical problems (e.g., rephrase a broad question, such as: "What amount of fertilizer is best?" to become "What effect will the application of different quantities of fertilizer X have on the growth of plant Y and its environment?") - state a prediction and a hypothesis based on background information or an observed pattern of events (e.g., predict the effect of a particular plant treatment) - formulate operational definitions (e.g., define the health of a plant in terms of its colour and growth pattern) Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data - research information relevant to a given problem - observe and record data, and create simple line drawings (e.g., describe plant growth, using qualitative and quantitative observations; draw and describe plant changes resulting from an experimental procedure) Analyze qualitative and quantitative data, and develop and assess possible explanations - compile and display data, by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs and line graphs (e.g., prepare a record of a plant's growth that charts its development in terms of height, leaf development, flowering and seed production) Work collaboratively in carrying out investigations and in generating and evaluating ideas (e.g., assume responsibility for their share of work in preparing for investigations and in gathering and recording evidence; consider alternative ideas and approaches suggested by members of the group; share the responsibility for difficulties encountered in an activity)