



 **CANADIAN  
AGRICULTURAL  
PARTNERSHIP**  
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# Connecting Agriculture to Alberta Junior High School Curriculum

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Alberta 

Canada 

*This guide provides an overview of connections to agriculture that can be developed around Alberta competencies, literacy and numeracy supports and programs of study for Science, Social Studies, Health/Wellness and Career and Technology Studies courses.*

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*A new survey from Linking Environment and Farming (LEAF) has found that although teenagers' knowledge of food and farming is "limited" there is a "real desire" to know more about how food is produced.... Interestingly, in a sector that frequently talks about a skills gap and worker shortages, almost a third of teens – 32% – said they would consider a career in food and farming. But only 22% reported being provided with information on the options open to them.*

Askew, K (2018). *Teen trends: A 'real desire' to know more about how food is produced*. William Reed online: Foodnavigator.com. [www.foodnavigator.com/Article/2018/11/07/Teen-trends-A-real-desire-to-know-more-about-how-food-is-produced?utm\\_source=copyright&utm\\_medium=OnSite&utm\\_campaign=copyright](http://www.foodnavigator.com/Article/2018/11/07/Teen-trends-A-real-desire-to-know-more-about-how-food-is-produced?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright)

## Addressing Competencies

**Competencies** are combinations of knowledge, skills and attitudes that students develop and apply for successful learning, living and working. They emphasize aspects of learning that apply within and across all subject areas. Competencies should be explicitly addressed in programs and resources, with activities and strategies that support their development.

Competencies are integrated across all learning outcomes in curriculum at all grade levels. They are developed through and supported by learning activities and experiences in the classroom. Teachers observe for evidence of competencies in students' work, but do not evaluate the competencies.



## CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Communication

- > Integrate messages from agricultural stakeholders with different opinions, views or experiences to enrich understandings.
- > Model respect and responsibility when reinforcing communication skills.
- > Plan activities that encourage students to select style, content and format of messages to inform, instruct, motivate, persuade, or share ideas.
- > Share information through verbal and non-verbal formats.



## CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Collaboration

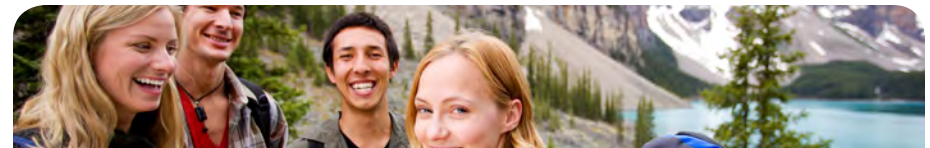
- > Build relationships and encourage the sharing of ideas between the real-world context of agricultural communities, individuals and students.
- > Provide opportunities for students to interview and/or work with individuals in agricultural industries.
- > Plan activities that encourage students to work together and contribute their own ideas.



## CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Critical Thinking

- > Provide opportunities for students to question and analyze evidence on the benefits and risks involved in agricultural practices, food security and food insecurity.
- > Plan activities that involve causes and consequences of economically and environmentally sustainable food production and agricultural practices.
- > Use activities that encourage students to compare and analyze different approaches and practices in agriculture.
- > Ask students to make predictions on future effects, results and trends in agriculture.



## CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Creativity and Innovation

- > Plan activities that ask students to create or manipulate tools, technologies and materials that are connected with food production and agricultural practices.
- > Share examples of innovative approaches that have been implemented by agricultural producers and researchers.
- > Provide background information on the technologies that contribute to agricultural innovation and change.



#### CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Managing Information

- > Use inquiry-based research methods to investigate the science involved in food production and agricultural practices.
- > Provide multiple sources of information that present and share different perspectives on issues involved with agriculture.
- > Ensure that students have opportunities to assess the reliability and validity of information that is presented to them.
- > Integrate background information on food production, agricultural practices and current trends and issues in farming.



#### CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Problem Solving

- > Share information about the needs and priorities of agricultural producers balanced with needs and priorities of the environment and society.
- > Ask students to take action to implement solutions and recommendations in response to agricultural issues and dilemmas.
- > Provide opportunities for students to work together and independently to examine evidence and generate solutions to problems and challenges in agriculture.



#### CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Cultural and Global Citizenship

- > Share perspectives on the values that are part of sustainable agricultural production, now and in the future.
- > Provide opportunities for students to demonstrate a commitment to environmental sustainability and stewardship.
- > Provide information that addresses the impact of agriculture on healthy and sustainable communities.
- > Explore the global context of agriculture, including the global marketplace, trade and government policies.
- > Examine and compare agricultural practices and products in other areas of the world.



#### CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Personal Growth and Well-being

- > Provide background information that informs students about influences on and impact of food choices.
- > Ask students to assess the personal connections they have to agriculture and food quality.
- > Integrate information that shares the interests, values, skills and education involved in careers connected to agriculture.



*Literacy and Numeracy are:*

- *Life-long and active processes that begin at birth and develop throughout one's lifetime*
- *Foundational to successful living, learning and participating in today's society*
- *Used to make decisions that impact one's life*
- *The means through which students develop knowledge and understanding in each subject/discipline area*
- *A shared responsibility of all K to 12 educators in all subjects or disciplines*

*We use literacy and numeracy every day when we interpret a utility bill, choose a cellphone plan, answer an email, post a message on social media, figure out how much paint to buy, compare prices at the grocery store or interpret a political cartoon.*

Alberta Education. *Literacy and Numeracy*: Author. Online <https://education.alberta.ca/literacy-and-numeracy/about-literacy-and-numeracy/>

## Addressing Literacy and Numeracy

Alberta Education's **literacy** and **numeracy** progressions are a series of outcomes that are used to support students in meeting the learning outcomes in the current provincial curriculum. They are integrated across all subject areas and are meant to be used to plan effective learning experiences that foster the development of literacy and numeracy.





## CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Literacy

**Literacy** is the ability, confidence and willingness to engage with language to acquire, construct and communicate meaning in all aspects of daily living. How can literacy be addressed with junior and senior high students?

- > Provide a broad range of sources (print, digital, videos, oral stories, experts, elders, accounts), including primary and secondary sources, to support responses to problems, questions or topics.
- > Build in strategies that ask students to identify misconceptions, perspectives, points of view and biases to determine the reliability, validity and authenticity of sources.
- > Provide opportunities for students to construct meaning by reflecting on and comparing their background knowledge of a concept or topic and applying multiple strategies when viewing, listening to and interacting with sources.
- > Use activities that ask students to organize the information they are presented with or research around a specific purpose or intent.
- > Provide opportunities for students to select and use different modes and media to represent and communicate their experiences, understandings and knowledge of concepts.
- > Integrate activities that encourage students to analyze and explain the ways media can be used to shape opinions and evoke emotions.



## CONNECTING AGRICULTURE TO ALBERTA CURRICULUM

### Numeracy

**Numeracy** is the ability, confidence and willingness to engage with quantitative or spatial information to make informed decisions in all aspects of daily living. How can numeracy be addressed with junior and senior high students?

- > Provide opportunities for students to use statistics, rates, percentages, scales and ratios in real-life situations connected to agriculture.
- > Build in strategies that ask students to make predictions based on agricultural and food production trends and priorities, sustainability trends and consumer trends in real-life situations.
- > Use activities that ask students to organize agriculturally related data and statistics, using charts and graphs, to make informed judgements and decisions.
- > Provide activities that ask students to use their knowledge of probability to evaluate claims and predictions to make informed decisions in real-life situations, focusing on sustainability, food quality and safety, health benefits and risks, climate change and other agricultural issues and challenges.
- > Integrate opportunities for students to use maps and other navigational tools to analyze land use and change.
- > Use activities that include diagrams and models to represent complex phenomena.



## Finding Topics and Themes in Alberta Curriculum

Students and society often have limited understanding of the sources, processes, and issues related to food production. However, there are numerous opportunities to connect to agriculture in Alberta curriculum and develop programs and resources that help teachers integrate important concepts related to food, the agriculture industry and environmental sustainability into their classrooms. Teachers need to see these curriculum connections in the subject areas they teach and find value in the approaches provided in programs and resources.

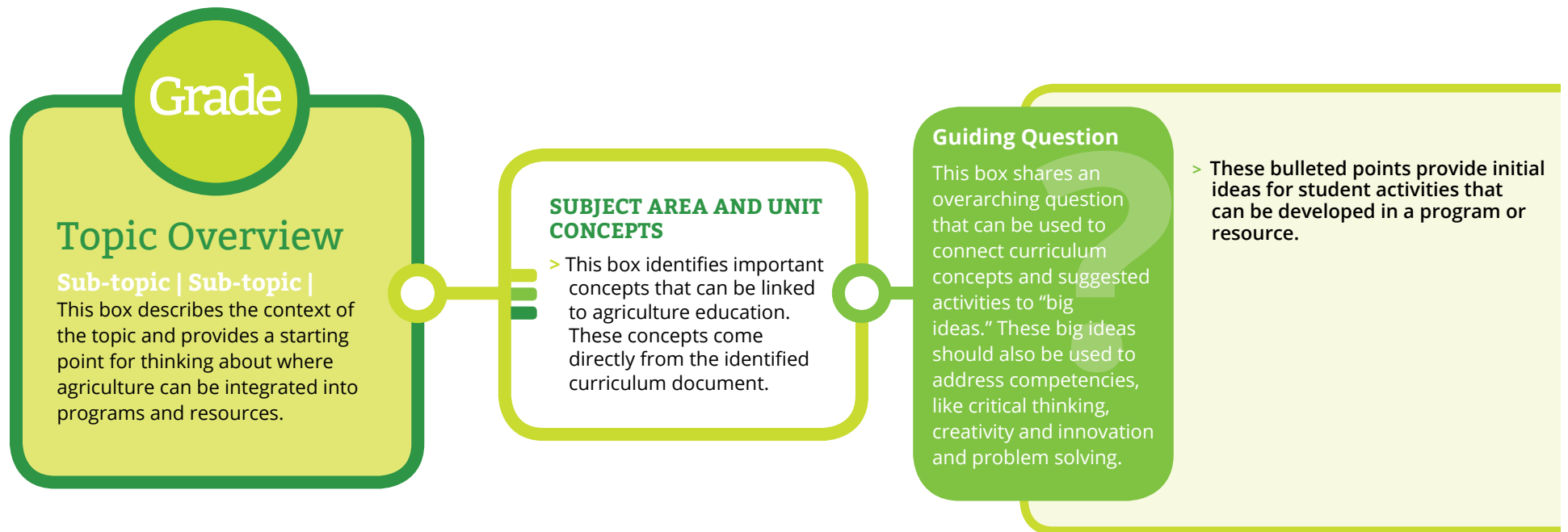
Most curriculum is developed around conceptual understandings and procedural knowledge and skills - or knowledge, skills and attitudes.

Agricultural topics and themes can be drawn from concepts identified in general and specific learning outcomes in curriculum documents. Activities can then be developed to integrate and support increased understandings of concepts related to food production and consumption, food safety, agricultural issues, and sustainability.

The following topics and themes are illustrated with an overview of examples of concepts and activity starters that are drawn directly from Alberta curriculum documents. Each topic and theme overview is followed by specific learning outcomes that teachers address in Social Studies, Science, Biology, Chemistry, Health and Life Skills, Career and Life Management (CALM) and Career and Technology Studies (CTS) courses.

- > **Environment and Sustainability** (Land, Energy, Water, Soil)
- > **Plants and Plant Health; Animals and Animal Welfare** (Crops, Livestock)
- > **Food and Agricultural Commodities** (Chemistry, Reactions, Nutrients, Food Production)
- > **Food Security and Economies of Food Production** (Globalization, Nationalism, Trade, Policies)
- > **Technologies** (Automation/Robotic Technology, Biotechnology, Genetics)

# How to Read the Topic and Theme Maps







 **CANADIAN  
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# Connecting Agriculture to Alberta Junior High School Curriculum Grade 7

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*Alberta* 

Canada 

# 7

## Environment and Sustainability

Land | Energy | Water | Soil

The use of land, energy, water and soil are central to agricultural practices and the food supply. Not only are resources such as soil and water vital to agricultural productivity, but agriculture both affects and is affected by the local, regional, and global environment. Concepts related to environmental issues and decisions in the Science curriculum can be explored through an agricultural lens.



### SCIENCE 7 Unit A

- > Interactions and interdependencies
- > Environmental monitoring
- > Environmental impacts
- > Producers, consumers, decomposers
- > Nutrient cycles and energy flow
- > Environmental management

How do human activities like agriculture affect and support ecosystems and their components?

- > Explore how the use of environments in Alberta and Canada have changed over time.
- > Investigate the range of agricultural products produced (food and fibre) and how these products result in benefits and challenges for ways of life.
- > Identify and describe the wastes that are produced by one plant-based or animal-based agriculture.
- > Identify producers, consumers and decomposers and describe how energy is supplied to and flows through a food web in an agricultural ecosystem.
- > Investigate how agricultural activities can challenge or support natural ecosystems.
- > Investigate the cycling of carbon and water through an agricultural ecosystem.

### SCIENCE 7 Unit B

- > Needs and uses of plants
- > Fertilizers and soil nutrients
- > Chemical and biological controls
- > Resource management
- > Sustainability

What are the benefits and challenges of agricultural practices and technologies used to grow crops?

- > Investigate and describe how land use has been changed over time by human activities – from natural environments to farmland.
- > Investigate the life cycles, processes and structures of two or more different crop varieties.
- > Analyze the environments in which agricultural crops grow – including the characteristics of different soils found in Alberta and practices that farmers use to protect the soil.
- > Investigate and create a comparison chart that analyzes the effects of herbicides, pesticides and biological controls in the growth of a specific crop.
- > Test the effect of different controls on crop plants.

# 7

## Environment and Sustainability

Land | Energy | Water | Soil

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 7 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

The outcomes identified for this topic are selected from Alberta programs of study and do not represent the whole curriculum. The style, numbers and numbering system used to identify these selected outcomes correlate directly to each specific program of study. The use of “i.e.” and “e.g.” in curriculum outcomes is deliberate, with “i.e.” indicating mandated and “e.g.” indicating optional learning expectations.



## SCIENCE

### Science 7 Unit A - Interactions and Ecosystems

#### Specific Learning Outcomes:

1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions
  - ✓ Illustrate how life-supporting environments meet the needs of living things for nutrients, energy sources, moisture, suitable habitat, and exchange of gases
  - ✓ Describe examples of interaction and interdependency within an ecosystem (e.g., identify examples of dependency between species, and describe adaptations involved; identify changing relationships between humans and their environments, over time and in different cultures—as, for example, in aboriginal cultures)
  - ✓ Identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments)
  - ✓ Analyze personal and public decisions that involve consideration of environmental impacts, and identify needs for scientific knowledge that can inform those decisions
2. Trace and interpret the flow of energy and materials within an ecosystem
  - ✓ Analyze an ecosystem to identify biotic and abiotic components, and describe interactions among these components
  - ✓ Analyze ecosystems to identify producers, consumers and decomposers; and describe how energy is supplied to and flows through a food web, by:
    - describing and giving examples of energy and nutrient storage in plants and animals
    - describing how matter is recycled in an ecosystem through interactions among plants, animals, fungi, bacteria and other microorganisms
    - interpreting food webs, and predicting the effects of changes to any part of a web
  - ✓ Describe the process of cycling carbon and water through an ecosystem
  - ✓ Identify mechanisms by which pollutants enter and move through the environment, and can become concentrated in some organisms (e.g., acid rain, mercury, PCBs, DDT)

3. Monitor a local environment, and assess the impacts of environmental factors on the growth, health and reproduction of organisms in that environment

- ✓ Identify signs of ecological succession in local ecosystems (e.g., emergence of fireweed in recently cut forest areas, replacement of poplar by spruce in maturing forests, reestablishment of native plants on unused farmland)

4. Describe the relationships among knowledge, decisions and actions in maintaining life-supporting environments

- ✓ Identify intended and unintended consequences of human activities within local and global environments (e.g., changes resulting from habitat loss, pest control or from introduction of new species; changes leading to species extinction)
- ✓ Describe and interpret examples of scientific investigations that serve to inform environmental decision making
- ✓ Illustrate, through examples, the limits of scientific and technological knowledge in making decisions about life-supporting environments (e.g., identify limits in scientific knowledge of the impact of changing land use on individual species; describe examples in which aboriginal knowledge—based on long-term observation—provides an alternative source of understanding)

## SCIENCE

### Science 7 Unit B - Plants for Food and Fibre

#### Specific Learning Outcomes:

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 needs of different plants and their tolerance for different growing conditions (e.g., tolerance for drought, soil salinization or short growing seasons)

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)
- ✓ Identify the effects of different practices on the sustainability of agriculture and environmental resources (e.g., identify positive and negative effects of using chemical fertilizers and pesticides and of using organic farming practices)



**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- ✓ Define practical problems (e.g., identify problems in growing plants under dry conditions)
- ✓ 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)

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✓ Identify strengths and weaknesses of different methods of collecting and displaying data (e.g., compare two different ways to measure the amount of moisture in soil; evaluate different ways of presenting data on the health and growth of plants)

# 7

## Plants and Plant Health; Animals and Animal Welfare

### Crops | Livestock

An understanding of life processes at the cellular level can be applied to the knowledge and skills required to ensure the health of animals and plants and the quality of the food supply. Concepts related to animal and plant growth and health are found in Science and Social Studies.



#### SCIENCE 7 Unit A

- > Interactions and interdependencies
- > Producers, consumers, decomposers
- > Nutrient cycles and energy flow
- > Species distribution

#### How do interactions in ecosystems have intended and unintended results?

- > Create an illustration of the biotic and abiotic components and interactions in an agricultural ecosystem.
- > Describe examples of energy and nutrient storage in livestock and crop plants.
- > Investigate evidence of interaction and change between animal and plant organisms in an agricultural ecosystem, such as a crop field.
- > Predict how the introduction of an organism affects livestock or crop plants (e.g. pest).
- > Investigate and describe the intended and unintended consequences of human activities in agriculture, such as pest control.
- > Diagram the nutrient cycle as it relates to crop growth and production.

#### SCIENCE 7 Unit B

- > Life processes and structure of plants
- > Fertilizers and soil nutrients
- > Chemical and biological controls
- > Plant varieties
- > Plant propagation and reproduction
- > Selective breeding

#### How are useful plant products produced?

- > Diagram the general structure and functions of a variety of crop plants.
- > Collect and interpret data on different crop plants to investigate and compare their tolerance for different growing conditions, including soil needs and growing seasons.
- > Use crop plants to describe the processes of diffusion, osmosis, conduction of fluids, transpiration, photosynthesis and gas exchange.
- > Illustrate the work that is done in a greenhouse, applying knowledge about propagation of plants from seeds and vegetative techniques, such as cuttings.
- > Create a timeline to trace the development of crop plant varieties through selective breeding, such as the development of new grain varieties.

# 7

## Plants and Plant Health; Animals and Animal Welfare

### Crops | Livestock

The outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 7 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and correlate them to the activities that are created. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

The outcomes identified for this topic are selected from Alberta programs of study and do not represent the whole curriculum. The style, numbers and numbering system used to identify these selected outcomes correlate directly to each specific program of study. The use of “i.e.” and “e.g.” in curriculum outcomes is deliberate, with “i.e.” indicating mandated and “e.g.” indicating optional learning expectations.



## SCIENCE

### Science 7 Unit A - Interactions and Ecosystems

#### Specific Learning Outcomes:

1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions
  - ✓ Identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them (e.g., identify impacts of the use of plants and animals as sources of food, fibre and other materials; identify potential impacts of waste products on environments)
2. Trace and interpret the flow of energy and materials within an ecosystem
  - ✓ Analyze an ecosystem to identify biotic and abiotic components, and describe interactions among these components
  - ✓ Analyze ecosystems to identify producers, consumers and decomposers; and describe how energy is supplied to and flows through a food web, by:
    - describing and giving examples of energy and nutrient storage in plants and animals
    - describing how matter is recycled in an ecosystem through interactions among plants, animals, fungi, bacteria and other microorganisms
    - interpreting food webs, and predicting the effects of changes to any part of a web

**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- ✓ Identify science-related issues (e.g., identify a specific issue regarding human impacts on environments)
- ✓ Identify questions to investigate arising from practical problems and issues (e.g., identify questions, such as: “What effects would an urban or industrial development have on a nearby forest or farming community?”)
- ✓ State a prediction and a hypothesis based on available evidence and background information (e.g., hypothesize how biochemical interconversions of starch and glucose might regulate the turgor pressure of cells; hypothesize the direction of root and plant growth of a bean plant growing on a rotating turntable, and predict the effects of varying RPMs on the angle of growth)

- ✔ Select appropriate methods and tools for collecting data and information (e.g., select or develop a method for estimating a plant population within a given study plot; design a survey as a first step in investigating an environmental issue)

Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data

- ✔ Research information relevant to a given problem or issue
- ✔ Select and integrate information from various print and electronic sources or from several parts of the same source (e.g., compile information on a global environmental issue from books, magazines, pamphlets and Internet sites, as well as from conversations with experts)
- ✔ Use tools and apparatus effectively and accurately for collecting data (e.g., measure factors, such as temperature, moisture, light, shelter and potential sources of food, that might affect the survival and distribution of different organisms within a local environment)
- ✔ Estimate measurements (e.g., estimate the population of a given plant in a one square metre quadrat, and use this figure to estimate the population within an area of 100 square metres)

## SCIENCE

### Grade 7 Unit B - Plants for Food and Fibre

#### Specific Learning Outcomes:

1. Investigate plant uses; and identify links among needs, technologies, products and impacts
  - ✔ Describe human uses of plants as sources of food and raw materials, and give examples of other uses (e.g., identify uses of plants as herbs or medicines; describe plant products, and identify plant sources on which they depend)
2. Investigate life processes and structures of plants, and interpret related characteristics and needs of plants in a local environment
  - ✔ Describe the general structure and functions of seed plants (e.g., describe the roots, stem, leaves and flower of a common local plant)
  - ✔ 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)
  - ✔ Investigate and interpret variations in needs of different plants and their tolerance for different growing conditions (e.g., tolerance for drought, soil salinization or short growing seasons)
  - ✔ Describe the processes of diffusion, osmosis, conduction of fluids, transpiration, photosynthesis and gas exchange in plants [Note: This item requires a general understanding of the processes; it does not require knowledge of the specific biochemistry of these processes.]
  - ✔ 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)

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 describe the development of plant varieties through selective breeding, and identify related needs and problems (e.g., identify needs leading to the development of new grain varieties; identify problems arising from the development of new plant varieties that require extensive fertilization)

**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- ✓ Define practical problems (e.g., identify problems in growing plants under dry conditions)
- ✓ 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?)
- ✓ 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)

**Skill:** 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)
- ✓ Estimate measurements (e.g., estimate plant populations; estimate the surface area of a leaf)

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✓ Identify strengths and weaknesses of different methods of collecting and displaying data (e.g., compare two different ways to measure the amount of moisture in soil; evaluate different ways of presenting data on the health and growth of plants)

- ✓ Use and/or construct a classification key (e.g., distinguish among several grain varieties, using a classification guide or key)
- ✓ 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)
- ✓ Identify new questions and problems that arise from what was learned

**Skill:** Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results

- ✓ Receive, understand and act on the ideas of others (e.g., adopt and use an agreed procedure for counting or estimating the population of a group of plants)
- ✓ Communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (e.g., show the growth of a group of plants over time through a data table and diagrams)

# 7

## Food and Agricultural Commodities

Chemistry | Reactions  
Nutrients | Food  
Production

Agricultural commodities most obviously encompass food, but also include fuel, fibre and raw materials for a diverse range of products. Concepts related to food production and nutrition are found in Science and Health and Life Skills.

### SCIENCE 7 Unit B

- > Needs and uses of plants
- > Plant varieties

How do we produce plants for food and fibre?

- > Investigate and create a mind map that identifies a variety of ways that plants are used for food, medicine and other products.
- > Identify varieties of plant products that are used in food products and other commodities, such as biofuels, clothing, etc.
- > Compare the nutrient values of food products that come from plant sources.

### HEALTH AND LIFE SKILLS Wellness Choices

- > Personal food choices
- > Food and nutrition
- > Food choice influences

How are responsible food choices made?

- > Identify the agricultural products that are used in a variety of personal food choices.
- > Identify the nutrients that are provided by a range of different agricultural products.
- > Compare personal food choices to standards for healthy eating.
- > Find and analyze food ads to identify strategies used to influence food choices.

# 7

## Food and Agricultural Commodities

Chemistry | Reactions |

Nutrients | Food Production

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 7 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 7 Unit B - Plants for Food and Fibre

#### Specific Learning Outcomes:

1. Investigate plant uses; and identify links among needs, technologies, products and impacts
  - ✓ Describe human uses of plants as sources of food and raw materials, and give examples of other uses (e.g., identify uses of plants as herbs or medicines; describe plant products, and identify plant sources on which they depend)
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 describe the development of plant varieties through selective breeding, and identify related needs and problems (e.g., identify needs leading to the development of new grain varieties; identify problems arising from the development of new plant varieties that require extensive fertilization)

**Attitude:** Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider the nutrient content of food they eat and the potential presence of residues; consider observations and ideas from a number of sources, during investigations and before drawing conclusions)

## HEALTH AND LIFE SKILLS

### Grade 7 - Wellness Choices

#### Specific Learning Outcomes:

**W-7.1** compare personal health choices to standards for health; e.g., physical activity, nutrition, relaxation, sleep, reflection

**W-7.4** Analyze the messages and approaches used by the media to promote certain body images and lifestyle choices

**W-7.5** Relate the factors that influence individual food choices to nutritional needs of adolescents; e.g., finances, media, peer pressure, hunger, body image, activity



# 7

## Food Security and Economies of Food Production

Globalization | Nationalism | Trade | Policies

Food security, according to the Food and Agriculture Organization, exists “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.” Food security is often linked to geographic location, economic inequalities and poverty. Concepts related to the economic impact of immigration and agricultural development over time in Social Studies curriculum can be explored through an agricultural lens.



### SOCIAL STUDIES 7.2

- > Urbanization
- > Immigration and development
- > Population growth

How has agriculture shaped the growth and development of western Canada?

- > Investigate the role that agriculture played in attracting immigrants to western Canada.
- > Create an illustrated timeline that shows periods of immigration and agricultural expansion.
- > Investigate the relationship between agricultural and economic development.
- > Assess how urbanization has had an economic impact on agriculture and food production.

# 7

## Food Security and Economies of Food Production

### Globalization | Nationalism | Trade | Policies

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 7 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SOCIAL STUDIES

### Social Studies 7.2 Following Confederation - Canadian Expansions

#### Specific Learning Outcomes:

**7.2.5** evaluate the impact of Confederation and of subsequent immigration on Canada from 1867 to the First World War by exploring and reflecting upon the following questions and issues:

- ✓ What strategies were used by the government to encourage immigration from Europe? (GC, LPP, TCC)
- ✓ How did communities, services and businesses established by Francophones contribute to the overall development of western Canada (i.e., health, education, churches, commerce, politics, journalism, agriculture)? (ER, TCC, CC, PADM)
- ✓ How did immigrants from eastern Europe contribute to the development of western Canada (i.e., health, education, churches, commerce, politics, journalism, agriculture)? (CC, ER, TCC, PADM)
- ✓ To what extent was agricultural activity a key factor in the population growth of western Canada? (TCC, LPP, ER)

**7.2.7** Assess, critically, the impact of urbanization and of technology on individual and collective identities in Canada by exploring and reflecting upon the following questions and issues:

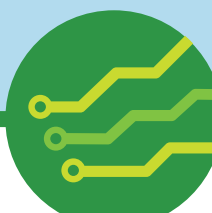
- ✓ What impact has increased urbanization had on rural communities in Canada? (LPP, CC)

# 7

## Technologies

Automation | Robotics |  
Biotechnology | Genetics

Agricultural technology encompasses advancements in automation and robotics, information technology applications as well as biotechnology and genetics. Concepts related to plant propagation, technological advances and population growth in Science and Social Studies curriculum can be explored through an agricultural lens.



### SCIENCE 7 UNIT B

- > Plant propagation and reproduction
- > Plant varieties
- > Selective breeding
- > Resource management

### How are technologies used to increase food production?

- > Identify technologies used in crop production, including those used for irrigation and crop monitoring.
- > Investigate and evaluate the impact of technologies that are used to increase crop yields, including modification and creation of artificial environments and plant reproduction.
- > Describe ways that technologies are used to solve practical problems involved in crop production.

### SOCIAL STUDIES 7.2

- > Population growth
- > Technology
- > Identities

### How have technological advances contributed to Canada's development?

- > Create a timeline that shows the development of farming equipment and changes in food production and population growth.
- > Research the relationship between food production and advances in technology during a specific time period in Canada's development.

# 7

## Technologies

Automation | Robotics |

Biotechnology | Genetics

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 7 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 7 Unit B - Plants for Food and Fibre

#### Specific Learning Outcomes:

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)

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)

**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- ✓ Define practical problems (e.g., identify problems in growing plants under dry conditions)
- ✓ 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?)
- ✓ 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)

## SOCIAL STUDIES

### Social Studies 7.2 Following Confederation - Canadian Expansions

#### Specific Learning Outcomes:

7.2.5 evaluate the impact of Confederation and of subsequent immigration on Canada from 1867 to the First World War by exploring and reflecting upon the following questions and issues:

- ✓ To what extent was agricultural activity a key factor in the population growth of western Canada? (TCC, LPP, ER)

7.2.7 Assess, critically, the impact of urbanization and of technology on individual and collective identities in Canada by exploring and reflecting upon the following questions and issues:

- ✓ In what ways did technological advances contribute to the development of Canada (e.g., aviation, farming equipment, radio transmissions, electronics, multimedia)? (ER, PADM)





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# Connecting Agriculture to Alberta Junior High School Curriculum Grade 8

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Alberta 

Canada 

# 8

## Environment and Sustainability

Land | Energy | Water | Soil

The use of land, energy, water and soil are central to agricultural practices and the food supply. Not only are resources such as soil and water vital to agricultural productivity, but agriculture both affects and is affected by the local, regional, and global environment. Concepts related to ecological and environmental issues and decisions in Science curriculum can be explored through an agricultural lens.



### SCIENCE 8 Unit A

- > Pure substances, mixtures and solutions
- > Concentration
- > Solubility and saturation points
- > Pressure
- > Mass, volume, density

What properties of fluids are important to their use in everyday applications?

- > Investigate and identify substances, mixtures and solutions that are used in agriculture (e.g., fertilizers, waste management).
- > Describe the use of pressure in the application of fluids in crop or livestock farming (e.g., irrigation, fertilizer application).

### SCIENCE 8 Unit D

- > Design and function
- > Simple machines

What are the social and environmental impacts of mechanical devices used in agriculture?

- > Identify and illustrate the changes in mechanical devices used in agriculture over time and the advances in efficiency, energy use and impact on the environment.
- > Use criteria that assesses and compares the environmental impact and social benefits to evaluate a mechanical device used in agriculture.

### SCIENCE 8 Unit E

- > Water quality
- > Water-borne materials
- > Adaptations to aquatic ecosystems
- > Human impact

What is the impact of human activities like agriculture on the environment?

- > Describe uses of water in agricultural activities and identify water sources, using examples from different type of farming.
- > Analyze farming practices that are used to conserve and monitor water sources and quality.
- > Create a comparison chart that assesses the environmental costs and benefits of technologies used in crop irrigation.



# 8

## Environment and Sustainability

Land | Energy | Water | Soil

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 8 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 8 Unit A -Mix and Flow of Matter

#### Specific Learning Outcomes:

1. Investigate and describe fluids used in technological devices and everyday materials

- ✓ Investigate and identify examples of fluids in household materials, technological devices, living things and natural environments

3. Investigate and compare the properties of gases and liquids; and relate variations in their viscosity, density, buoyancy and compressibility to the particle model of matter

- ✓ Describe pressure as a force per unit area by using the formula  $p = F/A$ , and describe applications of pressure in fluids and everyday situations (e.g., describe pressure exerted by water in hoses, air in tires, carbon dioxide in fire extinguishers; explain the effects of flat heels and stiletto heels, using the concept of pressure)

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✓ Identify and suggest explanations for discrepancies in data (e.g., explain a loss in the volume of a liquid, by identifying such factors as evaporation or absorption by a filtering material)
- ✓ Predict the value of a variable, by interpolating or extrapolating from graphical data (e.g., extrapolate results to predict how much solute will dissolve in a given solvent at a given temperature)
- ✓ Identify new questions and problems that arise from what was learned (e.g., identify questions, such as: “What techniques are used to remove pollutants from air and water?”)
- ✓ Identify and evaluate potential applications of findings

## SCIENCE

### Science 8 Unit D - Mechanical Systems

#### Specific Learning Outcomes:

4. Analyze the social and environmental contexts of science and technology, as they apply to the development of mechanical devices
- ✓ Evaluate the design and function of a mechanical device in relation to its efficiency and effectiveness, and identify its impacts on humans and the environment
  - ✓ Develop and apply a set of criteria for evaluating a given mechanical device, and defend those criteria in terms of relevance to social and environmental needs
  - ✓ Illustrate how technological development is influenced by advances in science, and by changes in society and the environment

## SCIENCE

### Science 8 Unit E - Freshwater and Saltwater Systems

#### Specific Learning Outcomes:

4. Analyze human impacts on aquatic systems; and identify the roles of science and technology in addressing related questions, problems and issues
- ✓ Analyze human water uses, and identify the nature and scope of impacts resulting from different uses (e.g., identify pollutants in ground water and surface water systems resulting from domestic and industrial use; analyze the effects of agriculture and forestry practices on stream flow and water quality)
  - ✓ Identify current practices and technologies that affect water quality, evaluate environmental costs and benefits, and identify and evaluate alternatives (e.g., research and analyze alternatives for ensuring safe supplies of potable water; research, analyze and debate alternatives for a specific water quality issue, such as the location and design of a landfill, the protection of a natural waterway, the use of secondary and tertiary wastewater treatment, the salinization of soils due to irrigation, the eutrophication of ponds and streams due to excess use of phosphates in fertilizers and detergents, or a proposal to export water resources)
  - ✓ Provide examples of problems that cannot be solved using scientific and technological knowledge alone (e.g., the need to prevent pollutants from entering aquatic environments, the need to avoid damage from ice sheets and icebergs)

# 8

## Plants and Plant Health; Animals and Animal Welfare

### Crops | Livestock

An understanding of life processes at the cellular level can be applied to the knowledge and skills required to ensure the health of animals and plants and the quality of the food supply. Concepts related to animal and plant functions and health are found in Science curriculum.



### SCIENCE 8 Unit B

- > Organisms
- > Cells
- > Organs
- > Tissues
- > Structure and function
- > Systems
- > Health and environmental factors

How do components of living systems function as balanced systems?

- > Use crop plants and/or livestock to study the structure and function of a variety of organisms.
- > Create diagrams to illustrate how at least two different crop plants and livestock animals have similar functions that are met in a variety of ways.
- > Use crop and animal species to distinguish between plant and animal cells; and to investigate and identify their cellular structures, including cells, tissues and organs.
- > Use graphs and charts to record observations and data of plant and animal structures and functions.

# 8

## Plants and Plant Health; Animals and Animal Welfare

### Crops | Livestock

The outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 8 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and correlate them to the activities that are created. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 8 Unit B - Cells and Systems

#### Specific Learning Outcomes:

1. Investigate living things; and identify and apply scientific ideas used to interpret their general structure, function and organization

- ✓ Illustrate and explain how different organisms have similar functions that are met in a variety of ways (e.g., recognize food gathering as a common function of animals, and note a variety of food-gathering structures)

2. Investigate and describe the role of cells within living things

- ✓ Distinguish between plant and animal cells (e.g., distinguish between cell walls and cell membranes)
- ✓ Examine plant and animal structures; and identify contributing roles of cells, tissues and organs

**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- ✓ Identify questions to investigate (e.g., identify questions that arise from their own observations of plant and animal diversity)
- ✓ Rephrase questions in a testable form (e.g., rephrase a question, such as: “Why this structure?” to become questions, such as: “How is this structure used by the organism?”, “How would the organism be affected if this structure were absent or did not function?” or “What similar structures do we find in other organisms?”)

**Skill:** Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data

- ✓ Observe and record data, and produce simple line drawings (e.g., draw cells and organisms)
- ✓ Organize data, using a format that is appropriate to the task or experiment (e.g., compare the structure and function of two or more organisms, using charts and drawings)

**Attitude:** Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., select and explore media on topics related to the diversity of living things and the maintenance of health; express interest in science-related/ technology-related careers that contribute to the welfare of living things)

**Attitude:** Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues (e.g., consider a wide variety of possible interpretations of their observations of animal structures and functions; critically evaluate inferences and conclusions, basing their arguments on fact rather than opinion)

# 8

## Food and Agricultural Commodities

Chemistry | Reactions  
Nutrients | Food  
Production

Agricultural commodities most obviously encompass food, but also include fuel, fibre and raw materials for a diverse range of products. Concepts related to food, nutrition and food processing are found in Science and Health and Life Skills.

### SCIENCE 8 Unit A

- > Pure substances, mixtures and solutions
- > Solubility and saturation points
- > Particle model of matter
- > Viscosity and flow rate
- > Mass, volume, density

What properties of fluids are important to their use?

- > Identify examples of fluids in food products and other agricultural commodities, including herbicides, biofuels, etc.
- > Investigate the behaviour of materials in solutions as they are applied in food production, including pasteurization, homogenization and cheese making.
- > Carry out experiments that investigate the viscosity of agricultural commodities used in everyday applications.
- > Explain how processes like heating, evaporation and absorption are applied in food production.
- > Identify and investigate careers in food chemistry and production.

### HEALTH AND LIFE SKILLS Wellness Choices

- > Personal food choices
- > Nutrients (calcium)
- > Nutrient balance

What informs personal choices that promote and maintain health?

- > Create a series of meals that illustrate balanced food choices for teens.
- > Identify nutrients in a variety of different meal and snack choices in different environments, including school, fast food and home.
- > Develop a group list of strategies that can be used to make healthy meal and snack choices when eating away from home.

# 8

## Food and Agricultural Commodities

Chemistry | Reactions |

Nutrients | Food Production

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## SCIENCE

### Science 8 Unit A - Mix and Flow of Matter

#### Specific Learning Outcomes:

1. Investigate and describe fluids used in technological devices and everyday materials
  - ✓ Investigate and identify examples of fluids in household materials, technological devices, living things and natural environments
2. Investigate and describe the composition of fluids, and interpret the behaviour of materials in solution
  - ✓ Distinguish among pure substances, mixtures and solutions, using common examples (e.g., identify examples found in households)
  - ✓ Investigate the solubility of different materials, and describe their concentration (e.g., describe concentration in grams of solute per 100 mL of solution)
  - ✓ Investigate and identify factors that affect solubility and the rate of dissolving a solute in a solvent (e.g., identify the effect of temperature on solubility; identify the effect of particle size and agitation on rate of dissolving)

**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions • design an experiment, and identify the major variables (e.g., design or apply a procedure for measuring the solubility of different materials)

**Skill:** Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data

- ✓ Carry out procedures, controlling the major variables (e.g., carry out a test of the viscosity of different fluids)
- ✓ Use instruments effectively and accurately for collecting data (e.g., measure the mass and volume of a given sample of liquid)
- ✓ Organize data, using a format that is appropriate to the task or experiment (e.g., demonstrate the use of a database or spreadsheet for organizing information)

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✔ Identify and suggest explanations for discrepancies in data (e.g., explain a loss in the volume of a liquid, by identifying such factors as evaporation or absorption by a filtering material)
- ✔ Predict the value of a variable, by interpolating or extrapolating from graphical data (e.g., extrapolate results to predict how much solute will dissolve in a given solvent at a given temperature)
- ✔ Identify and evaluate potential applications of findings

**Attitude:** Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., attempt at home to repeat or extend a science investigation done at school; investigate applications of fluid properties in technologies used in the local community)

**Attitude:** Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., investigate examples of mechanical devices in their home and community; ask questions about techniques and materials used; show an interest in related careers and hobbies)

## HEALTH AND LIFE SKILLS

### Grade 8 - Wellness Choices

#### Specific Learning Outcomes:

**W-8.2** Analyze the impact of positive and changing choices on health throughout the life span; e.g., need for varying amounts of sleep, calcium

**W-8.5** evaluate personal food choices, and identify strategies to maintain optimal nutrition when eating away from home; e.g., eating healthy fast foods

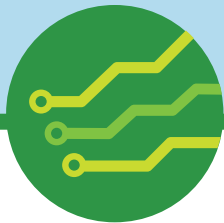


# 8

## Technologies

Automation | Robotics |  
Biotechnology | Genetics

Agricultural technology encompasses advancements in automation and robotics, information technology applications as well as biotechnology and genetics. Concepts related to technologies in Science curriculum can be explored through an agricultural lens.



### SCIENCE 8 Unit D

- > Design and function
- > Simple machines
- > Mechanical advantage, speed ratios and force ratios

How do  
mechanical  
devices affect  
the efficiency  
of agricultural  
activities?

- > Identify a variety of mechanical devices that have been used in agricultural activities over time.
- > Describe how common human needs have led to innovation and the development of mechanical devices to solve problems.
- > Develop a set of criteria to evaluate the design and function of a selected mechanical device used in agriculture.

# 8

## Technologies

Automation | Robotics |

Biotechnology | Genetics

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 8 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 8 - Unit D Mechanical Systems

#### Specific Learning Outcomes:

1. Illustrate the development of science and technology by describing, comparing and interpreting mechanical devices that have been improved over time

- ✓ Investigate and provide examples of mechanical devices used in the past to meet particular needs (e.g., describe and interpret devices developed to move water or be moved by water, such as the Persian wheel, Archimedes' screw, mill wheel)
- ✓ Illustrate how a common need has been met in different ways over time (e.g., development of different kinds of lifting devices)

4. Analyze the social and environmental contexts of science and technology, as they apply to the development of mechanical devices

- ✓ Evaluate the design and function of a mechanical device in relation to its efficiency and effectiveness, and identify its impacts on humans and the environment
- ✓ Develop and apply a set of criteria for evaluating a given mechanical device, and defend those criteria in terms of relevance to social and environmental needs
- ✓ Illustrate how technological development is influenced by advances in science, and by changes in society and the environment

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✓ Identify and evaluate potential applications of findings (e.g., identify possible applications of a simple machine or mechanical system they have studied)

Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields (e.g., investigate examples of mechanical devices in their home and community; ask questions about techniques and materials used; show an interest in related careers and hobbies)



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# Connecting Agriculture to Alberta Senior High School Curriculum Grade 9

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Alberta 

Canada 

# 9

## Environment and Sustainability

Land | Energy | Water | Soil

The use of land, energy, water and soil are central to agricultural practices and the food supply. Not only are resources such as soil and water vital to agricultural productivity, but agriculture both affects and is affected by the local, regional, and global environment. Concepts related to environmental issues and decisions in Science and Social Studies curriculum can be explored through an agricultural lens.



### SCIENCE 9 Unit A

- > Biological diversity
- > Species
- > Diversity within species
- > Habitat diversity
- > Niches
- > Populations

#### What impact does human activity have on biological diversity?

- > Identify the biological diversity of agricultural plants and animals.
- > Investigate how diversity within species has been affected by human-caused factors, such as those used to modify crop plants and livestock.
- > Use agricultural environments to collect data on plant characteristics and populations.
- > Use a graphic organizer, such as a mind map or Venn diagram, to describe the relationship between human activities, species diversity and environmental impact.

### SCIENCE 9 Unit C

- > Chemicals essential to life
- > Substrates and nutrients
- > Air and water quality
- > Organic and inorganic material
- > Acids and bases
- > Evidence of toxicity
- > Stability and biodegradability
- > Hazards, probabilities and risk assessment
- > Uncertainties in environmental monitoring and in assessing toxicity and risk

#### How do agriculturally-based substances affect local and global environments?

- > Create a retrieval chart that identifies common organic and inorganic substances that are essential to the health and growth of crop plants and/or livestock.
- > Investigate and create diagrams that show processes by which chemicals can be introduced to the environment and compare these with actions farmers take to monitor and avoid chemical contamination (e.g., protecting water sources, managing waste).
- > Investigate the practices that are used by farmers to monitor air, soil and water quality.

### SOCIAL STUDIES 9.2

- > Consumerism
- > Government
- > Environmental issues
- > Quality of life

#### How does consumer and government decision making affect the environment?

- > Identify consumer food trends that are connected to environmental concerns and issues.
- > Investigate the role of government in the protection of the environment and influence on agricultural activities.

# 9

## Environment and Sustainability

Land | Energy | Water | Soil

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 9 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 9 Unit A - Biological Diversity

#### Specific Learning Outcomes:

1. Investigate and interpret diversity among species and within species, and describe how diversity contributes to species survival
    - ✓ Observe variation in living things, and describe examples of variation among species and within species (e.g., observe and describe characteristics that distinguish two closely related species)
    - ✓ Identify the role of variation in species survival under changing environmental conditions (e.g., resistance to disease, ability to survive in severe environments)
  4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making
    - ✓ Evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity (e.g., breeding of endangered populations in zoos, development of seed banks, designating protected areas, development of international treaties regulating trade of protected species and animal parts)
- Skill:** Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results
- ✓ Communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (e.g., illustrate and compare methods of reproduction in sample organisms studied)
  - ✓ Evaluate individual and group processes used in investigating an issue and evaluating alternative decisions (e.g., evaluate strategies for locating information, such as the use of particular key words or search tools; evaluate approaches for sharing work on a given research task and for synthesizing the information found)
  - ✓ Defend a given position on an issue, based on their findings (e.g., defend a position on a proposed measure to protect a particular plant or animal population)

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations • identify strengths and weaknesses of different ways of displaying data (e.g., compare different ways of recording and displaying data on plant variation in a study plot)

- ✓ Interpret patterns and trends in data, and infer and explain relationships among the variables (e.g., interpret data on changing animal populations, and infer possible causes)
- ✓ Apply given criteria for evaluating evidence and sources of information (e.g., evaluate sources based on their currency, credibility and the extent to which claims are supported by data)

**Attitude:** Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness that the scientific study of changing animal and plant populations can arise from a variety of global needs, involving many individuals and organizations)

## SCIENCE

### Science 9 Unit C - Environmental Chemistry

#### Specific Learning Outcomes:

1. Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things
  - ✓ Identify common organic and inorganic substances that are essential to the health and growth of humans and other living things, and illustrate the roles served by these substances (e.g., identify calcium as an essential material for bones; identify minerals that are known to enhance plant growth but that limit growth if too little or too much is available)
  - ✓ Describe, in general terms, the forms of organic matter synthesized by plants and animals, including carbohydrates, proteins and lipids
  - ✓ Identify questions that may need to be addressed in deciding what substances—in what amounts—can be safely released into the environment (e.g., identify questions and considerations that may be important in determining how much phosphate can be released into river water without significant harm to living things)
2. Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality
  - ✓ Identify substrates and nutrient sources for living things within a variety of environments
  - ✓ Identify chemical factors in an environment that might affect the health and distribution of living things in that environment (e.g., available oxygen, pH, dissolved nutrients in soil)
  - ✓ Apply and interpret measures of chemical concentration in parts per million, billion or trillion
  - ✓ Describe effects of acids and bases on living things (e.g., acid rain in lakes, antacids for upset stomachs, pH in shampoos and conditioners)
3. Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment
  - ✓ Describe mechanisms for the transfer of materials through air, water and soil; and identify factors that may accelerate or retard distribution (e.g., wind speed, soil porosity)

- ✔ Describe mechanisms for biodegradation, and interpret information on the biodegradability of different materials

**Skill:** Ask questions about the relationships between and among observable variables, and plan investigations to address those questions

- ✔ Identify science-related issues (e.g., identify issues regarding the use of soil fertilizers)
- ✔ Identify questions arising from practical problems and issues (e.g., ask questions about the needs of different living things for nutrients and about the mechanisms by which these nutrients are obtained)
- ✔ Select appropriate methods and tools for collecting data and information and for solving problems (e.g., design an investigation to compare the chemical characteristics of two soils)

**Skill:** Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data

- ✔ Identify data and information that are relevant to the issue
- ✔ Select and integrate information that is relevant to the issue (e.g., demonstrate proficiency in uploading and downloading text, image, audio and video files)
- ✔ Use instruments and materials effectively and accurately for collecting data (e.g., measure and compare the pH in household products, foods and environments)
- ✔ Organize data, using a format that is appropriate to the task or experiment
- ✔ Use tools and apparatus safely

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✔ Identify strengths and weaknesses of different ways of displaying data
- ✔ Identify and suggest explanations for discrepancies in data (e.g., identify possible reasons for variation in the measured concentration of a chemical, where one sample is very different from others or where one group has a very different result from others)
- ✔ Identify the line of best fit on a scatterplot, and interpolate or extrapolate based on the line of best fit (e.g., interpret class data on the effects of acidity on mould growth, graph the data, prepare a line of best fit, and predict the amount of growth that might be expected at different acidity values)

- ✔ Apply given criteria for evaluating evidence and sources of information (e.g., use scatterplot data in evaluating how strong a relationship exists between two variables; evaluate claims of environmental impacts, based on the scope and relevance of supporting evidence)

- ✔ Identify new questions and problems that arise from what was learned

**Skill:** Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results

- ✔ Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise
- ✔ Receive, understand and act on the ideas of others (e.g., seek and achieve group consensus on procedures to be used in an investigative activity, and act on that consensus)
- ✔ Defend a given position on an issue or problem, based on their findings (e.g., provide a clear rationale for a choice between alternative chemical products in a consumer application)

**Attitude:** Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., consider more than one perspective when formulating conclusions, solving problems or making decisions on environmental quality issues)

**Attitude:** Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., show respect for all forms of life; modify their behaviour in light of an issue related to conservation and protection of the environment; recognize that the materials people use may have environmental consequences when people dispose of them)

## SOCIAL STUDIES

### Social Studies 9.2 Issues for Canadians - Economic Systems in Canada and the United States

#### Specific Learning Outcomes:

9.2.5 Assess, critically, the relationship between consumerism and quality of life in Canada and the United States by exploring and reflecting upon the following questions and issues:

- ✓ How does individual consumer behaviour impact quality of life (e.g., environmental issues)? (PADM, ER)
- ✓ How do government decisions on environmental issues impact quality of life (i.e., preservation, exploitation and trade of natural resources)? (PADM, ER)



# 9

## Plants and Plant Health; Animals and Animal Welfare

### Crops | Livestock

An understanding of life processes and reproduction can be applied to the knowledge and skills required to ensure the health of animals and plants and the quality of the food supply. Concepts related to animal and plant health are found in Science curriculum.



### SCIENCE 9 Unit A

- > Species
- > Diversity within species
- > Asexual and sexual reproduction
- > Natural and artificial selection of genetic characteristics

### How is plant and animal species diversity important to agriculture?

- > Create an illustrated map that identifies and describes the characteristics of crop plants and livestock grown and raised on Alberta farms to illustrate species diversity.
- > Investigate the symbiotic relationships that can exist within agricultural environments and compare the benefits and challenges these relationships provide.
- > Investigate how resistance to disease has been improved in crop plant species and/or livestock breeds.

# 9

## Plants and Plant Health; Animals and Animal Welfare

### Crops | Livestock

The outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 9 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and correlate them to the activities that are created. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

The outcomes identified for this topic are selected from Alberta programs of study and do not represent the whole curriculum. The style, numbers and numbering system used to identify these selected outcomes correlate directly to each specific program of study. The use of “i.e.” and “e.g.” in curriculum outcomes is deliberate, with “i.e.” indicating mandated and “e.g.” indicating optional learning expectations.



## SCIENCE

### Science 9 Unit A - Biological Diversity

#### Specific Learning Outcomes:

1. Investigate and interpret diversity among species and within species, and describe how diversity contributes to species survival
  - ✓ Observe variation in living things, and describe examples of variation among species and within species (e.g., observe and describe characteristics that distinguish two closely related species)
  - ✓ Investigate and interpret dependencies among species that link the survival of one species to the survival of others
    - identify examples of symbiotic relationships (e.g., organisms that benefit other organisms by providing habitat, food, means of fertilization, or a source of oxygen)
    - classify symbiotic relationships as mutualism, commensalism, parasitism
  - ✓ Identify the role of variation in species survival under changing environmental conditions (e.g., resistance to disease, ability to survive in severe environments)
2. Investigate the nature of reproductive processes and their role in transmitting species characteristics
  - ✓ Distinguish between sexual and asexual reproduction, and identify and interpret examples of asexual and sexual reproduction in different species, by:
    - describing mechanisms of asexual reproduction including binary fission, budding and the production of spores
    - describing mechanisms of sexual reproduction (e.g., cross-fertilization in seed plants, sexual reproduction in mammals)
    - describing examples of organisms that show both sexual and asexual reproduction (e.g., yeasts that reproduce both by budding and sexual reproduction; plants that reproduce through suckering, runners or bulbs, as well as by seed production)
    - describing the formation of zygote and embryo in plant and animal reproduction

3. Describe, in general terms, the role of genetic materials in the continuity and variation of species characteristics; and investigate and interpret related technologies

- ✓ Distinguish between, and identify examples of, natural and artificial selection (e.g., evolution of beak shapes in birds, development of high milk production in dairy cows)

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations • identify strengths and weaknesses of different ways of displaying data (e.g., compare different ways of recording and displaying data on plant variation in a study plot)

- ✓ Interpret patterns and trends in data, and infer and explain relationships among the variables (e.g., interpret data on changing animal populations, and infer possible causes)
- ✓ Apply given criteria for evaluating evidence and sources of information (e.g., evaluate sources based on their currency, credibility and the extent to which claims are supported by data)
- ✓ Identify new questions and problems that arise from what was learned

**Skill:** Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results

- ✓ Communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means (e.g., illustrate and compare methods of reproduction in sample organisms studied)
- ✓ Evaluate individual and group processes used in investigating an issue and evaluating alternative decisions (e.g., evaluate strategies for locating information, such as the use of particular key words or search tools; evaluate approaches for sharing work on a given research task and for synthesizing the information found)
- ✓ Defend a given position on an issue, based on their findings (e.g., defend a position on a proposed measure to protect a particular plant or animal population)

**Attitude:** Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., select and explore media on topics related to species diversity; express interest in hobbies and careers that involve the care, culture and study of living things)

**Attitude:** Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds (e.g., show awareness that the scientific study of changing animal and plant populations can arise from a variety of global needs, involving many individuals and organizations)

# 9

## Food and Agricultural Commodities

Chemistry | Reactions  
Nutrients | Food Production

Agricultural commodities most obviously encompass food, but also include fuel, fibre and raw materials for a diverse range of products. Concepts related to food, nutrition, and raw materials used for feed, plastics and other products are found in Science and Health and Life Skills curriculum.

### SCIENCE 9 Unit C

- > Chemicals essential to life
- > Substrates and nutrients

What is the role of substances in human and environmental health?

- > Describe the role of macronutrients - carbohydrates, proteins and lipids.
- > Compare nutrients that are required by humans and those required by plants and animals.
- > Identify acids and bases in products associated with food production and use experiments to demonstrate how they react with each other in examples of food preparation.
- > Perform experiments to identify the pH in different foods or in products used in farming.

### HEALTH AND LIFE SKILLS

- > Personal food choices
- > Nutritional food choices
- > Body image
- > Media influences

What strategies can be used to make nutritional food choices?

- > Analyze media messages, including social media examples, that promote an idealized body image.
- > Identify fad diets and analyze the food imbalances that can result in risks to health.
- > Investigate local foods produced in Alberta and identify their role in a balanced diet.
- > Work with groups to develop an action plan for improving or ensuring a healthy balance in the food choices that are available in school settings.

# 9

## Food and Agricultural Commodities

### Chemistry | Reactions Nutrients | Food Production

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 9 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science Unit C - Environmental Chemistry

#### Specific Learning Outcomes:

1. Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things
  - ✓ Identify common organic and inorganic substances that are essential to the health and growth of humans and other living things, and illustrate the roles served by these substances (e.g., identify calcium as an essential material for bones; identify minerals that are known to enhance plant growth but that limit growth if too little or too much is available)
  - ✓ Describe, in general terms, the forms of organic matter synthesized by plants and animals, including carbohydrates, proteins and lipids
  - ✓ Identify questions that may need to be addressed in deciding what substances—in what amounts—can be safely released into the environment (e.g., identify questions and considerations that may be important in determining how much phosphate can be released into river water without significant harm to living things)
2. Identify processes for measuring the quantity of different substances in the environment and for monitoring air and water quality
  - ✓ Identify substrates and nutrient sources for living things within a variety of environments
  - ✓ Apply and interpret measures of chemical concentration in parts per million, billion or trillion
  - ✓ Identify acids, bases and neutral substances, based on measures of their pH (e.g., use indicator solutions or pH meters to measure the pH of water samples)
  - ✓ Investigate, safely, and describe the effects of acids and bases on each other and on other substances (e.g., investigate and describe the reaction that results when baking powder is dissolved; describe the role of acids and bases in neutralizing each other)
  - ✓ Describe effects of acids and bases on living things (e.g., acid rain in lakes, antacids for upset stomachs, pH in shampoos and conditioners)

**Skill:** Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data

- ✓ Identify data and information that are relevant to the issue
- ✓ Select and integrate information that is relevant to the issue (e.g., demonstrate proficiency in uploading and downloading text, image, audio and video files)
- ✓ Use instruments and materials effectively and accurately for collecting data (e.g., measure and compare the pH in household products, foods and environments)
- ✓ Organize data, using a format that is appropriate to the task or experiment
- ✓ Use tools and apparatus safely

**Skill:** Analyze qualitative and quantitative data, and develop and assess possible explanations

- ✓ Identify strengths and weaknesses of different ways of displaying data
- ✓ Identify and suggest explanations for discrepancies in data (e.g., identify possible reasons for variation in the measured concentration of a chemical, where one sample is very different from others or where one group has a very different result from others)
- ✓ Identify the line of best fit on a scatterplot, and interpolate or extrapolate based on the line of best fit (e.g., interpret class data on the effects of acidity on mould growth, graph the data, prepare a line of best fit, and predict the amount of growth that might be expected at different acidity values)
- ✓ Apply given criteria for evaluating evidence and sources of information (e.g., use scatterplot data in evaluating how strong a relationship exists between two variables; evaluate claims of environmental impacts, based on the scope and relevance of supporting evidence)
- ✓ Identify new questions and problems that arise from what was learned

**Skill:** Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results

- ✓ Work cooperatively with team members to develop and carry out a plan, and troubleshoot problems as they arise
- ✓ Receive, understand and act on the ideas of others (e.g., seek and achieve group consensus on procedures to be used in an investigative activity, and act on that consensus)
- ✓ Defend a given position on an issue or problem, based on their findings (e.g., provide a clear rationale for a choice between alternative chemical products in a consumer application)

**Attitude:** Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment (e.g., show respect for all forms of life; modify their behaviour in light of an issue related to conservation and protection of the environment; recognize that the materials people use may have environmental consequences when people dispose of them)

## HEALTH AND LIFE SKILLS

### Grade 9 - Wellness Choices

#### Specific Learning Outcomes:

**W-9.4** Analyze and develop strategies to reduce the effects of stereotyping on body image; e.g., health risks of altering natural body size/shape to meet media ideal

**W-9.5** Develop strategies that promote healthy nutritional choices for self and others; e.g., adopt goals that reflect healthy eating, encourage the placement of nutritious food in vending machine

# 9

## Food Security and Economies of Food Production

Globalization |  
Nationalism | Trade |  
Policies

Food security, according to the Food and Agriculture Organization, exists “when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.” Food security is often linked to geographic location, economic inequalities and poverty. Concepts related to economic systems, consumer influences, government policy and trade in Social Studies curriculum can be explored through an agricultural lens.



### SOCIAL STUDIES 9

- > Consumerism
- > Economic systems
- > Quality of life
- > Government policy
- > Individual and collective identities
- > Collective

How can individuals, groups and governments shape economic decision making?

- > Explore the role of agriculture in a market and mixed economic system.
- > Create a mind map that explores the relationship between consumer food choices and individual or collective identities.
- > Investigate the influence of government policy on food production and distribution (food safety, food labelling, organic food regulations).
- > Investigate consumer food trends and explain how they influence the ways that food is grown and produced.
- > Describe an example of a boycott related to food or agricultural practices.

# 9

## Food Security and Economies of Food Production

Globalization | Nationalism | Trade | Policies

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 9 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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### SOCIAL STUDIES

#### Social Studies 9.2 Issues for Canadians - Economic Systems in Canada and the United States

##### Specific Learning Outcomes:

9.2.2 Appreciate the relationship between consumerism and quality of life (C, CC)

9.2.4 Compare and contrast the principles and practices of market and mixed economies by exploring and reflecting upon the following questions and issues:

- ✓ What are the principles of a market economy? (ER)
- ✓ Why do governments intervene in a market economy? (ER, PADM)
- ✓ What is the role of the consumer in market and mixed economies? (ER)
- ✓ To what extent do consumer actions reflect individual and collective identity? (ER, I)

9.2.5 Assess, critically, the relationship between consumerism and quality of life in Canada and the United States by exploring and reflecting upon the following questions and issues:

- ✓ How does consumerism provide opportunities for and limitations on impacting quality of life? (PADM, ER)
- ✓ How is consumerism used as a power of a collective (e.g., boycotts)? (ER, PADM, C)

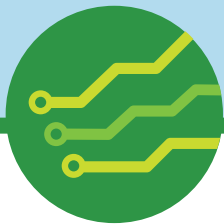


# 9

## Technologies

### Automation | Robotics | Biotechnology | Genetics

Agricultural technology encompasses advancements in automation and robotics, information technology applications as well as biotechnology and genetics. Concepts related to genetics and reproductive technologies in Science curriculum can be explored through an agricultural lens.



#### SCIENCE 9 Unit A

- > Chromosomes, genes and DNA (introductory treatment)
- > Cell division—includes binary fission and formation of sex cells
- > Natural and artificial selection of genetic characteristics

#### What impact does technology have on biological diversity?

- > Create flow charts that illustrate how reproductive processes are used as the basis of natural and artificial selection of genetic characteristics in crop plants and livestock.
- > Investigate and identify reasons why genetic technologies that are used in agriculture (food quality, yield, nutritional values, reduction in use of pesticides, increase sustainable practices, reduce production costs).
- > Interview farmers about issues related to the use of biotechnologies in agriculture.
- > Illustrate how seed banks work to protect genetic diversity.
- > Identify facts and myths associated with differing perspectives on genetically modified foods.
- > Explain how biotechnology involves more than genetic modification.

# 9

## Technologies

Automation | Robotics |

Biotechnology | Genetics

The specific learning outcomes in the charts that follow are drawn directly from Alberta programs of study for Grade 9 students. These learning outcomes address knowledge, skills and attitudes in the identified subject areas that support this topic. When developing programs or resources, select from these outcomes and develop activities that will help students meet the expectations that the outcomes represent. Note that there may be additional learning outcomes in these subject area programs of study – particularly skills that cross over multiple units – that can be supported through your activities.

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## SCIENCE

### Science 9 Unit A - Biological Diversity

#### Specific Learning Outcomes:

2. Investigate the nature of reproductive processes and their role in transmitting species characteristics

- ✓ Distinguish between sexual and asexual reproduction, and identify and interpret examples of asexual and sexual reproduction in different species, by:
  - describing mechanisms of asexual reproduction including binary fission, budding and the production of spores
  - describing mechanisms of sexual reproduction (e.g., cross-fertilization in seed plants, sexual reproduction in mammals)
  - describing examples of organisms that show both sexual and asexual reproduction (e.g., yeasts that reproduce both by budding and sexual reproduction; plants that reproduce through suckering, runners or bulbs, as well as by seed production)
  - describing the formation of zygote and embryo in plant and animal reproduction
- ✓ Identify examples of dominant and recessive characteristics and recognize that dominance and recessiveness provide only a partial explanation for the variation of characteristics in offspring

3. Describe, in general terms, the role of genetic materials in the continuity and variation of species characteristics; and investigate and interpret related technologies

- ✓ Describe, in general terms, the role and relationship of chromosomes, genes and DNA
- ✓ Distinguish between, and identify examples of, natural and artificial selection (e.g., evolution of beak shapes in birds, development of high milk production in dairy cows)
- ✓ Describe, in simple terms, some genetic technologies (e.g., cloning and genetic engineering); and identify questions and issues related to their application

4. Identify impacts of human action on species survival and variation within species, and analyze related issues for personal and public decision making

- ✔ Evaluate the success and limitations of various local and global strategies for minimizing loss of species diversity (e.g., breeding of endangered populations in zoos, development of seed banks, designating protected areas, development of international treaties regulating trade of protected species and animal parts)
- ✔ Investigate and describe the use of biotechnology in environmental, agricultural or forest management; and identify potential impacts and issues (e.g., investigate issues related to the development of patented crop varieties and varieties that require extensive chemical treatments; identify issues related to selective breeding in game farming and in the rearing of fish stocks)

**Attitude:** Show interest in science-related questions and issues, and confidently pursue personal interests and career possibilities within science-related fields (e.g., select and explore media on topics related to species diversity; express interest in hobbies and careers that involve the care, culture and study of living things)

