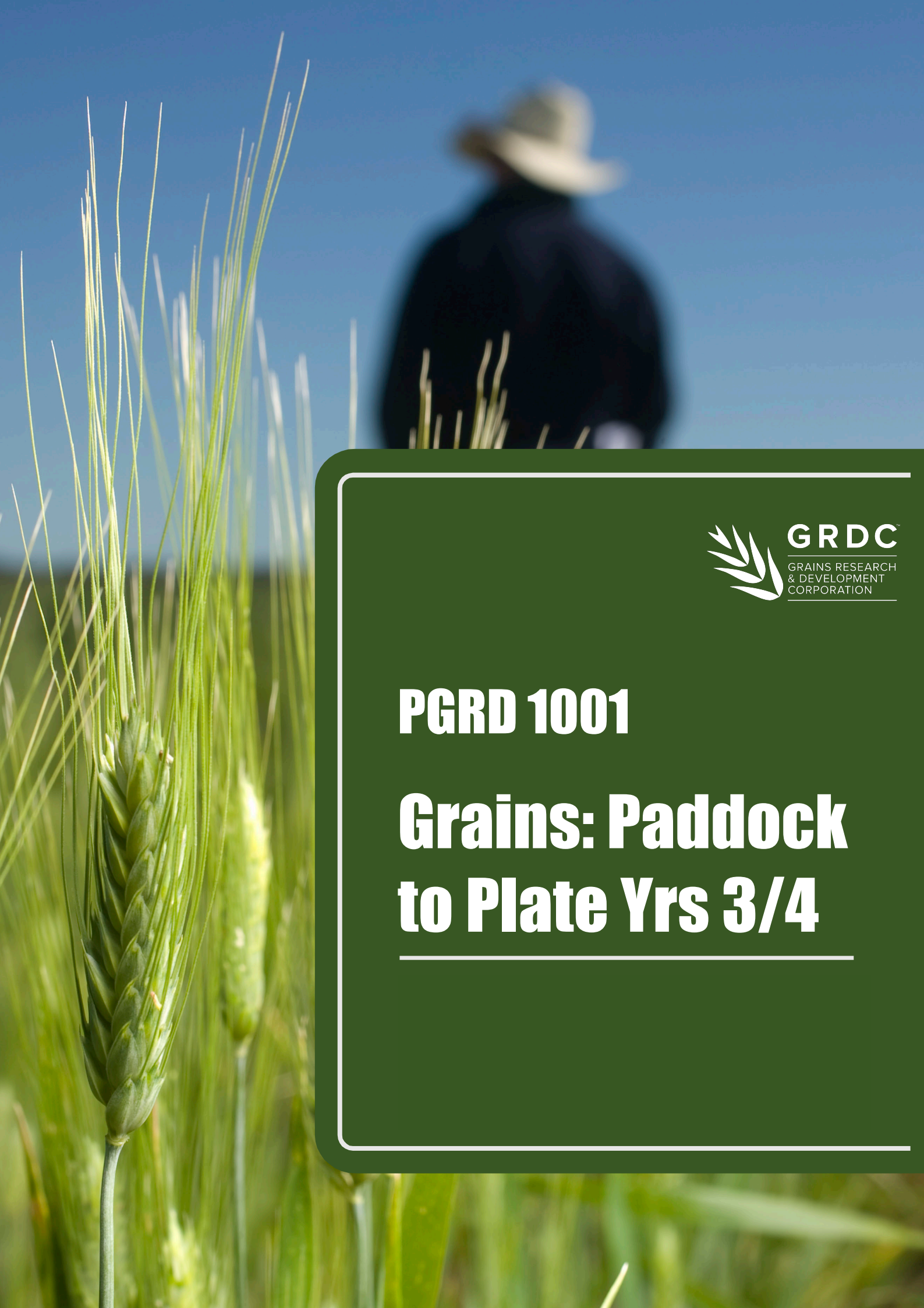


GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

PGRD 1001

Grains: Paddock to Plate Yrs 3/4

Instructions for Students

GRAINS: PADDOCK TO PLATE

YEARS 3/4

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

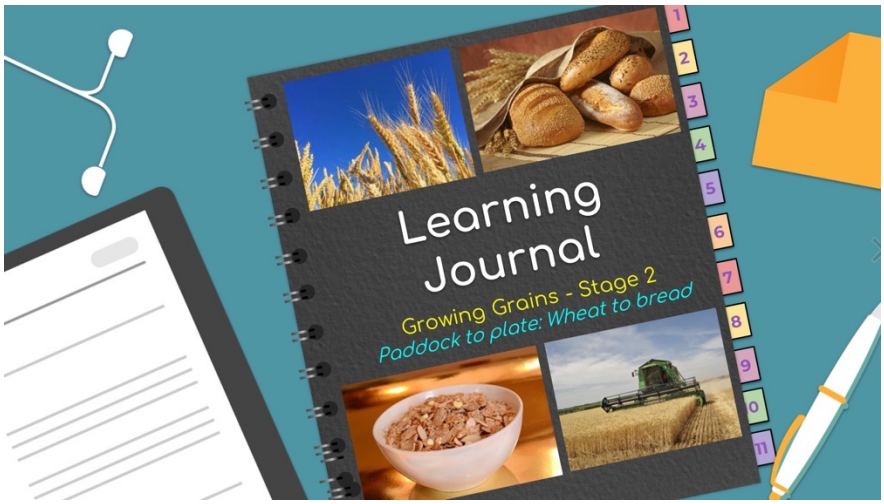
This course will consist of seven (7) online lessons (plus an optional extension lesson). Each lesson will require you to read or view important information.

Some lessons will require you to complete quizzes based on the information you have learnt. To pass each quiz, a score of **at least 80%** will be needed in order to progress to the next lesson. Other lessons will outline hands-on activities, experiments or design tasks that can be completed in the classroom.

In each lesson, you will be asked to reflect on and record your work in the learning journal, a PowerPoint, which you can submit to your teacher at the end of the course.

Save the Learning Journal to Your Computer:

- PowerPoint: LearningJournal-Grains-34.pptx



The learning journal can be used in the following ways. You may choose to:

- Save the PowerPoint document in the Google Drive. The document can be opened and edited at any time in Google Slides. Changes will be saved automatically. At the completion of the online course, you can email your teacher with a link to their learning journal as evidence of work completed.

- Save the PowerPoint document on the computer. The document can be opened, edited and saved at any time. At the completion of the online course, you can email your teacher with the Powerpoint document attached as evidence of work completed.
- Open the PowerPoint document, download and print the pages. Record learning with hand-written responses. At the completion of the online course, you can submit the hard copy of their work to your teacher as evidence of work completed.

Instructions for Teachers

The table below outlines the content and structure of the course, with links to the NSW and Australian Curriculums.

Lesson	Learning Content	Learning Tasks	NSW Curriculum Links	Australian Curriculum Links
1	**What Are Grains?**	LJ* activity 1 Interactive quiz	ST2-5LW-T PD2-7	ACTDEK012 ACPPS036
2	**Paddock to Plate: Planting Seeds**	LJ activity 2 Hands-on task	ST2-5LW-T	ACTDEK012
3	**Paddock to Plate: Growing Healthy Crops**	LJ activity 3 Interactive quiz	ST2-5LW-T	ACTDEK012
4	**Paddock to Plate: Harvesting the Wheat**	LJ activity 4 Interactive quiz	ST2-5LW-T	ACTDEK012
5	**Paddock to Plate: Turning Wheat Into Bread**	LJ activity 5 Hands-on task	ST2-5LW-T	ACTDEK012
6	**Why Eat Whole Wheat?**	LJ activity 6 Experiment	ST2-5LW-T ST2-1WS-S PD2-7	ACTDEK012 ACSIS054 ACSIS065 ACPPS036
7	**Promoting Whole Wheat Products**	Design task	ST2-5LW-T PD2-7 EN2-7B	ACTDEK012 ACELY1682 ACELY1694 ACPPS036

Extension lesson (optional)	**Cooking With Whole Wheat Flour**	Hands-on task	ST2-5LW-T PD2-7	ACTDEK012 ACPPS036

* LJ = Learning Journal

Resources required for the hands-on learning tasks in this course are outlined below:

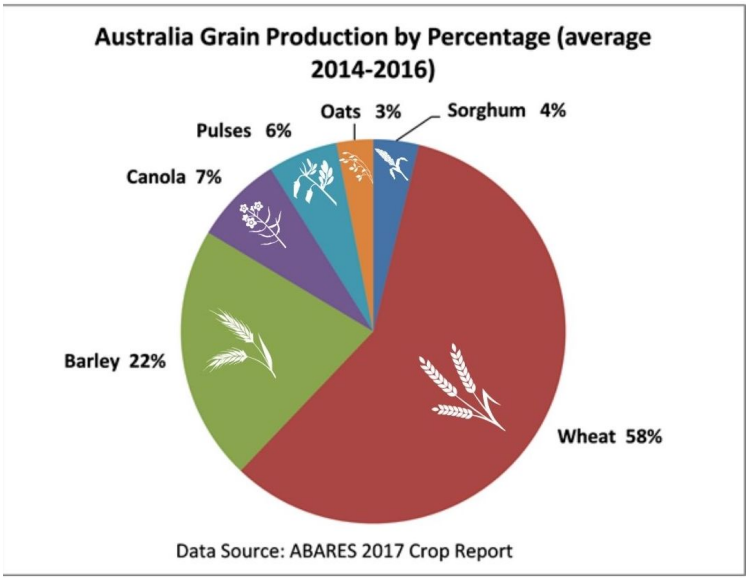
Lesson 2	**Hands-on Learning Task: Plant Your Own Seed** • Clear plastic cup • Seed raising mix/ potting soil • Wheat seeds • Spray bottle (water)
Lesson 5	**Hands-on Learning Task: Milling Grains** • Wheat grains • Mortar and pestle/ rocks
Lesson 6	**Hands-on Learning Task: Digestion Experiment** • 2 clear jars • White vinegar • 1 slice white bread • 1 slice whole wheat bread • Spoon • Timing device
Extension activity	**Hands-on Learning Task: Baking With Whole Wheat Flour** Students can choose from a range of recipes - ingredient lists are supplied via links in the lesson notes.

What Are Grains?

Lesson 1

Grains are the **edible seeds** of **specific grasses** belonging to the Poaceae (also known as Gramineae) family.

There are many different types of grains that are grown in Australia. The pie chart below shows the grains which are most commonly grown:



Visit the Grains and Legumes Nutrition Council website to see images of some of the grains that we grow and eat in Australia. You can click on the images to learn more about each of these grains.

(NB: Link 'Grains and Legumes Nutrition Council' to https://www.glnc.org.au/grains/types-of-grains/)

Which Foods Are Made From Grains?

There are many foods people eat daily that have been made from grains, including **bread**, **pasta** and **breakfast cereals**. Snacks such as muesli bars, baked goods, crackers, and popcorn are more examples of grain-based foods.

Look at the image below of a variety of foods made from grain.

- How many of these types of food do you eat on a regular basis?
- Which is your favourite food made from grain?

Grains as Part of a Healthy Diet

Foods made from grains are an important component of our daily dietary requirements and are good sources of **fibre**, **carbohydrates,** and **protein**. Look at the diagram from the Australian Guide to Healthy Eating below, which outlines the five different food groups and the quantities recommended for a healthy, balanced diet.

Watch this video to learn more about these recommendations from the Australian Guide to Healthy Eating:

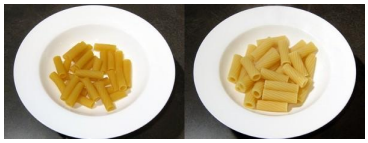
https://www.youtube.com/watch?v=7rgI5q-XnKg

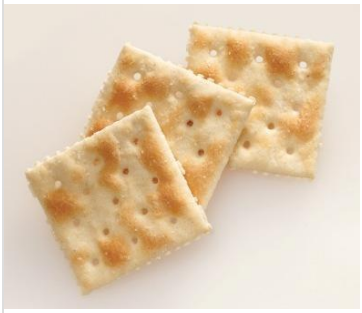
The table below indicates the recommended minimum daily serves of grain foods for children:

	2-3 years old	**4-8 years old**	**9-11 years old**	**12-13 years old**
Boys	4 serves/day	4 serves/day	5 serves/day	6 serves/day
Girls	4 serves/day	4 serves/day	4 serves/day	5 serves/day

(Recommendations from *Grains and Legumes Nutrition Council*)

One serve of grains is equivalent to:

1 slice of bread or ½ bread roll (preferably whole grain or high fibre)	
½ cup cooked rice, pasta, noodles, couscous, quinoa, barley	
½ cup cooked porridge	

⅔ cup cereal flakes or ¼ cup muesli	
3 crispbreads	
1 crumpet / 1 English muffin / 1 scone	
¼ cup flour	

Have a think about the foods you usually eat daily.

- How many have been made from grains?
- Do you think you eat the recommended amount of grains based on the information above?

Learning Journal Activity #1

1. Open your Learning Journal and click on/turn to **Lesson 1.**

2. List as many **grain crops** that are grown in Australia as you can. Use information from the Grains and Legumes Nutrition Council to help you.

3. Revise the information provided regarding recommended daily serves of grains for children and adolescents. Create a **Grains Meal Plan** for a student of your age/gender based on these recommendations.

GRAIN QUIZ 1

Choose only ONE best answer.

1 serve of grains is equivalent to...

a. 3 scones
b. 1 box of crackers
c. 1 slice of bread
d. 2 cups of cereal

Which type of food is made from grains?

a. Yoghurt
b. Fruit salad
c. Pasta
d. Lollies

What are grains?

a. Any food made from milk products
b. The edible seeds from specific grasses
c. The roots, stems and leaves of specific plants
d. The roots, stems and leaves of specific plants

Visit the Grains and Legumes Nutrition Council website. Which three grains are the most commonly eaten in Australia?

a. Corn, barley, and rye
b. Wheat, oats, and rice
c. Sorghum, millet, and oats
d. Wheat, corn, and barley

Look at the information from the Grains and Legumes Nutrition Council regarding the recommended daily serves of grains for children. It is recommended that 9 & 10 year old children should be eating...

a. 5 serves/day (boys); 4 serves/day (girls)
b. 4 serves/day (boys); 3 serves/day (girls)
c. 2 serves/day (boys); 2 serves/day (girls)
d. 4 serves/day (boys); 5 serves/day (girls)

Grains are important sources of...

a. Fibre, carbohydrates, protein
b. Fats, minerals, water
c. Fibre, vitamins, fats
d. Protein, minerals, fats

Watch the video from the Australian Guide to Healthy Eating. It recommends we should eat the most serves of...

a. Fruit and vegetables
b. Meat and dairy
c. Meat and vegetables
d. Grains and vegetables

According to the pie chart (ABARES data), which two grains are most commonly produced in Australia?

a. Canola and pulses
b. Oats and sorghum
c. Wheat and barley
d. Wheat and oats

Planting Seeds

Lesson 2

What Is Wheat?

We have learnt that the grain crop that is most commonly grown in Australia is **wheat**.

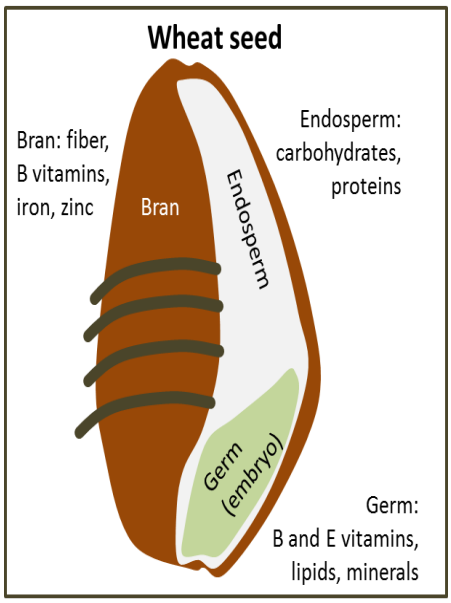
Fast facts about wheat:

- Australia produces about 24 million tonnes of wheat per year (ABARES 2016).
- Around 80% of the wheat grown in Australia is exported to over 50 countries.
- The remaining 20% is used by Australians to make flour, breads, noodles, biscuits, cakes and pasta. It can also be used to feed livestock (farm animals).
- Wheat is grown from a seed and there are many different varieties of wheat grown throughout Australia.

But How Does a Wheat Seed Become a Loaf of Bread?

We are going to investigate this 'paddock to plate' process over the next four lessons.

It All Starts With A Seed



Take a closer look at the parts of a wheat seed.

The main parts include the:

- bran,
- endosperm,
- and germ.

The germ is the embryo, which is where the new plant will begin to grow from.

It takes many seeds to grow a wheat crop. Before sowing their crop, farmers must first prepare their paddocks and ensure they are free from weeds or disease.

Once the paddocks are prepared, farmers use an **air seeder** to **sow** (or plant) their seeds. The air seeder is pulled by a tractor.

As it is pulled over the paddock, the seeder digs the ground and uses air to push the seeds about 2-5cm into the soil.

Take an inside look at how an air seeder works by watching this short video: https://www.youtube.com/watch?v=dF-lakj3uio

Seeding takes place anywhere from April to June, depending on the weather and location. After a rainfall event, seeds will begin to germinate. Shoots and roots will start to grow.

Water, nutrients, and energy from the sun will help the shoots develop and the stems and leaves will lengthen and grow.

Hands-On Task: Plant Your Own Seeds

The best way to watch how a wheat seed germinates and shoots is to plant one yourself!

You will need the following equipment:

- Clear plastic cup
- Seed raising mix/ potting soil
- Wheat seeds
- Spray bottle (water)

Instructions:

1. Scoop potting soil into the plastic cup. Pat down firmly.

2. Carefully push several seeds into the cup approximately 3 cm from the surface of the soil. Place seeds against the wall of the cup to ensure you can see them and watch them grow.

3. Spray the soil with water.

4. Place the cup in a sunny, sheltered position. Dampen the soil using the spray bottle each day.

5. Watch as your seeds begin to change and grow. Document the changes in your learning journal.

Learning Journal Activity #2

1. Open your learning journal and click on/turn to **Lesson 2.**

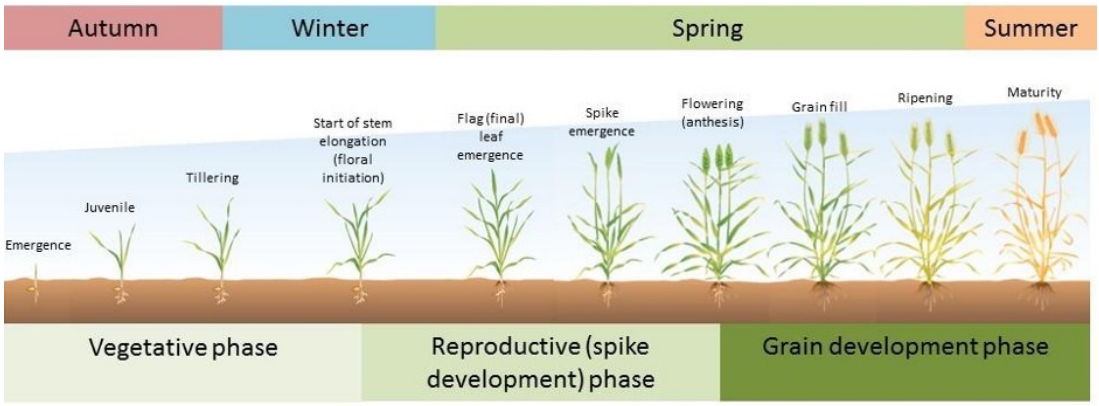
2. Record your observations of how your seed has grown in the seed diary. This may be completed over the course of a few weeks to allow your seed to grow and change.

3. Photographs of your seed can be inserted if using an electronic version of the learning journal, or alternatively drawn if using a printed version.

Growing Healthy Crops

Lesson 3

Wheat crops are planted in autumn. Over the seasons that follow, the plants will emerge and grow through three main phases:



During these phases, farmers need to monitor the growth and health of the wheat plants to ensure they survive and thrive. There are several factors that need to be considered.

Weather Conditions

As with all crops, weather is a very important factor when growing wheat. Extreme weather events (such as heavy frost, drought, heavy rain, and extreme heat) can damage the wheat crop and reduce grain yield. It is impossible for wheat growers to prevent these weather events. However, weather predictions are always closely monitored and can influence decisions that are made about sowing time and harvest time.

Pests and Weeds

Farmers watch their crops closely for signs of pests or weeds that could damage the crop. Weeds can be a problem because they compete with the crop for nutrients and moisture. Herbicides may be used to kill any weeds that are threatening the healthy development of the crop.

Pests such as insects are not usually a problem for winter cereal crops (e.g., wheat), but different weather conditions can sometimes result in higher numbers of pests which can become a problem. Pests such as mice or insects feed on the plants and affect the growth and health of the crop.

***Cutworms** cut the stems of plants and cause them to collapse, while **aphids** affect the plants just as they're starting to grow.*

Nutrition

It is important to ensure the soil continues to have the right **nutrients** for the plants to grow. Two of the main nutrients' plants need are **nitrogen** and **phosphorus**. If the soil is lacking nutrients, growers can improve the soil by adding nutrients and organic fertilisers. Often, they consult an **agronomist** (plant and soil scientist) for advice on how to improve their soil and crop.

Read the Envirostory 'Finding a Soil Solution' to understand more about how farmers and agronomists work together to solve problems about crop health.

https://www.envirostories.com.au/wp-content/uploads/pdf/2017015SoilSolution.pdf

Learning Journal Activity #3

1. Open your learning journal and click on/turn to **Lesson 3.**

2. Wheat growers always pay close attention to the changing weather conditions, knowing that these conditions could affect their crops. One way of researching weather predictions is by using the Bureau of Meteorology (BOM) website: http://www.bom.gov.au

3. Try using the BOM website to see what weather is predicted for your area this week. Type the name of your closest town/suburb in the search bar in the top right-hand corner of the page.

4. Record your findings in the learning journal.

Grain Quiz 2

In the enviro-story entitled "Finding a Soil Solution", what was the problem that Farmer Lawson was having with his wheat crop? The wheat crop was

a. being eat by cutworms.
b. The wheat crop was being overrun by weeds.
c. The wheat crop wasn't growing.
d. The wheat crop was ripening too quickly.

How was Farmer Lawson's problem solved?

a. The cutworms were treated with a pesticide.
b. The weeds were treated with a herbicide.
c. The soil was treated with limestone.
d. The crop was harvested earlier than usual.

In which season is wheat generally planted in Australia?

a. Summer
b. Autumn
c. Winter
d. Spring

How many main phases does a wheat plant go through as it grows?

a. 2
b. 3
c. 4
d. 5

Which weather condition might damage wheat crops and reduce grain yield?

a. Heavy frost
b. Drought
c. Extreme Heat
d. All of the above

What is an Agronomist?

a. Heavy machinery operator
b. Plant and soil scientist
c. Grains transport specialist
d. Weather forecaster

Why can weeds be a problem for the healthy development of a wheat crop?

a. Weeds can poison the wheat plants.
b. Weeds stop the wheat from ripening.
c. Weeds compete with the wheat plants for nutrients and moisture.
d. Weeds attract insects who can eat the wheat plants.

What are two of the main soil nutrients needed for a healthy wheat crop?

a. Nitrogen and phosphorus
b. Potassium and calcium
c. Magnesium and sulphur
d. Iron and zinc

Harvesting the Wheat

Lesson 4

If conditions are right, the wheat crop should be growing well. The wheat heads will have emerged from the stem and the plants will start to flower. The spikes will become filled with new grains, which will ripen during the warmer months. This is when the wheat turns from green to golden.

When the grain is completely dry and ripe, it is ready to be **harvested.** This is when the grain is gathered and collected from the crop.

Harvest Time

Harvest time is always a very busy time on a farm! The weather conditions must be perfect for harvesting to continue - rain, storms, wind, or extreme heat can ruin the crop. Wheat is generally harvested in spring or summer. The month can vary from year to year depending on weather conditions.

There is special equipment needed to harvest wheat. These include:

Havester

The harvester cuts the wheat and catches the grain from the heads.

Chaser bin

The chaser bin is pulled by a tractor. When the harvester is full of grain, it unloads into the chaser bin. The chaser bin then empies the grain into a silo for storage or into a truck to be taken away.

Watch this video to learn about harvest time on a property called 'Barooga':

https://education.abc.net.au/home#!/media/2438561/barooga-at-harvest-time

What Happens Next?

Once the harvest is complete, the grain will be graded. This is done by looking at the specific qualities of the grain, and assessing whether it will be good for pasta, cake, or for bread. Trucks or trains will then transport the grain to big storage units

called **silos** (pictured below). From here it will either be **exported** to other countries that have bought the grain, or will be sold to Australian companies that will **mill** the grain into flour and make a range of products. We will learn more about this process in Lesson 5.

Learning Journal Activity #4

1. Open your learning journal and click on/turn to **Lesson 4.**

2. The weather and seasons are important factors when planting, growing, and harvesting wheat crops. Use the information you have learnt in the previous lessons to complete the **Wheat Seasonal Diary** in your learning journal.

Grain Quiz 3

When is a wheat crop ready to be harvested?

a. When the spikes emerge from the stem.
b. When the plants start to flower.
c. When the spikes become filled with new grains.
d. When the grain is dry, ripe, and golden.

In the video Barooga at harvest time, what is the chaff used for?

a. Food for the animals.
b. Seeds for next year's crop.
c. Mulch for the soil.
d. It has no use at all.

In the video Barooga at harvest time, where does the big truck take the grain?

a. To the farmer's house.
b. To a silo for storage.
c. To the supermarket.
d. To a bakery.

In the video Barooga at harvest time, which weather conditions are we told are considered ideal for harvesting the wheat crop?

a. Warm and dry
b. Wet and windy
c. Cool and damp
d. Foggy and icy

What is the name of the machine that cuts the wheat and harvests the grain?

a. Tractor
b. Header / Harvester
c. Chaser Bin
d. Silo

In the video Barooga at harvest time, why do the wheat grower’s need to harvest their crops quickly?

a. Because it's almost Christmas.
b. Because their machinery needs repairing.
c. Because rain is coming.
d. Because the weather is too hot.

Turning Wheat Into Bread

Lesson 5

The Milling Process

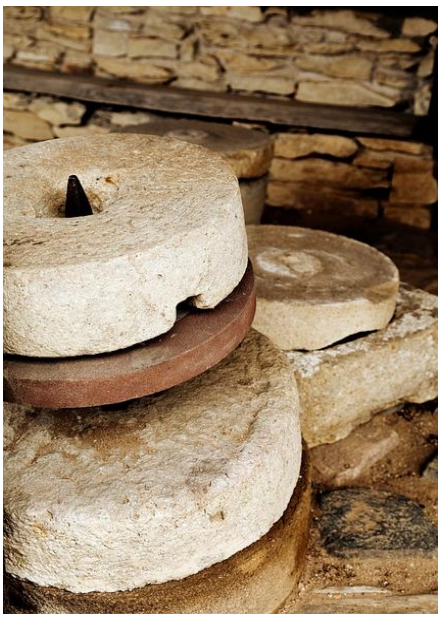
wheat → flour → bread

The process of turning wheat into flour is called **milling**.

Traditionally, milling would have been accomplished by grinding grains between two stones and crushing it into a fine powder.

There is evidence that Indigenous Australians were grinding native grains into flour as far back as 65,000 years ago to make damper, also known by Europeans as bush bread or seedcake.

They use a variety of ground native seeds, nuts and roots to form a dough, then bake the dough in the coals of a fire.



Another early method of milling was the use of millstones - two round stones stacked on top of one another and rotated to crush the grains.

Smaller millstones could be operated by hand, however large millstones were operated by animals pulling the top stone around and around over the bottom stone.

Today, milling is a much more technologically advanced process. Flour mills are large facilities that have a vast range of machines working to crush wheat and turn it into flour.

They employ many people to manage the equipment and oversee the flour production.

Watch the following news clip about an Australian flour mill working hard to keep up with demand for flour during the pandemic in 2020. Take note of the machines and equipment that are used within the mill.

https://www.youtube.com/watch?v=xjdGPJBlvI0

Using Flour to Make Bread

Once the wheat has been milled into flour, it can be used to produce a range of food products. These include pasta, biscuits, cake, pizza dough, muffins, crackers and, of course, bread!

Bread is a very important staple food in Australian households. It can come in many different flavours and even in different shapes (for example loaves, rolls, pita bread, wraps). What is your favourite type of bread?

Have you ever wondered how the bread you buy from the supermarket has been made? Watch this video to learn about the process of making bread:

https://education.abc.net.au/home#!/media/86086/daily-bread

Extension video: Automated Bread Factory

Hands-On Learning: Milling Grain

Today, our wheat grain is milled into flour in technologically advanced factories and is then readily available to purchase in the supermarket. But imagine how much effort it would have taken to mill flour before this technology had been invented.

- Have a go at milling grains by hand to experience this process. You could grind them between two rocks or use a mortar and pestle if you have one available.
- Describe and reflect on the method you use in your learning journal (Lesson 5) and include photographs if possible.

Learning Journal Activity #5

1. Open your learning journal and click on/turn to **Lesson 5.**
2. Use the space provided to describe and reflect on your hands-on learning task - milling grains by hand.
3. If possible, include photographs of the process and of the grains before and after being milled.

Why Eat Whole Wheat

Lesson 6

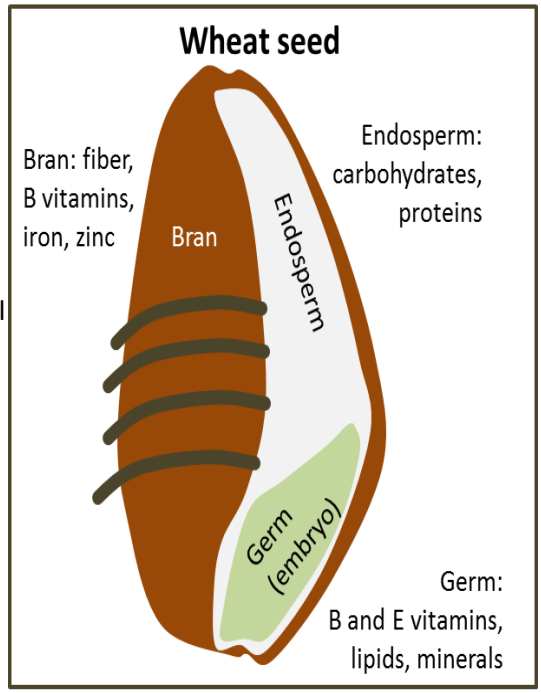
In the previous three lessons we have learned about the **paddock to plate** process of growing wheat to make bread. We know that there are many different types of bread available in supermarkets and bakeries for us to buy - sometimes it can be difficult to choose between them all!

In this lesson, we will investigate the benefits of eating whole wheat bread (also known as wholemeal/ wholegrain) rather than white bread.

How Is Whole Wheat Bread Different From White Bread?

Let's take another look at the different parts of a grain. As already identified in Lesson 2, there are three main parts of a wheat grain:

- the bran,
- the endosperm,
- and the germ.



Whole wheat bread is made from flour that uses all the parts of the wheat grain, ensuring that important nutrients including fibre, Vitamin B, Vitamin E, iron, and zinc are available. These nutrients are important components of a healthy diet.

White bread (or 'refined bread') is made from flour that only uses the endosperm part of the grain. The bran and germ have been removed, which also means that most of the healthy nutrients have been removed.

Watch the video Daily Bread. It will revise the paddock to plate process of making bread that we have already learnt about and will also investigate the benefits of eating whole wheat bread.

Extension Video: White Bread Vs Wholegrain Bread

Hands-On Learning: Digestion Experiment - Whole Wheat Vs White Bread

Conduct the following experiment to see the difference between how our bodies digest whole wheat bread compared with white bread.

The equipment list and method are listed below. You can record your results and reflect on your experiment in your Learning Journal.

Background Information

Digestion is the process of breaking down the food you eat into nutrients that your body needs for energy, growth, and repair.

Foods that are easy/quick to digest are often low in fibre and are not able to provide you with energy for very long periods.

Foods that digest more slowly are usually higher in fibre and can give you energy for longer periods.

Quick Question: *Which bread takes longer to digest - whole wheat or white?*

Learning Journal Activity #6:

Equipment:

- 2 clear jars
- White vinegar
- 1 slice white bread
- 1 slice whole wheat bread
- Spoon
- Timing device

Method:

1. Half fill each jar with vinegar. Vinegar is an acidic substance and will represent the stomach acids in our body that help to break down our food.

2. Break up pieces of the whole wheat bread and place inside one jar of vinegar.

3. Repeat the same process with the white slice of bread and place inside the second jar of vinegar.

4. Use the spoon to gently stir each jar. This simulates the movement of food inside our stomach during the digestion process.

5. Continue to stir for a few seconds each minute. Take note of any changes in the bread. Repeat for 10 minutes.

6. Use the spoon to lift out the pieces of bread. Which type of bread has been broken down ('digested') more quickly than the other?

Results:

Record your results in your learning journal (Lesson 6)

Conclusion:

Reflect on your learning in your learning journal (Lesson 6)

Promoting Whole Wheat Products

Lesson 7

In the previous lesson, we learnt about the nutritional and digestion benefits of eating products made from whole wheat flour over white flour.

It is not always an easy sell to get people (particularly children) to eat whole wheat products, as white flour products are often softer, sweeter, and therefore more appealing to appetites! They also, however, offer far less nutritional value than their whole wheat varieties.

Design Task

Your task is to create a **persuasive text** that encourages students of your age group to **include more whole grains in their diets**.

This text could take a variety of forms, such as:

- Poster
- Print advertisement
- Radio advertisement
- Argument (written)
- Speech

Consult with your teacher regarding the type of text you would like to create, and the best way to submit this for marking.

Use your Learning Journal (Lesson 7) to plan your text and record any relevant information you have researched that could assist with your persuasive piece.

Learning Journal Activity #7:

1. Open your learning journal and click on/turn to **Lesson 7.**
2. Use the space provided to record your planning for the design task.

Baking With Whole Wheat Flour

Extension Activity

This is an **optional** extension activity that could be used as a concluding lesson to the unit if time allows and necessary resources are available.

Now that we have studied how wheat is grown and how flour is made, what better way to conclude our learning than by creating (and eating) our very own food!

This video shows a young girl learning how to bake bread. Have you ever **kneaded dough** before? Watch how it's done:

https://education.abc.net.au/home#!/media/30321/how-do-you-make-bread

There are links below to a variety of different recipes you could choose from, or you could research different recipes of your own. Your class might like to take a vote to decide on which recipe you'd like to try.

We have examined throughout this unit the benefits of using **whole wheat** flour. Therefore, all recipes listed below ask for whole wheat, rather than white flour.

Bread	https://bakingamoment.com/soft-whole-wheat-bread/
Banana Bread	https://www.kingarthurbaking.com/recipes/whole-grain-banana-bread-recipe
Muffins	https://www.myrecipes.com/recipe/browned-butter-whole-wheat-muffins
Chocolate-chip Cookies	https://www.bettycrocker.com/recipes/whole-wheat-chocolate-chip-cookies/391acf6b-df6c-49d3-894b-4ac705dc9cb2
Pizza Dough	https://www.allrecipes.com/recipe/46595/amazing-whole-wheat-pizza-crust/

NOTE: If you need to convert the temperature from Fahrenheit to Celsius, try this calculator.

FOR THE TEACHER: Important Factors To Consider

Food Allergies And Intolerances

It is essential before undergoing any cooking activities with students to receive permission from parents and obtain any information regarding student food allergies or intolerances. Students who are coeliac or gluten intolerant will need to substitute regular flour with gluten free flour for all of the recipes provided.

Hygiene

Issues regarding food handling, cleanliness and hygiene will be important considerations for this extension activity. Ensure you are up to date with regard to your school's current regulations for food handling.