What are some of the crops that feed the world?

crop varieties

How much do you know about the agricultural plants that are used for many food products? Did you know that many of them originated from plants that grew naturally in different ecosystems and environments? Agricultural crops today are actually quite different than the wild plants they came from.

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What does the quotation suggest about the diversity of plants used for food?

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The food we eat

"The food we eat is not only a quantity of proteins or vitamins, but it is a diversity of foods that [is important]," Graziano da Silva [the Director-General of the Food and Agriculture Organization of the United Nations] said.

He warned however, that this diversity is at risk. Currently 80 percent of our diet is based on a few commodities - like wheat, rice, maize, and soybeans - while throughout our history humans have used over 7 000 products, "which are at the basis of our different diets and cultures."

"Investing in local products and bringing this diversity back into our diets is one of the most important challenges that we have today," Graziano da Silva said.

Food and Agriculture Organization. (November 24, 2018). Food diversity expresses cultural heritage and is key for healthy diets. United Nations: Online. www.fao.org/news/story/en/item/1171702/icode/

FOCUS ON CEREAL GRAINS: WHEAT AND BARLEY

Wheat is a member of the grass family. The wheat plant produces a dry seed called a kernel as its fruit. Wheat is a cereal crop – one of the oldest. There are thousands of varieties of wheat.

- The wheat we consume today is much the same as it was hundreds of years ago. Although advancements have been made to help wheat withstand the cold Canadian climate, many of the same **milling** (the process that turns the grains into flour) and baking qualities are still present.
- Wheat, now used for bread, pastries, pizza, pasta and many other food products, has been an important cereal crop in Canada since the 1800s.
- The different varieties of wheat can be classified in three ways:
  - By colours like red, yellow, white
  - By their planting season, including **spring wheat**, which is planted in the spring and harvested in early fall; and **winter wheat**, planted in the fall and harvested the following summer
  - By the characteristics of the grain, called durum, hard wheat and soft wheat

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How many food products from wheat and barley are you aware of? What wheat or barley-based food products do you use?

HARD WHEAT

SOFT WHEAT

Wheat varieties have a range of gluten content. The gluten is found in the starchy centre of the grain. **Gluten** is a type of protein and is naturally found in certain cereal grains like wheat and barley. It holds food together and adds a "stretchy" quality. Some compare it to a pizza maker tossing and stretching out a ball of dough. Without gluten, the dough would quickly rip.

- **Hard wheat** varieties are bronze-coloured with a high gluten content. Hard wheat has a higher gluten content than soft wheats. It is used for making bread flour and all-purpose flour.
- **Soft wheats** are light golden in colour and are low in gluten. They are used to make cake and pastry flours.
- **Durum wheats** are generally high in gluten-producing proteins. They are, in effect, the "hardest" wheats. They are used for making semolina, which is made into macaroni and other pastas.

DURUM WHEAT

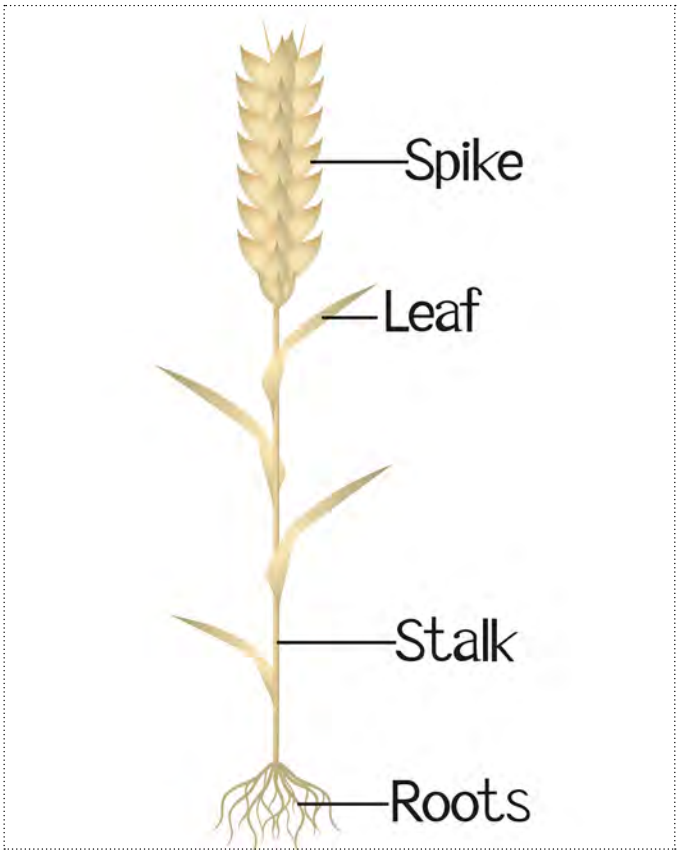
The wheat plant has long slim leaves and stems that are hollow except at the **nodes**, which are solid areas of the stem from which the leaves grow. The leaves protect the plant and gather light for photosynthesis. The roots are deep to gather nutrients from the soil.

The flower head of the wheat plant is called a **spikelet**. The spikelet produces between 20 to 100 very small flowers. These small flowers hold the wheat kernel.

The **kernel** is the seed of the wheat plant. It is made of three parts:

- Endosperm (most of the kernel and contains starch)
- Bran (the outer shell of the grain)
- Germ (the part of the seed that sprouts)

Information adapted from OpenTextBC, under a Creative Commons Attribution-4.0 International License from Classification of Wheat.
https://opentextbc.ca/ingredients/chapter/classification-of-wheat/

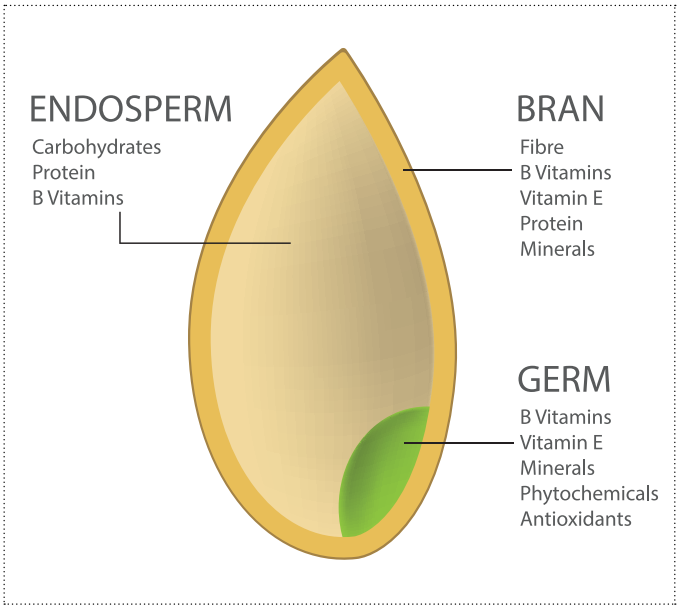


PARTS AND STRUCTURES OF A WHEAT PLANT

Barley is also a major cereal grain. It is a member of the grass family and, like wheat, is one of the oldest grains. It is the fourth largest grain crop in the world.

- There are three types of barley – two-row, six-row and hull-less.
- Six-row barley has a higher protein content. It is often used for animal feed.
- Two-row barley has a higher sugar content and is commonly used for making malt, which is used in some alcoholic beverages like beer.

BARLEY PLANT



STRUCTURES OF A WHEAT GRAIN

Malt is a type of cereal grain, such as barley, that has undergone a drying process known as malting. The cereal grain is first soaked in water to sprout and then dried with hot air to stop germination. Malted grains can have a sweet flavour. Barley is also used in breads, soups and stews.

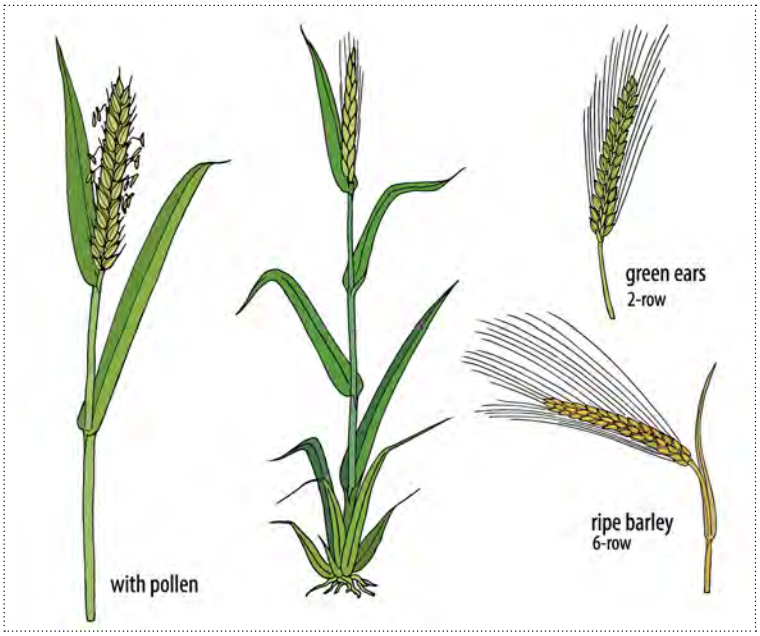
Like wheat, barley plant has a round stem that is hollow.

The head of the plant is made of spikelets, also like wheat, which enclose the flowers of the barley plant.

Barley varieties can have either one or three spikelets. This gives the head the appearance of having two or six rows of kernels. This is where the names two-row and six-row barley comes from.

Barley kernels are similar to wheat kernels. They have three parts – endosperm, bran and germ.

When barley is ready to be harvested, it has a yellow-white colour.



PARTS AND STRUCTURES OF A BARLEY PLANT

What comparisons can you make between the illustrations and photos of wheat and barley plants?

BARLEY READY TO BE HARVESTED

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Other cereal grains include maize, rice, oats, rye and sorghum. What common characteristics do you think all cereal grain plants might have? How could you find out what the differences are?

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FOCUS ON OILSEEDS: CANOLA

Canola is an oilseed crop. Oilseed plants are grown for the oil that is contained in their seeds. Edible seed oils also include soybeans, sunflowers, rapeseed, cotton and peanuts.

CANOLA PLANT AND FLOWERS

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What range of food products come from oilseed crops?

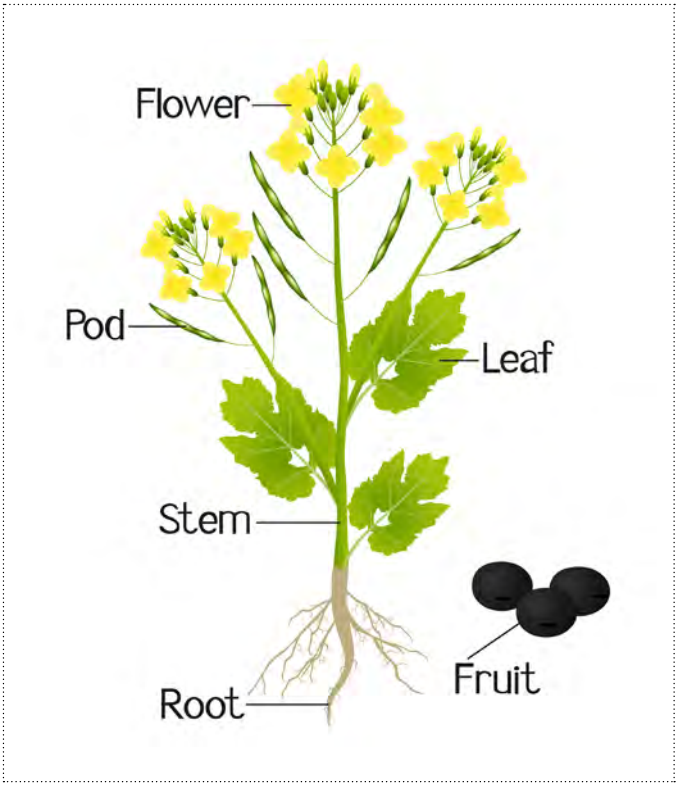
Canola was developed by plant breeders in Saskatchewan and Manitoba during the 1960s and 1970s. Through traditional cross-breeding experiments, these plant breeders minimized the undesirable compounds in rapeseed plants and developed varieties that provided an edible, healthy oil.

Cross-breeding involves crossing together – transferring pollen from one parent plant to another parent plant – to try to obtain a new plant variety that combines the best characteristics of each parent. It can be a long process.

Canola is a plant that is a member of a large family of plants called **crucifers**. Crucifers are easy to identify because the four yellow flower petals form the shape of a cross.

Canola belongs to a section (or genus) of the crucifer family called Brassica. As well as canola, Brassica plants include mustard, Brussels sprouts, cabbage, cauliflower, broccoli and turnip. Brassicas are a major source of food in many countries, including Canada.

The canola plants grow to a height of one to two metres. The yellow flower produces seed pods that are about 5 centimetres in length. There is an average of 60 to 100 pods per plant.



PARTS AND STRUCTURES OF A CANOLA PLANT

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Each seed pod contains 20 to 30 tiny, round seeds which are 1 mm in diameter. When it is ready to harvest, the plant changes colour from green to light yellow. The seeds become a brown-black colour in the pods. These tiny seeds are crushed to squeeze out the canola oil.

After the oil is extracted, the remainder of the seed becomes canola meal. This meal is used as livestock feed.

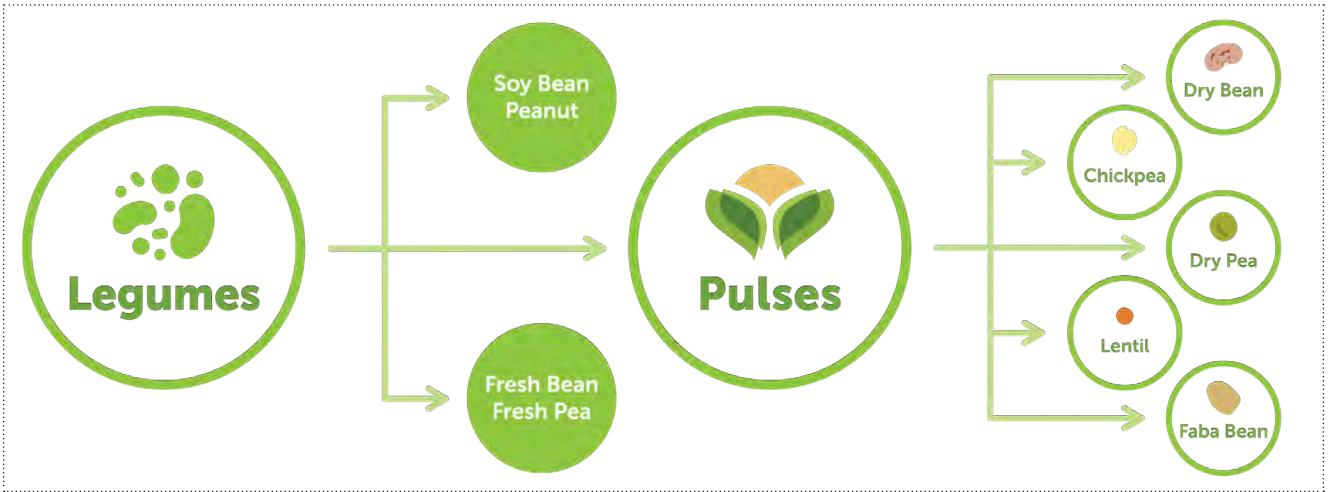
CANOLA PLANT AND PODS

CANOLA SEED IN DRY PODS

FOCUS ON PULSES

Pulse crops are becoming an increasingly important crop in Canada. Pulse crops are part of the legume family. The word "pulse" comes from the Latin word *puls*, meaning potage or thick soup. Pulses are the dry edible seeds of pod plants. Pulse crops grown in Alberta include field peas, chickpeas, dry beans, lentils and faba beans.

Soybeans are sometimes grouped with pulses, and they are a legume; however, they are not a true pulse crop. They are grown for both their protein and oil.



FIELD PEAS

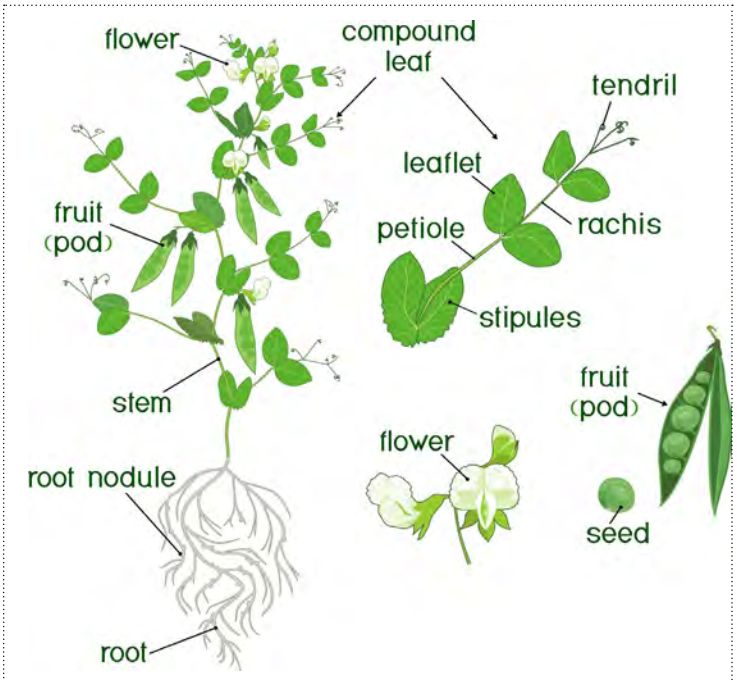
Field peas, also known as dry peas, are a pulse crop. They are grown and used as a dry, shelled product for either human consumption or livestock feed. Field peas are different than garden peas, which are sold as a fresh, frozen or canned vegetable.

Field peas have slender stems from 0.3 to 1.8 metres tall with green to pale green leaves. There are two types of leaf structures that field peas may have:

- Leafed types have a leaf consisting of one to three pairs of leaflets and simple branched tendrils.
- Semi-leafless types of field peas have no leaflets on the **leaf axis** - the angle between the upper side of the stem and a leaf, branch, or petiole, but instead have several tendrils and large stipule leaves.

The most commonly grown field pea has white flowers. Flower nodes have either one, two or multiple flowers. Most varieties grown in Alberta produce two flowers.

Field peas, like most pulse crops, are self pollinating. Pea pods are normally 5 to 7 cm long and contain four to nine seeds – the peas.



PARTS AND STRUCTURES OF A FIELD PEA PLANT

The illustration and photos show the structures of a field pea plant. Can you match the description to the structures pictured?

FIELD PEA CROP

FIELD PEA FLOWERS

LENTILS

Lentils are also a pulse crop. Lentils are mainly used for food with only a small amount used as livestock feed.

Two main groups of lentils are grown in Alberta – large-seeded and small-seeded. Lentils have different coloured seeds. The two main colours are green and red.

The lentil plant is bushy and usually short, but can range from 20 to 75 centimetres, with a shallow root system of just over half a metre deep. When seeds **germinate**, the **cotyledon** – the leaf that appears first from the seed embryo – remains under the ground. The first two nodes on the stem also develop below or at the soil surface.

PARTS AND STRUCTURES OF A LENTIL PLANT

The leaves of the lentil plant are about 5 cm long and have between 9 and 15 leaflets. Stipules, much smaller than leaflets, occur in pairs on either side of the leaf axis where it joins the stem. Just prior to flowering, new leaves will develop a short tendril at the leaf tip.

The plant usually has two or more branches coming from the main stem. This is where most of the seed pods grow. Lentil flowers can be white, lilac or pale blue and like field peas, are self pollinating. Flower stalks produce one to three flowers, which develop pods. Pods are less than 2.5 cm in length and usually contain one or two seeds – the lentils.

Germination is the process that occurs when a seed that has been dormant (inactive) begins to sprout and grow into a seedling. Why do you think a plant like the lentil first sprouts underground?

Can you identify the structures pictured in the illustration and photos of lentils on this page? How would you label this plant illustration?

LENTIL CROP FLOWERING

LENTIL PODS

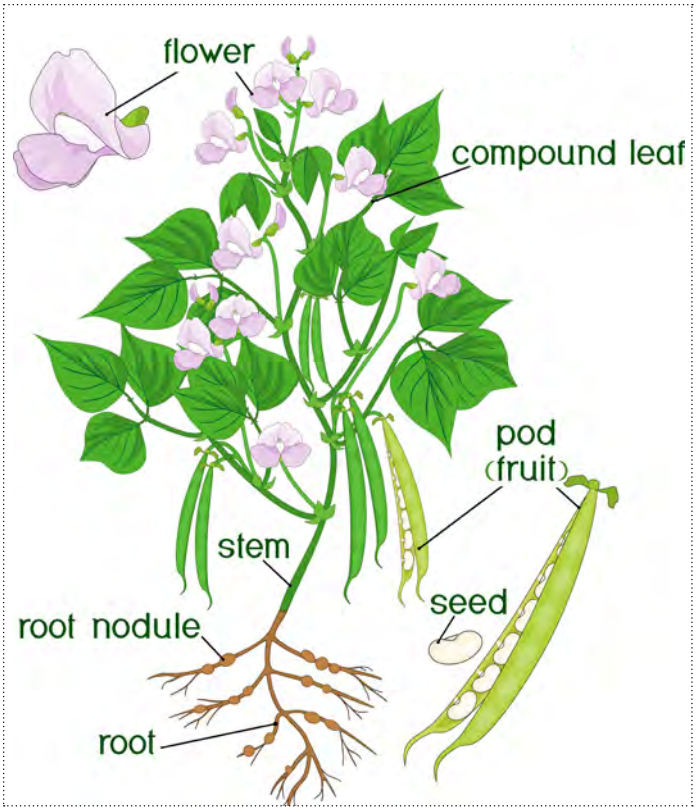
DRY BEANS

The dry bean is also a pulse crop. There are many types of dry beans. Some varieties are classified by the way the plant grows – such as a bush or as a vine. Dry beans are also grouped based on seed and bean type – Great Northern, Pinto, Cranberry, Pink, Small Red, Yellow, Black Shiny, and Black Matte. Great Northerns and Pinto beans make up the majority of bean crops in Alberta.

Dry bean plants are a dicot crop – this means that they are flowering plants that have two leaves, or cotyledons, in the embryo of the seed. After the seed germinates, the cotyledon pushes up above the soil.

The true first leaves are single leaves and grow opposite each other. All the following leaves are trifoliate – this means they have a leaf divided into three leaflets – and are arranged on alternate sides of the stem. Depending on the variety of bean plant, each main stem has between five and 12 nodes. On the climbing vine varieties, there can be even more nodes.

Dry beans can have white, purple or pink self-fertilizing flowers that develop into a straight or slightly curved pod that contains five to seven seeds - the beans. Seeds can be round, elliptical, flattened, or rounded-elongated in shape and have a rich assortment of coat colours and patterns.



PARTS AND STRUCTURES OF A DRY BEAN PLANT

The illustration and photos show the structures of dry bean plants. Can you match the description to the structures pictured?

DRY BEAN FIELD

DRY BEAN PODS

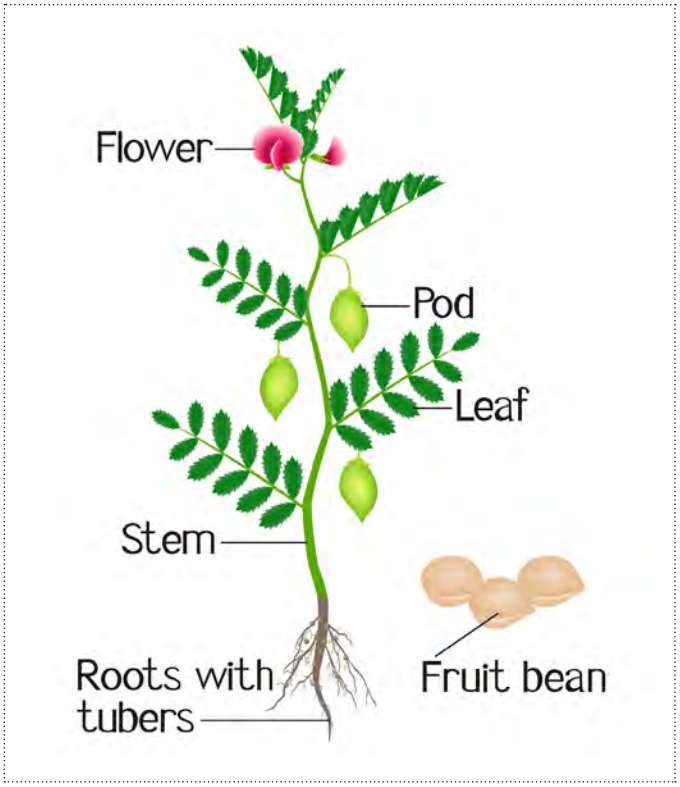
CHICKPEAS

Chickpeas are also a pulse crop that is grown primarily for human consumption. There are two main types of seeds grown in Alberta, called Desi and Kabuli. Another name for Kabuli chickpeas is garbanzo beans. Desi-type are small seeds with rough, usually yellow to brown seed coats. Kabuli are larger, more rounded cream-coloured seeds. The majority of chickpeas grown in Alberta are the Kabuli type. This type is used to make hummus.

The chickpea plant is short, usually growing to between 30 and 70 cm tall. The main stem of the plant has up to seven primary branches that grow near ground level. From these primary branches, many smaller branches grow and produce small, divided leaves that each have 10 to 15 leaflets.

The chickpea plant has an extensive root system – the taproot often grows down well below one metre. This can help the plant during dry weather conditions.

Chickpea plants are self pollinating. Desi-type chickpeas produce coloured flowers, while Kabuli produce white flowers. These flowers develop into inflated pods which contain one or sometimes two seeds – the chickpeas.



PARTS AND STRUCTURES OF A CHICKPEA PLANT

The illustration and photos show the structures of chickpea plants. Can you match the description to the structures pictured?

CHICKPEA FLOWER

CHICKPEA PLANTS AND PODS

FABA BEANS

Faba beans are also known as fava beans in other countries around the world. They are a pulse crop that is grown for both human consumption and for livestock feed. Faba bean plants have a thick, firm stem that supports a height of one to two metres tall with one or more strong, hollow stems coming from the base, with green foliage. The stem turns dark when it is mature.

Faba bean leaves are much larger than other pulses such as chickpeas, lentils, and peas. The leaves are featherlike, with two to six leaflets each.

Faba bean leaves can be up to 8 cm in length in an alternating arrangement. The first true leaf is produced at the third node. The first two leaves consist of two leaflets each and remaining leaves consist of three or more leaflets. Faba bean plants do not have tendrils. The faba bean has a large tap root and broad secondary root system.

Faba beans can be both cross-pollinated and self-pollinated. If pollination does not occur on a particular flower, it will not form a pod.

Flowers can be pure white, purple or pink. Each flower cluster can produce one to six pods. The pods are long and green and grow up to 10 cm long. They contain two to eight seeds. The pods turn black as they mature and the seeds change from tan to brown to grey.

PARTS AND STRUCTURES OF A FABA BEAN PLANT

The illustration and photos show the structures of a faba bean plant. Can you identify the structures pictured?

FABA BEAN PLANT

FABA BEAN PODS

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SOYBEANS

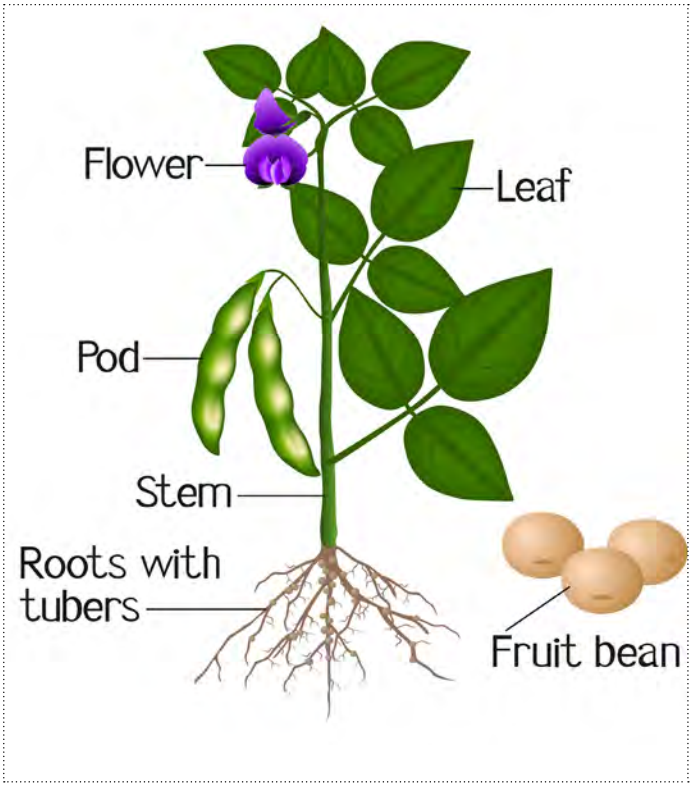
Soybeans are a legume plant, but they are not a true pulse crop. Soybeans are grown as a source of protein and oil.

Soybeans are a dicot plant. When the soybean seed germinates, the cotyledons and the growing point are the first to push up above ground. The first leaves are single leaves. All the other leaves that grow are trifoliate that alternate from side to side up the stem.

The flowers appear on the stems. Soybeans are almost completely self-pollinating.

Soybeans have hairy pods that grow in clusters of three to five, and each pod is 3 to 8 cm long. Pods can have one to five seeds, but most often have three seeds per pod.

Soybean seeds come in a wide variety of sizes and hull colours such as black, brown, yellow and green.



PARTS AND STRUCTURES OF A SOYBEAN PLANT

The illustration and photos show the structures of a soybean plant. Can you match the description to the structures pictured?

SOYBEAN FIELD

SOYBEAN PODS