



Department of
Primary Industries

Australian Hamburgers

Technology Mandatory

Area of Study - Agriculture and Food Technologies



www.dpi.nsw.gov.au



Supporting document
NSW DPI Schools Program

Author: Meg Dunford (Project Officer School programs, NSW DPI Orange) and Libby Dawes (Head of Agriculture, Scots, All Saints College, Bathurst)

Editors and Advisors: Michelle Fifield (Education Officer Schools, NSW DPI Orange), Jo Hathway (Project Officer School programs, NSW DPI Tocal College) and David Brouwer (NSW DPI Tocal College).
Designer: Romina Barbagallo (Communications Officer, NSW DPI Orange)

Disclaimer: This resource is produced for use by NSW Agriculture and Technology Mandatory teachers and students. The information contained in this resource is based on knowledge and understanding at the time of writing (October, 2018). However, because of advances in knowledge and technology, users are reminded to ensure that the information upon which they rely is up to date and to check the currency of the information, content and hyperlinks.

To the extent permitted by law, NSW Department of Industry excludes all liability for any direct or indirect losses, damages, costs or expenses, incurred by, or arising by reason of, any person using or relying on this document (in part or in whole) and any information or material contained in it.

Recognising that some of the information in this document is provided by third parties, the State of New South Wales, the author and the publisher take no responsibility for the accuracy, currency, reliability and correctness of any information included in the document provided by third parties. NSW Department of Industry expressly disclaims responsibility for any error in, or omission from, this report arising from, or in connection, with any of the assumptions being incorrect or otherwise.

Copyright

© State of NSW through the Department of Industry 2024, except where indicated otherwise. This work is licensed under a [Creative Commons Attribution-NonCommercial 4.0 International \(CC BY-NC 4.0\)](https://creativecommons.org/licenses/by-nc/4.0/). Under this license the material is available for free use and adaption. Educators may use, share, adapt, and republish material from the resource. You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.

[\(https://creativecommons.org/licenses/by-nc/4.0/\)](https://creativecommons.org/licenses/by-nc/4.0/)

Australian Hamburgers, Edition 2- updated 2024

Contents

Information for teachers.....	4
Syllabus context – Agriculture and food technologies.....	4
Learning outcomes.....	4
Resource description.....	4
Glossary.....	5
Agriculture in Australia.....	6
What is agriculture?.....	6
The history of agriculture in Australia.....	6
The value of agriculture.....	9
Australian agricultural sectors.....	12
Wheat.....	12
Beef.....	16
Dairy.....	19
Pork.....	22
Sheep.....	26
Poultry.....	30
Practical Activity- food preparation.....	37
Horticulture.....	38
Practical activity - vegetable garden.....	42
Mini design projects.....	44
References and further reading:.....	45
NSW Syllabus outcomes.....	47
Technology Mandatory 2017 Stage 4.....	47

Information for teachers

Syllabus context – Agriculture and food technologies

This Australian Hamburger unit of work is mapped to outcomes from *Agriculture and Food Technologies* of the NSW Technology Mandatory (2017) syllabus. It integrates content from agriculture (food and fibre production) and food technologies to enable delivery considering the school context and available resources.

Agriculture (food and fibre production) focuses on investigating managed environments, such as farms and plantations. Students learn about the processes of food and fibre production and investigate the sustainable supply of agriculturally produced raw materials. Students develop deep knowledge and understanding about managed systems that produce food and fibre through designing and producing solutions.

Food technologies focuses on the use of resources produced and harvested to sustain human life. Students learn about the features and properties of food. Students are able to develop knowledge and understanding about food selection and preparation, food safety and how to make informed choices when experimenting with and preparing nutritious food.

Source: [NESA, 2017. Technology Mandatory Syllabus.](#)

Learning outcomes

This unit of work provides students with the opportunity to investigate the importance of Australian agricultural production to our society and gain a broad understanding of some of our main agricultural industries including: beef, sheep, poultry, pork, cropping (wheat) and horticulture.

Resource description

The Australian Hamburgers unit of work consists of three resources: a workbook, an answer guide, and a design folio.

These resources are designed to be used together however, you are advised to alter the resources to suit your learners, school facilities and individual skills.

The core workbook includes guides for practical activities, in-class extension investigations and mini design projects which will challenge student understanding and prepare them to complete a major project for the unit to design and prepare a nutritious food product: a hamburger using raw materials from Australian agricultural production.

This workbook has been designed as a digital resource, therefore, to use all aspects and complete the workbook and learning activities students will require access to the internet to follow embedded links throughout the document.

Additional activities suggested in conjunction with this workbook involve students designing, growing, managing and making observations on a vegetable or herb garden to grow fresh produce to use in their major design product; conduct breed investigations; learn food preparation and cooking techniques; and design packaging for their hamburger.

Glossary

Term	Definition
Agriculture	The science or practice of farming, including cultivation of the soil for growing crops and rearing animals to provide food, fibre, fuel and other products.
By-product	A secondary product made in the manufacturing process of the raw primary product being produced. For example, a by-product of meat production could be skins for leather.
Consumer	People who buy and use a product to satisfy their needs or wants, for example people buying fruit to consume or eat.
Domestic market	Also referred to as an internal market or domestic trading. Domestic markets supply goods and services within a single country.
Economy	An economy encompasses all activity related to production, consumption and trade of goods and services in an area.
Extensive agriculture	A type of farming characterised by growing animals or plants over large areas of land or at low stocking rates. Extensive farming systems usually have lower inputs of labour and feed and lower production per unit area, compared to intensive agriculture systems.
Holistic	Holistic farming is an approach that manages all aspects of the farm as a whole. All parts including animals, plants, humans, and natural resources are considered together and the impacts and connections between them are managed together.
Input	Anything that is added into or used in production. Inputs include physical things like seed, hay, raw materials; and cultural inputs such as money, labour and skills.
Intensive agriculture	A type of farming characterised by growing animals or plants at high stocking rates and densities. Intensive farming systems have higher inputs of labour and feed and high production per unit area compared to extensive agriculture systems.
Irrigation	Irrigation is the artificial supply of water to soil and plants to increase growth.
Management	Management involves activities surrounding organising and co-ordinating a plan or strategy to accomplish an objective. Agricultural management involves resources such as money and finances; natural resources such as soil and water; technology; labour; animals; and plants and humans.
Output	Outputs are raw products from farming such as milk, eggs and livestock.
Primary Industry	Industries including mining, agriculture and forestry, which are concerned with obtaining or providing natural raw materials for conversion into commodities and products for the consumer.
Processing or manufacturing	Any of the various stages of alteration to turn a raw product into a product available for consumers. For example if the raw product is a tomato, processing steps include: harvesting, washing, peeling, cooking, canning and transport. The processed product would be canned tomatoes.
Producer	A person who produces goods, products or services. Farmers are producers.
Sustainability	An approach to farming which produces profitable high quality products without depleting or degrading the environment or natural resources of for example, soil and water.
System	A set of units that interact, react and depend on themselves and the living and nonliving parts of an environment, for example a natural ecosystem. In agriculture a farm system consists of many interacting units such as plants, animals, climate, soil, weeds, pest and diseases and management practices which operate within a boundary.

Agriculture in Australia

What is agriculture?

Agriculture is the science of growing, rearing and producing food, fibre, timber and fuel. Food and agriculture are essential for human survival.

It was the birth of agriculture and farming that laid down the basis for human civilisation. Since the first crops were domesticated around 10,000 years ago, advances in agriculture have been closely linked with human development and the growing world population.

Agricultural industry and production affects everyone's lives every moment of the day.

Industry production sectors are cropping, pasture production, livestock production, market gardening and horticulture, aquaculture, forestry and viticulture. Within each industry the diverse skills, knowledge, practices, opportunities and careers are endless.

The history of agriculture in Australia

In Australia, the Aboriginal and Torres Strait Islander peoples have been the traditional custodians of the Australian continent for an estimated 50,000 years.

In this time, they developed a deep understanding and knowledge of living sustainably and conserving their country. This meant that they sought to use and protect resources in the environment.

They developed agriculture, aquaculture and farming methods using sustainable and holistic approaches and a deep understanding and respect for 'country' (the land), its limitations, the climate and the environment. They never overused the resources in one place. Their approaches to farming and agriculture have helped change the Australian landscape, in particular, the distribution of different ecosystems.

Examples of Aboriginal agriculture include:

- Cultivation and large scale cropping of plants in areas, for example yams
- Firestick farming which involved the strategic burning of land to promote plant regrowth
- Complex aquaculture and irrigation systems to drought proof the environment; guarantee food security and conserve ecosystems and the animals and plants in them. See Figure 1 the Lake Condah Aboriginal fish traps and irrigation channels
- Development of complex seasonal



Figure 1 Aboriginal fish traps made from rocks, Darling River, 1938;
[Source: LaTrobe Picture Collection, State Library of Victoria](#)

harvesting regimes which prevented over hunting and overuse of food and natural resources. See the NSW [‘DPI Food and Fibre production- an Aboriginal perspective’](#) Schools Program resource to investigate further.

Watch [‘Brewarrina fish traps’](#) and [‘Indigenous engineering and technology at Budj Bim’](#) to learn more about the historic Aboriginal aquaculture technologies.

European settlement in 1788 brought along with it great changes in agricultural practices, production and the animals and plants that were farmed on the Australian continent. European settlers brought non-native species and practices which were suited to farming and agriculture in the United Kingdom and Europe.

The European methods of farming that were first introduced to this country had to be modified to allow for Australia’s climate, and its very different soils and vegetation. As a result, animals and plants were bred and developed as Australian settlers began to understand the limitations of the land and climate. Over time they developed sustainable, productive and efficient practices and technology suited to the challenging and harsh Australian environment and climate.

Australian agricultural production has changed significantly since the First Fleet landed and the massive evolution of the industry, in less than 250 years is extraordinary. Agriculture today is very sophisticated and highly technical and is one of Australia most innovative, efficient and environmentally focused industries.



Brewarrina fish traps, NSW

Australian farmers have been quick to adopt large scale mechanisation, technology and sustainable and efficient farming practices in order to remain price-competitive with global competitors. Increases in productivity have occurred with innovative farming techniques, scientific developments in areas such as plant and animal breeding, and improvements in managing crops, livestock, land, water and pests. Supporting these innovations is the use of sophisticated machinery and information technology that allow our farmers to work smarter.

The farming sector helps connect all Australians, both urban and rural, through what it does and what it provides. Farming has helped shape our nation; it is embedded into our daily life; it is a major contributor to our economy and will help sustain our population and those of our export markets in the years to come.

Follow this link to watch CSIRO’s [‘Growing the Future’](#) to investigate future agricultural innovations.

Agriculture in Australia learning activities

1. Define agriculture.

- List 5 agriculture products that you have used today. For each, give an example of an industry sector that produced it. For example, toast for breakfast is made from flour from processed wheat that was grown through cropping.

- Use research to complete the table to identify what each of the following industry sector produces and give an example of raw products. The first example has been given for you.

Industry sector	Production purpose	Main products
Dairy	Growing dairy cattle breeds to supply milk	Milk and dairy products cheese, yoghurt, custard, ice cream etc.
Beef		
Sheep meat and wool		
Cropping		
Viticulture		
Aquaculture		
Poultry		
Horticulture		
Pastures		
Forestry		
Apiculture		

Group activity

Break into pairs to complete the following activity. In your pair; choose two of the following historical innovators to research. Present your findings to your class.

- Use research to investigate the following people and the impact they had on historical Australian agricultural. For each innovator include the year/s of their work and briefly explain the invention or technology they developed.
 - James Ruse
 - John and Elizabeth Macarthur
 - Maria 'Granny' Smith
 - Samuel McCaughey
 - John Ridley
 - Professor William Lowrie
 - William Farrer
 - George and William Peppin

The value of agriculture

Agriculture is a significant industry to the Australian economy and society. In addition to supplying agricultural products to export markets, Australia supports basic food security domestically. Food security is having year-round access to nutritious, affordable and sustainable food for an active and healthy lifestyle.

Australia produces enough food to feed 60 million people, which is three times the current Australian population. Australian agricultural production accounts for about 3% of the global food trade through exports and is worth more than AUS\$30 billion annually. We are one of only 11 countries that are net exporters of food (Landridge, 2014).

NSW boasts a diverse range of primary industries. The State's total production value can be measured through the Gross Value Production (GVP). Figure 2 illustrates the industries contributing to the estimated \$15,442 million GVP.



Figure 2 NSW Primary Industry GVP. Source NSW DPI, 2017

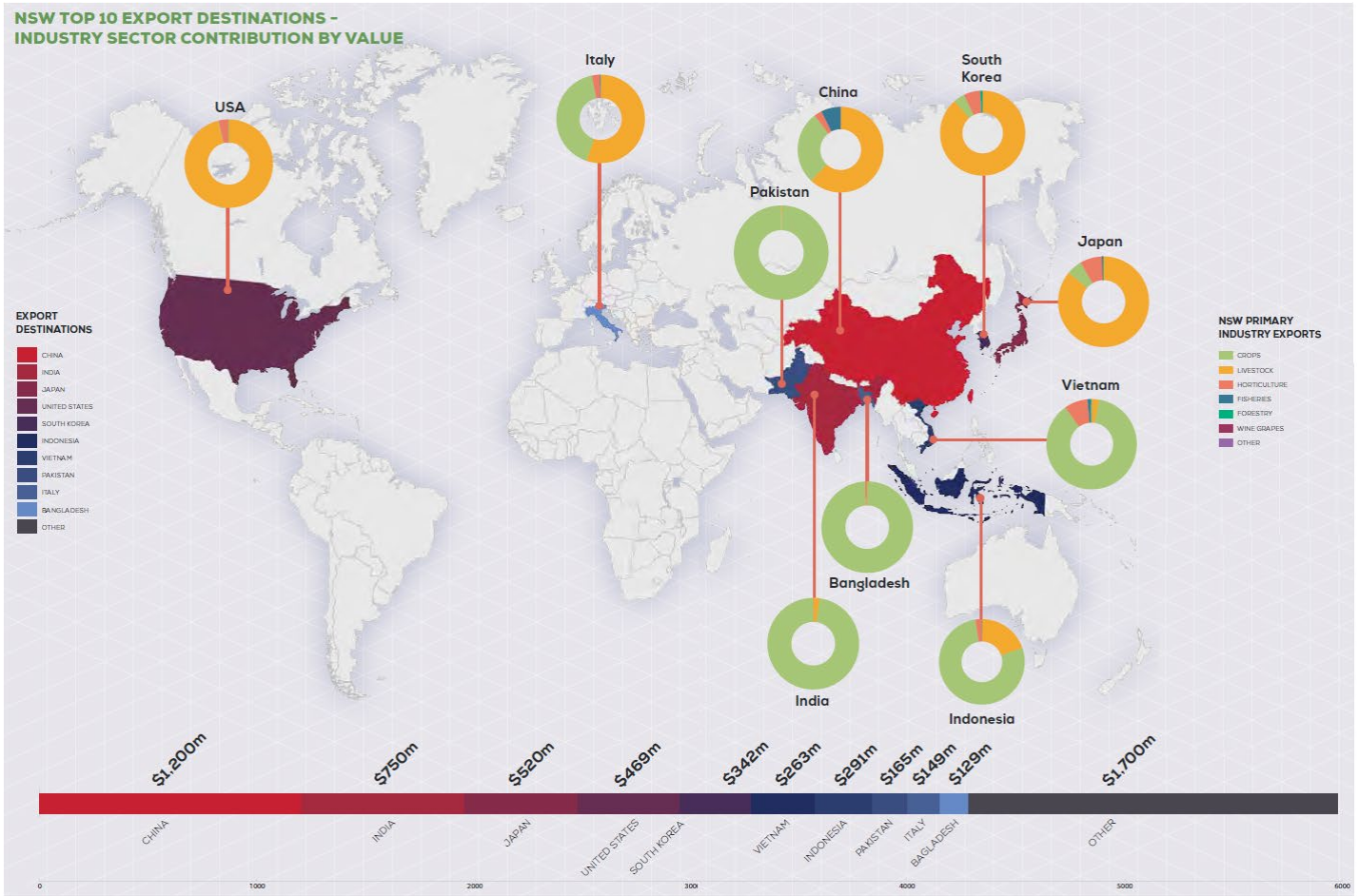


Figure 3 NSW Primary Industries 2016-2017 exports. Source NSW DPI, 2017

The value of agriculture learning activities

1. Define food security.

2. Use Figure 2 to list the top 10 contributors to NSW Primary Industries 2016-2017 GVP.

3. Use Figure 3 to identify 5 export destinations for NSW crops.

4. Use Figure 3 to identify 5 export destinations for NSW livestock.

5. Use Figure 3 to identify the major export destination for NSW fisheries and aquaculture products.

6. Identify a global area or continent that is important to the NSW primary industries export market. Explain why you think that particular area consumes large amounts of NSW primary industries products.

Australian agricultural sectors

In the last section you identified major NSW agricultural sectors which have great economic importance, sustaining food security and our economy. In this section you will investigate the wheat, beef, dairy, sheep, pork, poultry and horticulture sectors further.

Wheat

Wheat is a type of annual grass that has been selectively bred and grown to produce cereal grain. The grain is mainly used to feed humans and livestock. Wheat is one of Australia's major agricultural crops and one of the most important grain crops in world commerce.

Australian wheat is mainly grown extensively on large areas of land. It can also be grown intensively using irrigation in areas with water available.

In 2016-2017 in NSW alone, nearly 5 million hectares of land were sown to wheat, yielding approximately 12,000 tonnes.

Wheat is grown from seed, which is the grain that is harvested and processed for food production. Soil must be prepared for wheat to be sown using high-tech mechanical implements including tractors, ploughs, seeders and direct drills depending on the location and soil quality.

In Australia wheat is a winter crop. It is sown in autumn to early winter and grows until it is ready to be harvested in late spring or early summer.



Figure 4 Wheat heads or spikes. Each spikelet was a flower which is now filled with an individual grain.

As the plant grows and develops it goes through different stages of growth. Follow this link to watch wheat growth stages: ['Beautiful time-lapse of growing wheat'](#).

Wheat is harvested using combine harvesters. The harvesters collect the ripe hardened grain from the plant which is processed in the machine to remove it from a protective husk which is part of the wheat plant's spikelet. Grain is then transported to collection silos where it is graded according to specific quality measurements. Farmers are paid on the quality of the grain, with protein content being the main factor.

Follow this link to watch Guy Grove's footage showing wheat being harvested at Ungarie ['Harvest 2017-Australia'](#).

Throughout wheat's growth and development it is important for the farmer to manage and monitor the crop to prevent it from being stressed. Plant stress comes from lack of water, lack of essential nutrients and pest and disease attack. Reducing plant stress increases plant growth and development, which improves grain quality and financial return to farmers.

Follow the link to the [Wheat \(AEGIC\) factsheet](#) to learn more about wheat production in Australia.

Wheat and grains nutritional value

Wheat consumed by humans is a seed belonging to the grain-producing family of plants called cereals. Other plants in the cereal family include: barley, rice, oats, triticale and rye.

Other grain-producing plants not part of the cereal family that we consume include millet, quinoa and corn (maize). The different grains can be cooked and eaten whole or processed by being ground into flour to make a variety of cereal products like bread, pasta and noodles, or made into ready-to-eat breakfast cereals (Eatforhealth.gov.au, 2015).

Cereals and grains are one of the five food groups and are an important part of a healthy balanced diet.

Cereal grain foods comprise four main groups. These main groups are:

- Breads - wholemeal, wholegrain, white, rye, pita, naan, focaccia, crispbreads, damper
- Breakfast cereals - ready to eat, high fibre (wholegrain) oats, porridge, muesli, whole-wheat biscuits
- Grains – wheat, rice, barley, corn, polenta, buckwheat, millet, sorghum, triticale, rye, quinoa, semolina
- Other products - Pasta, noodles, English muffin, crumpet, rice cakes, couscous, popcorn, flour (Eatforhealth.gov.au, 2015).



Figure 5 Singular wheat grains or seeds. At the top of the picture is a cracked grain which shows the white starch filled endosperm

The difference between wholemeal and refined grain

Cereal grain seeds like wheat have three layers: bran, germ and endosperm. The bran and germ are high in fibre, vitamins, minerals, and antioxidants; the endosperm is starch-filled. Wholegrain cereals are processed by being either being left whole or by crushing the whole grain to a fine texture. These products contain the three layers of the grain. So wholegrain cereal products contain more fibre, vitamins, minerals and antioxidants than refined cereal foods such as white bread. Wholegrain foods are particularly important in vegetarian diets as a source of iron and zinc (Eatforhealth.gov.au, 2015).

Refined grains, for example white flour, have had the bran and germ layers removed during processing. This removes most of the healthy fibre, vitamins and minerals, leaving a bulk of high energy starch. Refined grains such as white flour are nearly always used in processed foods, such as cakes and biscuits. These types of grain foods are recommended in limited quantities in your diet as they do not have the nutritional benefits of whole grains and tend to have large amounts of added fats, sugars and/or added salt (Eatforhealth.gov.au, 2015).

Watch [“Whole Grains: Nutritional facts”](#), Penn Sate Extension.

Wheat learning activities

Follow this link to the [Wheat \(AEGIC\) factsheet](#) to complete activities 1-3

- 1. List the main production areas for Australian wheat.

- 2. List the main export markets for Australian wheat.

- 3. Identify and explain the different end- uses for wheat.

Follow this link to the [Eatforhealth.gov.au Grains and cereals page](#) to complete activities 4-6.

- 4. Identify and explain the healthier option between refined grain and wholegrain products.




- 5. Complete the table to identify what a standard serve of grain or cereal is equivalent to.

Grain type	Serving size and weight
Bread	
Cooked rice	
Cooked pasta	
Cooked porridge	
Breakfast cereal	
English muffin or scone	

6. Complete the table to identify how many serves children and adolescents should have of grain cereals each day.

Age Group (years old)	Serving of wholemeal grains	
	Boys	Girls
1-2		
4-8		
12-13		
14-18		

7. The following table has images of some common cereal grains used by humans. Go to [NSW DPI Agricultural crops and pastures of NSW](http://www.dpi.nsw.gov.au/industry/agriculture/crops/pastures) to complete the table. Name the plant and list examples of products made from the plant. The first has been given to you.

Plant name	Plant	Grain	Product/s
Wheat			Pasta, bread, flour, biscuits, noodles
			
			
			
			
			

Beef

With a worldwide population of about 1.4 billion animals, cattle are one of the most important livestock species for human food production. They are a major source of milk, meat, hides and in some places around the world, used for their draught power as beasts of burden.

Domestication has led to the development of specialised breeds. These breeds have evolved due to thousands of years of human-controlled selective breeding. This involves selecting and mating individual animals with desirable characteristics. The major two characteristics which cattle have been selectively bred for are milk production (which resulted in dairy breeds) and meat production (resulting in beef breeds).

Characteristics selected for breeding include coat colour, temperament, size, structure, fertility, pest and disease resistance and adaptability to different environments.

In Australia, beef cattle are commercially produced in all states and territories.

Beef cattle are either *Bos indicus* or *Bos taurus*

species.



Figure 6 *Bos indicus* cattle

- *Bos indicus* species (tropical breeds) have large ears; a slick-haired coat; excess skin in their dewlap (the loose skin running from the jaw to between the front legs). They also have a noticeable hump above the shoulder. They are well adapted to the hot and humid climates and have tick resistance. Australian breeds include Belmont Red, Brahman, Brangus, Braford, Charbray, Droughtmaster and Santa Gertrudis.
- *Bos taurus* cattle have been developed from British and European stock. They have no hump, and thick coats that allow them to be productive in cooler temperatures. They are well adapted to temperate areas of Australia, such as the southern states. Common *Bos taurus* breeds include Angus, Charolais, Hereford, Limousin, Murray Grey, Shorthorn and Simmental.



Figure 7 *Bos taurus* bull

In Australia, beef cattle are produced in both extensive and intensive systems depending on the production objective, resources available and environmental factors such as soil type and climate.

Follow these links to watch clips on extensive and intensive Australian beef production.

- Extensive beef production involves cattle being farmed at low stocking rates fed on pasture. Watch [Innovative cattle stations in Australia](#) to see the Cadzow family's 8,000 head operation Mt Riddick Station, located North of Alice Springs in the Northern Territory

- Intensive beef production involves cattle being farmed at high stocking rates with irrigated pastures or in feedlots. Watch [Australia grain fed beef – why do feedlots exist?](#)

Beef cattle farming systems are mainly based on grazing pastures with additional feed (called supplementary feed) being supplied to either meet a production goal or when pastures do not provide enough nutrition for the animals. An example could include feeding cows with young calves to produce more milk so that calves grow to their potential. Another example could include feeding cattle in drought.

Farmers manage and take great care of all their livestock's welfare and needs. If animals get stressed the first thing this affects is their weight gain and production. Australian beef cattle farmers make a living from the profits of growing cattle and take pride in looking after, producing and selling high quality cattle for meat. Australian beef is known globally for its high quality and disease free status. If the farmers do not have the welfare of their animals as an important focus of their production, they cannot make profits.



Figure 8 Beef cattle in a feedlot being supplementary fed

Follow this link to [Australia's beef industry Fast Facts](#) to learn more about beef cattle production in Australia.

Red meat nutritional value

This section contains nutritional information for lean red meats including sheep meat, pork and beef.

Beef, pork, lamb and mutton are all red meat. Other examples of lean red meat are veal (which is very tender beef cuts produced from young cattle that have been milk fed), kangaroo and goat.

Red meat is an important component of Australian meals, culture and lifestyle and a wide variety of foods come from this food group. Meat is one of the five food groups and is an important part of a healthy, balanced diet.

Red meat is a good source of high quality protein. Protein is essential for growth, maintenance and the repair of the body. It also provides energy. Red meat has a wide variety of essential nutrients including iodine, iron, zinc and essential and healthy omega-3 fatty acids.

Red meat also contains a variety of vitamins, including a range of B vitamins, particularly vitamin B3 (niacin), vitamin B6 and vitamin B12. As vitamin B12 is only found naturally in foods from animals, people who do not consume meat or other animal products may have an inadequate intake, which has negative effects on health ([Eatforhealth.gov.au, 2015](#)).

Consuming at least one serve of lean red meat each day is recommended, with a maximum of 7 serves of lean red meat per week. Protein sources in a healthy and balanced diet should come from a variety of sources including red meat, poultry, seafood, eggs, and legumes or pulses ([Eatforhealth.gov.au, 2015](#)).

Salted, smoked and preserved red meats such as ham, bacon, jerky and salami can be higher in saturated fats, salt and contain chemical properties, so should be consumed in limited quantities to maintain a healthy balanced diet.

Beef learning activities

Follow this link to [Australia's beef industry Fast Facts](#) to complete activities 1-4.

1. How many head of beef cattle were in Australia and NSW in 2016-17?

2. In 2016-17 how much beef and veal did Australia export and to how many countries?

List the 4 major export destinations for Australian beef.

3. Fill the spaces to complete the sentence. "Australia produces _____ of the worlds beef supply and is the _____ largest beef exporter in the world".

[Follow this link to investigate The Conversation article 'Organic, grass fed and hormone-free: does this make red meat any healthier?' Use your findings here to answer 5-10.](#)

4. Explain the nutritional difference between organic and non-organic red meat.

5. How much beef would an Australian have to eat from a hormone treated animal to get the same level of naturally occurring oestrogen found in an egg?

6. What does grass fed beef (meat) mean?

7. What does grain-fed meat mean?

8. List four reasons for grain feeding animals.

9. Identify and explain what Wagyu beef is.

Figure 9 Poll Hereford cows with crossbred calves



Dairy

Dairy cattle breeds have been specifically developed for milk production. The main breeds farmed in Australia are *Bos taurus* breeds including: Holstein-Friesian, Jersey, Aussie Red, Illawarra, Guernsey, Brown Swiss and Ayrshire. *Bos taurus* breeds do not have the physical adaptations to handle heat and humidity and remain productive. As a result, dairy production mainly occurs in areas with mild temperatures.

Dairy production providing fresh milk for the domestic market occurs in all Australian states and territories except for the Northern Territory. Dairy farms are mostly found in high rainfall or irrigation zones due to the need for water to grow high quality and quantity pastures to feed the cows. As a result, dairy production mainly occurs in the south-eastern Australian states in high rainfall, temperate coastal zones and inland in irrigated areas in the southern NSW and northern Victoria Murray-Darling Basin area. Victoria is the largest production state, followed by NSW.



Figure 10 Holstein-Friesian dairy cow

Dairy products are perishable, meaning that they have a short shelf life before deteriorating.

Australia's dairy industry is Australia's third largest national rural industry, ranking behind wheat and beef, and has a gross value of \$4 billion.

Australia produces a range of dairy products including milk and value added products milk powder, yoghurt, custard, ice cream, butter and cheese. Value adding is a process whereby a raw material is processed to increase its market value to the consumer.

Cattle produce milk after giving birth to a calf. The quality and quantity of milk differs between animals and breeds, but some of the high volume producing breeds such as the Holstein- Friesian can produce approximately 35L of milk per day and over 7,500 litres total milk yield throughout a lactation period.



Figure 11 Dairy cows grazing

The daily routine of milking cows occurs twice a day for every day throughout the cow's lactation, with some operations milking three times a day. Cows are milked on farm using specialised equipment and machinery by staff or in some operations with advanced technology using robotic milking machines. Follow this link to see the Dornouf family from Tasmania, who use automated milking robots for commercial milking. ['Gala- The world's first commercial Automatic Milking Robots \(AMR\)'](#)

To further investigate the Australian Dairy industry, follow this link to the [AgriFutures Dairy](#) page.

Dairy nutritional value

Milk and dairy products are one of the five food groups and are an essential part of a healthy balanced diet.

Milk, cheese and yoghurt and other dairy products provide calcium in a readily absorbed and convenient form, which is very important for human health and our bodies' function. Dairy products are a good source of many nutrients, including calcium, protein, iodine, phosphorous, potassium, magnesium, vitamin A, vitamin D, riboflavin, vitamin B12 and zinc. They really are superfoods for their health benefits. Some people prefer to follow a dairy food-free or milk-free diet because of allergies, or intolerances to lactose (the natural sugar in milk). Allergies and intolerance should always be diagnosed by a doctor. Avoiding dairy foods and not making suitable alternative choices can affect your long term health and development (Eatforhealth.gov.au, 2015).

Full fat varieties of dairy products can have high energy and saturated fat contents. Saturated fat intake should be balanced and consumed in moderation for most humans over the age of 2. Energy food consumed should be matched and balanced by activity levels. Reduced fat and low energy varieties of milks and dairy products are not suitable as a milk drink for children under the age of two due to their high energy needs required for growth (Eatforhealth.gov.au, 2015).

Most people need at least 2-3 serves of dairy each day, however, the minimum recommended amount will vary according to your age, sex and life stage. For example, women over 51 years need 4 serves a day as their calcium requirements are high (Eatforhealth.gov.au, 2015).

Dairy learning activities

- 1. Define value adding and give an example of a value added dairy product.

- 2. How often are cows milked?

Follow this link to investigate to the 'AgriFutures Dairy' page to answer 3.

- 3. List 3 export destinations for Australian dairy products.

- 4. Dairy production is carried out in every Australian state and territory except for the Northern Territory. Explain why you think there is no or little dairy production carried out in the Northern Territory. (hint think about climate, dairy cow breeds and temperature requirements, transport and population size)

Follow this link Eatforhealth.gov.au Milk, yoghurt, cheese and alternatives page, to investigate dairy product nutrition and answer questions 5-6.

5. Complete the table to identify what a standard serve of dairy is equivalent to.

Diary Product	Serving size
UHT long life, reconstitutes powdered milk or buttermilk	
Evaporated milk	
Hard cheese such as cheddar	
Ricotta cheese	
Yoghurt	
Fresh milk	

6. Complete the table to identify how many serves children and adolescents should have of dairy each day.

Age Group (years old)	Serving of lean red meat	
	Male	Female
1-2		
4-8		
12-13		
19-50		
70+		

Extension Activities

- Investigate the processes of homogenisation and pasteurisation and explain how they are used in milk processing.
- Watch video clips on how different value-added dairy products are processed, including hard cheese, soft cheese, yoghurt and cream.

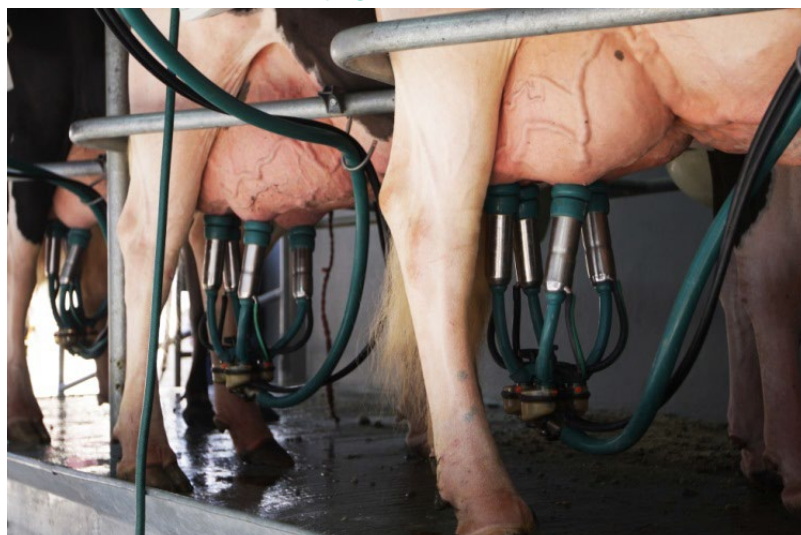


Figure 12 Cows being milked

Pork

Pigs produce the food product pork. Pork is eaten as a freshly cooked meat or processed and preserved to make a range of value-added products including bacon, ham, sausages, and smoked pork.

In NSW, 72% of sows are farmed on just over 2% of the state's farms, which have 500 or more sows (sows are female pigs that have given birth to piglets). These farms produce the majority of the pork in NSW. Pig production in Australia is an intensive farming industry.

The Australian pork industry employs more than 20 000 people and contributes approximately \$2.8 billion to the economy.

Australia produces around 360,000 tonnes of pig meat every year. A little over 8 per cent is exported to Singapore, New Zealand and Hong Kong, and 25 per cent is sold through restaurants and other food service outlets in Australia.

All fresh pork sold in Australia is 100 per cent Australian grown. However, approximately two thirds of processed pork (ham, bacon and smallgoods products) is made from frozen pork imported from Denmark, the Netherlands, Canada and the United States (Australian Pork, 2015). To support Australian farmers and our pork industry, buy only Australian pork and look for one of three labels:



- The bright pink Australian PorkMark logo
- The packet label states 'Product of Australia'
- The packet label states 'Australian Grown'

Pig breeds grown in Australia include Large White, Yorkshire and Landrace. These breeds have pale pink skin, white hair and are called white breeds. Other breeds include the more colourful Large Black, Berkshire, Duroc and Hampshire. These are called coloured breeds.

A lot of the commercially produced pigs grown in Australia are crossbred, which means that the animal's ancestors were different breeds that were selectively crossed and bred. Crossbred animals tend to perform better than their parents in a range of areas including growth and fertility. The agricultural term used to describe this is hybrid vigour.

Pigs are fed mostly grain-based diets until they reach between 24–55 kg and are sold as 'porkers'. Pigs that grow larger than 55 kg are sold as 'baconers' or 'finishers' (Australian Pork, 2015).

There are a numerous pig farming methods in Australia – indoor housing, deep litter, free range and outdoor bred systems.

Follow this link to watch different type of pig housing in Australia at [Housing pigs- current approaches](#).

To further investigate the Australian pork industry, go to [Australian Pork Limited](#).



Figure 13 Finisher pigs

Pork learning activities

- 1. Explain why it is important to buy Australian food and fibre products.

- 2. What logos and information should you look for on the packaging to help you choose Australian products?

Use the internet and carry out research to answer questions 3-6. A great site to start your research is Australian Pork [“About pig farming”](#).

3. Describe the features of the Australian pig farming indoor housing systems.

4. Describe the features of the Australian pig farming deep litter systems.

5. Describe the features of the Australian pig farming free range systems.

6. Describe the features of the Australian pig farming outdoor bred systems.

Follow this link to the [Eatforhealth.gov.au Lean meat](#) page to complete activities 7-10

7. What is the maximum amount of serves you should have of lean red meat in a week for a balanced healthy diet?

8. Complete the table to identify what a standard serve of lean red meat is equivalent to.

Lean red meat raw	Serving size and weight
Beef (90 g)	
Lamb (90 g)	
Veal (90 g)	
Pork (90 g)	
Goat (90 g)	
Kangaroo (90 g)	

10. Complete the table to identify how many serves children and adolescents should have of Lean meat and poultry, fish, eggs, nuts and seeds, and legumes/beans each day?

Age Group (years old)	Serving of lean red meat	
	Male	Female
1-2		
4-8		
12-13		
19-50		
70+		

11. List high protein food sources that could be substituted for lean red meat?



Figure 14 Sow feeding piglets

Sheep

Sheep are grown in Australia for the major commercial markets of wool or meat (lamb and mutton) production; with minor markets being skins and milk. As a result, there is a range of sheep producing systems in Australia for wool production, prime lamb production and dual purpose sheep for meat and wool and mixed enterprises such as cropping and grazing.

Sheep production uses a range of extensive and intensive practices, from paddock grazing of wool breeds, to feed lotting lambs for meat production.

Sheep are produced in all states and territories of Australia except for the Northern Territory. Production does not occur in hot, humid tropical and subtropical environments due to pests and diseases.

Australia is the world's largest wool producing country, accounting for about 25% of world production, followed by China, then New Zealand. The highest Australian production state is NSW followed by Victoria, Western Australia and South Australia.

Australia is the world largest exporter of sheep meat, and is the world's second largest producer of lamb and mutton.

Australia is currently the world's third largest live sheep exporter to Europe, the Middle East and North Africa. Our main three destination markets are Kuwait, Qatar and Turkey.

Australian sheep growers have bred sheep that suit particular climatic and geographical conditions in various parts of the country.

In wool production, sheep have been selectively bred for their high quality wool.

Prime lamb production systems produce carcass lambs which are sold as soon as they reach market weights.

Sheep breeds are generally high producers for a single feature: wool or meat. Dual purpose breeds are all-rounders with quality wool and carcass production. Dual purpose breeds usually do not produce the high quality wool or carcasses of the specific purpose breeds.

There are many sheep breeds that suit particular areas of Australia. Breeds are generally grouped under the following headings:



Figure 15 Merino rams



Figure 16 Prime lambs grazing with their crossbred mothers

- Merinos and Merino derivatives including superfine, fine, medium and strong wool sheep, bred to produce high quality wool.
- British Long Wool breeds including Border Leicester and Lincolns which are better known for their carcass qualities.
- British Short Wools including Southdown, Dorset and Suffolk used for prime lamb production.
- Breeds including Coopworth, Corriedale, Polwarth, Poll Dorset, Gromark and South Suffolk are dual-purpose sheep.
- Carpet wool breeds including Tukidale and Drysdale are bred specifically for production of carpet wools.
- Shedding breeds including Awassi, Dorper and Damara for meat production and cross breeding (Cottle, Daly and Hergenhan, 2014).

Follow this link to watch [The Western Australian Sheep industry](#). The principles in this clip are applicable to sheep production around the country.

Watch MLA feedback TV's [The making of Modern Day Lamb](#) to investigate the development of the Australian lamb industry.



Figure 17 Black faced Suffolk with Dorsets

Watch [Wool Production and Processing](#) Australian wool processing.

Animal Welfare

Animal welfare and ethical treatment of animals is the human responsibility to provide and adopt standards of care and respect to the animals in their care.

Animal welfare guidelines, legislation and how animal welfare is measured and enforced differ between and within countries globally.

In Australia, the federal government has responsibility for trade and international agreements that involve animal welfare issues; including providing legislation that covers the import, export, processing and welfare of animals and animal products. Australian government animal welfare regulations require that farmers deliver an acceptable standard of care for their animals. State and territory animal welfare agencies manage and enforce these regulations.



Australian agriculture and farmers are world leaders in animal welfare. Australian farmers take pride in breeding and producing animals for various markets to a high quality level and follow and adopt animal welfare practices for the following reasons:

- Farmers genuinely care and take pride in looking after the animals in their charge to the best of their abilities.

- Stressed animals are not productive. Other than genuinely caring for their animals, loss in production leads to loss of profit.
- To keep the good reputation of high quality Australian livestock production.
- To meet consumer and community expectations and trust of Australian animals being farmed with high animal welfare standards.

Even though Australian agriculture boasts a good reputation of high animal welfare; there are unfortunately cases of poor animal welfare carried out by individuals. Developing an understanding and empathy toward farming and livestock production from the paddock to plate is important to consider when making a judgement on what we see in the media. We must realise that individual cases of poor animal welfare, while upsetting and unjust, do not reflect whole industry practices and all producers.

Examples of welfare practices in agriculture which involve debatable ethics include live animal export, caged egg production with chickens, using farrowing crates in piggeries, mulesing sheep and removing young calves from dairy cows to name a few.

Consider the animal welfare issue of mulesing sheep.

Flystrike is a significant health and welfare risk to Australian sheep. It kills thousands of sheep every year and costs producers \$280 million annually. Flystrike must be actively monitored and managed to prevent productivity losses and ensure good animal welfare. Mulesing reduces breech flystrike in sheep.

Mulesing is a management practice which involves the surgical removal of excess wool-bearing skin from around the tail and breech area of sheep as an aid to provide protection and prevent fly strike throughout the animal’s lifetime. See Figure 17.



Figure 18 Mulesed adult sheep.

Mulesing is a process carried out on young animals up to 12 months of age. The operation is carried out by accredited contractors and pain relief is provided. While the operation causes some pain, it provides lifelong protection against flystrike.

Extension activity

- Use the internet to investigate sheep flystrike - make sure to find images of flyblown sheep.
- Brainstorm with your class advantages and disadvantages of the process.
- Decide if mulesing has overall positive or negative animal welfare impacts.

Sheep learning activities

1. Explain the difference between lamb and mutton.

3. Explain the difference between export markets for sheep meat and live animal export.

The NSW Department of Primary Industries (NSW DPI) is responsible for ensuring good animal welfare outcomes. Follow this link to the [NSW DPI Animal Welfare](#) page to answer question 3.

4. List the three pieces of legislations that NSW DPI administers.

There has been much media coverage surrounding poor animal welfare associated with the live animal export trade. Follow this link to The Conversation article [Why Australia banning live sheep exports may be a net loss for animal welfare](#) to answer questions 4-8.

5. List the top 10 countries which were the largest exporters of live animals in 2022.

6. Identify the major live export market (country) for Australian cattle.

7. Identify the major live export market (country) for Australian sheep.

8. Explain why these markets (countries) demand live animals?

practices, like halal. They cannot produce enough stock to meet their domestic demand, so they import animals from other countries such as Australia.

9. Australia can boast it leads the world in animal welfare practices. It is the only country that safeguards the welfare of animals every step along the supply chain, from the paddock to point of slaughter in other countries. Identify the two Australian laws which regulate export animal welfare.

Poultry

Poultry are domesticated birds kept for their meat, eggs and feathers. Species include chicken, ducks, geese, game birds, guinea fowl, peacocks, pheasants, pigeons, quail, and turkeys. The term poultry can be used to describe the different domesticated birds as well as the meat they produce. In Australia, chickens are the major poultry species kept commercially.

Chickens are grown commercially for the major production markets chicken meat and eggs. The chicken meat production industry is called the 'broiler' industry and the egg laying industry is called the 'layer' industry. These industries support our domestic market and export markets.

In Australia, chicken meat has the highest consumption rate of all the animal meats. The following table shows the average annual consumption of the major animal proteins in Australia.

	Beef and veal	Pork	Sheep meat	Chicken	Eggs	Seafood
Average annual consumption per person	34 kg	27kg	10kg	48kg	226 eggs/year	15 kg

In 2018 Australia produced 123.8 million tonnes of chicken meat. Of this amount, 38.9 million tonnes (worth \$63.6 million), was exported to major markets in South Africa, South Pacific Islands, Hong Kong, Singapore and the Philippines (ACMF, 2018). Whole eggs and egg products are exported to mainly Asian markets such as Taiwan and Korea.

Commercial breeds used in both Australian broiler and layer industries have been developed for the specific purpose of either meat or egg production, and are highly refined hybrid (crossbred) breeds.

The hybrid strains used in Australia are generally Ross and Cobb for the broiler industry and ISA, Hisex, and Hy-Line are the layer breeds.

Pure breeds are rarely used for commercial production. Popular Australian pure breeds for backyard production include Australorps (Australian developed dual purpose breed); Leghorn (layers); ISA Brown (layers); Plymoth Rock (dual purpose breed); Silkie (layers and pets); and Sussex (dual purpose breed).



Figure 19 Broiler farm- barn system

Commercial layer and broiler

production occurs close to processing plants and close to larger cities and urban areas with readily available feed sources, electricity, labour, good quality water, processing plants and transport. Fresh eggs and poultry meat are perishable products so closeness to consumers for transport and feed sources is important.

Poultry are commercially farmed for egg production in every state and territory in Australia except the Northern Territory. With a lack of grain production in the Northern Territory, the cost of transporting feed stops commercial poultry production for both industries.



Figure 20 Australorp pullets (young chickens)

Both broiler and layer production can be carried out under intensive to semi-intensive systems. The broiler industry ranges between intensive litter-furbished sheds to semi intensive free range systems. The layer industry ranges from intensive cage and barn laying systems to semi intensive free range systems and organic for all systems.

There are also specialised diets allowing the product to target niche markets, including: organic chicken meat or eggs, corn fed chicken meat and enriched eggs (for example Omega-3).

To learn more about the Australian broiler and layer industries and different production systems, follow these links:



- Watch Australian Eggs' [‘Danyel Ahmed: an Australian cage egg farmer’](#) to investigate caged layer systems.
- Watch Australian Eggs' [‘Rob Pepper: an Australian barn egg farmer’](#) to research barn systems and watch egg grading and packaging.
- Watch Australian Eggs' [‘Meet free-range egg farmer Lachlan Green’](#) to explore a free range system, niche marketing, animal welfare and grading and packaging systems.
- Watch [‘RSPCA Approved farming: Meat chicken’](#) to investigate RSPCA branded broiler production.
- Watch [“Take the Bell and Evans broiler farm tour”](#) to see broiler production in a vertically integrated American farm.

Poultry nutritional value

Like beef, lamb and pork, chicken meat is an excellent source of protein. Like all animal proteins, chicken contains all nine essential amino acids. Protein has many functions in the human body, including building body tissues and muscles. When the skin is removed from chicken, it is a lean meat with a good ratio of unsaturated to saturated fatty acids. Unsaturated fats (healthy fats) can help lower cholesterol and help reduce the risk of heart disease and are essential for brain growth and function.

Chicken is rich in many vitamins especially B vitamins; niacin or vitamin B3 and vitamin B6. It is also rich in minerals essential for human health, including phosphorous and selenium. Phosphorus is essential for healthy, strong bones and teeth and is a part of all cell membranes in the human body. Selenium is important for immune system function and aids in regulating the thyroid hormone.

Chicken meat consists of dark and white meat. Dark meat is found on the thighs, legs and wings and the white meat is the breast meat.



What is the difference between red and white meat?

White meat includes chicken, turkey, rabbit and fish meat. Red meat is associated with beef, mutton, lamb and pork.

Red meat contains myoglobin, which are cells that transport oxygen into the blood and are found in a higher amount in animals using a lot of muscular activity. For example, a cow, sheep or pig will have more extended periods of standing and running and therefore high levels of myoglobin. Older animals also have a higher level of myoglobin. The darker the meat, the more myoglobin present. That is why, even in chicken and turkeys, the legs are slightly darker than the breast meat. Pig meat contains myoglobin, but at lower levels compared to beef and sheep, which is why their meat appears more pink than red (Lee, 2017).

The biggest difference between red and white meat is fat content. White meat has less saturated fat. Red meat contains higher levels of saturated fat, but also contains higher levels of vitamins like iron, zinc and B vitamins. The iron present in red meat is more easily absorbed by the body compared to iron found in plants.

Both red and white meat should be eaten for a healthy balanced diet and optimum health. Explore Eatforhealth.gov.au [Lean meat](#) to find out more regarding serving sizes and daily requirements.

Go to the [Australian Chicken Meat Federation Nutritional Database](#) and explore the interactive online tool to compare meat cuts and their nutritional qualities.



Poultry learning activities

1. Describe the differences between broiler and layer chickens.

2. Which production system (cage, barn or free range) do you think is best for layer chickens in terms of animal welfare? Explain your answer using facts to back your opinion.

3. Explain the difference between red and white meat.

4. A vegan or vegetarian consumes a diet containing no animal proteins. What are these diets low in and could there be health issues if the person's diet is not managed properly?

The following table is created from the [Australian Chicken Meat Federation Nutritional Database](#) comparison tool. Analyse the table to complete activities 5-7.

Chicken cut (100g)	Energy (kJ)	Protein (g)	Saturated fat (g)	Total Fat (g)
--------------------	-------------	-------------	-------------------	---------------

Breast, lean, baked	637	29	1.2	3.9
Breast, lean, grilled	598	29.8	0.8	2.5
Breast, lean, casseroled	596	27	1.2	3.7
Breast, lean, stir fry without oil	681	35	0.6	2
Chicken nugget, purchased from take away fried in canola oil	1089	12.8	15.6	2.3
Breast, lean, raw	438	22.3	0.5	1.6
Drumstick lean, skin and fat raw	645	17.6	2.8	9.3
Drumstick, lean, raw	492	18.5	1.4	4.8
Thigh, lean, raw	496	18.3	1.5	5
Thigh, lean, skin and fat, raw	940	15.5	5.6	18.3
Wing, lean, raw	470	18.7	1.2	4.1

5. Rank the cooking methods it terms of apparent healthiest to least healthy, based on saturated fat content.

6. List other healthy cooking methods.

7. Foods with high saturated fat contents should be consumed in moderation. According to the table, which type of chicken cut and cooking technique should be consumed in moderation?

Go to the [Australian Chicken Meat Federation Nutritional Database](#) and explore the online meat comparison tool to complete this table, and complete questions 8-15.

Meat type	Meat cut (100g)	Energy (kJ)	Protein (g)	Saturated fat (g)	Total Fat (g)	Iron (mg)	Potassium (mg)	Niacin (B3) (mg)	Cholesterol (mg)
Chicken	Raw lean breast								
Beef	Raw fillet steak, fully trimmed								
Duck	Lean raw whole								
Lamb	Raw loin chop, fully trimmed								
Mutton	Raw leg roast, fully trimmed								
Pork	Raw medallion or loin steak, separable fat,								
Turkey	Raw, lean breast								
Veal	Raw loin chop, fully trimmed								

8. Are all the meats listed above healthy? Explain your answer.

9. Do you think that the cooking method has a big impact on nutritional value of food? Explain your answer.

10. A person has high cholesterol. Which type of meat should they consume in moderation?

11. A person has an iron deficiency. Which type of meat should they plan to include in their diet?

13. Which meat type has the highest potassium content?

14. Which meat type has the highest niacin content?

15. Which meat type has the lowest saturated fat content?

16. Does total fat content indicate how healthy the food is? What should you look at as well?

Practical Activity- food preparation

In your class, investigate and practise a variety of cooking and food preparation techniques. As you are investigating and trialling the different techniques, think about the impact of the cooking technique on the nutrient value of the food.

Humans have developed a variety of preparation and cooking techniques for every single food we consume. Different techniques maximise flavour, texture, food safety, longevity, appearance and nutritional value. Different techniques are also due to cultural, personal or religious beliefs.

Cooking techniques are a set of methods and procedures for preparing, cooking and presenting food. Good techniques take into account economical use of food and cooking fuel resources, as well as food safety. The techniques used in preparing a meal can affect what the meal is like as much as the ingredients themselves.

Though many basic cooking techniques are shared amongst the various cuisines in the world, many cuisines such as Chinese and Japanese have evolved their own techniques. Some cooking techniques evolved from environmental factors. For instance, cooking fuel (wood) was scarce in China, so the technique evolved of cutting pieces of meat and vegetables small so that they would cook faster and require less cooking fuel.

Techniques for prepping food in Western cuisine include: beating, chopping, creaming, crimping, deboning, de-seeding, dicing, filleting, glazing, grating, peeling, rolling, shredding, skinning, slicing, tenderizing and zesting.

Examples of food cooking techniques include bake, barbecue, boil, braise, deep-fry, grill, pan-fry, poach, raw, sauté, steam, stewing, stir-fry and slow-cook. The list is endless.

For your investigation follow these links to the Australian healthy food guide's article [‘The healthy cooking techniques everyone should know’](#).



Horticulture

Australia's horticulture industry includes the production of fruit, vegetables, nuts, cut flowers, turf and nursery products. The horticulture industry supplies both domestic and export markets. It is an intensive agriculture industry. Production is usually seasonal.

Australia's horticulture industry has a reputation as a sustainable producer of premium, safe and disease-free food. This is due to the high standards across all stages of the supply and production chain, from farm to consumer. Australia supplies year-round, fresh produce to domestic consumers, as well as exporting more than 90 different types of fresh fruit and vegetables to more than 60 countries. The largest destinations are Hong Kong, Japan, the United States and Singapore, although many other countries and regions such as the Middle East, Pacific Islands and Europe are significant destinations for Australian fruit and vegetables (Department of Agriculture and Water Resources, 2016).



The major horticulture growing areas in Australia include:

- Goulburn Valley of Victoria
- Murrumbidgee Irrigation Area of New South Wales
- Sunraysia district of Victoria and New South Wales
- Riverland region of South Australia
- Northern Tasmania
- Southwest Western Australia and
- The coastal, tropical strip of both northern New South Wales and Queensland (Department of Agriculture and Water Resources, 2016).

Fruit and vegetable production systems are set up specifically for the type of plant product being grown. Every plant has specific environmental requirements for moisture, soil type, pH, temperature ranges, and amount of light and cold temperature requirements. These factors determine where plants can be successfully grown around Australia. Horticultural plants may be either annuals or perennials.

[‘South Australian Horticulture’](#) produced by Primary Industries and Regions SA. Watch this clip to investigate the South Australian horticulture sector and explore the production areas, products, technologies and environmental sustainability.

[‘Paddock to Plate: How do your potatoes grow?’](#) produced by Regional development. Watch this clip to investigate the South Australian potato production industry from the paddock to the plate. It also investigates the health benefits and runs through a potato-based recipe.

The horticulture industry uses specific technologies and machinery. The industry is increasingly turning to technology to increase efficiency, sustainability and to address high employment needs associated with planting, pruning, pest and disease management and harvesting.

Follow this link to investigate technology and watch the RIPPA the autonomous robot at '[RIPPA The farm robot exterminates pests and weeds](#)'. RIPPA has been developed by the University of Sydney's Australian Centre for Field Robotics. The clip provides an update on RIPPA's current use and future potential.

Extension activity

Investigate specific horticultural plants and products grown in each climatic zone around your state.

Fruit and vegetable nutritional value

Everyone knows it is important for our health to eat a variety of fruit and vegetables. But how much and why?

A wide range of fruit and vegetables are grown and available in Australia domestically. There is plenty of choice throughout the year.

When you are eating fruits and vegetables you are eating different parts of the plants. All fruits are the flesh surrounding and protecting seeds. Nuts and legumes are seeds that are either eaten when immature (for example snow peas and corn on the cob), or the mature form (for example almonds and peanuts). Vegetables include different parts of plants including leaves, roots, tubers, bulbs, flowers, stems, seeds and shoots (Eatforhealth.gov.au, 2015).



Choosing fruits and vegetables in season provide better value and better quality as the product is fresh. Fresh fruit and vegetable products have better nutritional value and flavour than the same products that have been processed through canning or freezing. Eating seasonally also adds more variety to your diet throughout the year and supports local producers and communities. Choosing a variety of different coloured fruits and vegetables increases the variety of nutrients and vitamins in your diet. Fresh fruits and vegetables are a major source of macronutrients such as fibre and micronutrients such as minerals and vitamins C, thiamine, riboflavin, B-6, niacin, folate, and vitamins A and E. They are 'superfoods' and an important part of a balanced diet (Eatforhealth.gov.au, 2015).

The guidelines for fruit and vegetables differ because each has different health and nutritional benefits and characteristics. Generally, you should have:

- Fruits: over the age of nine you should have 2 serves of fruit per day
- Vegetables: adults should have at least five serves of vegetables per day

Follow these links to the Eatforhealth.gov.au [Vegetables and Legumes/beans page](#) and the [Fruit page](#) to find out how much you should consume each day.

Horticulture learning activities

- 1. Explain why you cannot successfully grow bananas, avocado and mangoes in much of NSW?

- 2. For the following list of horticultural products identify what part of the plant is consumed.

Product	Plant part consumed	Product	Plant part consumed
Apple		Chickpea	
Potato		Onion	
Peanut		Carrot	
Leek		Pak Choy	
Brussel sprout		Basil	
Pumpkin		Mango	
Tomato		Cashew	
Snow pea		Spinach	
Celery		Orange	
Broccoli		Cauliflower	
Strawberry		Blueberry	
Lettuce		Radish	
Beetroot		Corn	

- 3. List 6 specific environmental plant requirements which determine where plants can be grown in Australia.

Follow this link to the Eatforhealth.gov.au to answer activities 4-5 using information from the Fruits and Vegetables information pages.

4. Complete the table to identify what a standard serve of fruit is equivalent to

Fresh or processed fruit	Serving size
Medium apple, banana or pear	
Diced or canned fruit (no added sugar)	
Small apricot, kiwi fruit, or plum	
Fruit juice (no added sugar)	
Dried fruit for example, 4 dried apricot halves, 1 ½ tablespoons of sultanas	

5. Complete the table to identify what a standard serve of vegetable is equivalent to

Fresh or processed vegetables	Serving size
Cooked green or orange vegetables for example broccoli, spinach, carrots, or pumpkin	
Cooked, dried or canned beans, peas or lentils	
Green leafy or raw salad vegetables	
Sweet corn	
Potato or other high starch vegetables for example, sweet potato, taro or cassava	
Tomato	

6. Are all vegetables and fruits nutritionally the same? Use research to give a specific example comparing a fruit and a vegetable

7. Explain the benefits of eating fresh produce compared to processed food products

Practical activity - vegetable garden

For your major design project you are required to grow at least two ingredients in your school garden. In this activity you will investigate and grow a vegetable garden.

Starting an edible garden isn't hard. It requires a place to grow things, time, water, research, planning and common sense. Growing your own vegetables is fun, healthy, interesting and a very rewarding activity when you get to harvest and eat something you have grown.

When starting a vegetable garden there are key things to consider.

- Where to grow
- What to grow
- When to sow
- How to care for your vegetables.

Where to grow

Select your garden site. Vegetables require good quality, deep soil to establish their roots and use nutrients from the soil. They must also have a good source of quality water and plenty of sunlight available. Site ideas include raised beds, agriculture plots, glasshouse etc.

What to grow

Conduct research into your local climate. Before even selecting plants, you will need to find out:

- Frost incidence
- Average temperature ranges (maximum and minimum)
- Seasonal rainfall incidence: do you have mainly summer rainfall or winter dominant rainfall?
- Average rainfall
- Go to the [Australian Bureau of Meteorology](#) to find out about your local climate.

All of these climatic factors will affect the types of plants you can grow at certain times of the year.

Once you have learnt about your local climate you can start choosing plants. Only choose plants that are suited to your soil, site, climate and season or they are likely to fail.

When to sow

Most of the vegetables and herbs you may grow in your garden are annuals. Annual plants have specific growing seasons, preferring summer or winter for growth depending on their temperature requirements.

You must match the plants you are growing to the time of year you are planning to sow. If you sow plants out of season they will quickly die. The only way you can alter this is by growing them in a hothouse or indoors where you can control the environment and temperature, however light can be a problem.

How to care for your vegetables

All plants have specific needs, such as amount of water, soil bed preparation, weed control, pest and disease control and added fertiliser or nutrients. Once you select your plants carry out research to check on the plants' specific requirements. A good site to look at is [Yates](#).

Research tasks

- Investigate your local climate at the [Australian Bureau of Meteorology](#)
- Investigate the [Yates](#) website to determine the best plants for your local conditions and create a calendar of events to include sowing and harvesting times
- Use the internet or the Yates site to research how to prepare your garden bed for planting
- Investigate the Mr Fothergill's website to design and build your own '[Virtual garden](#)'
- Sketch the design for your garden bed

Mini design projects

1. Industry and career factsheet

You have studied seven major Australian agricultural industries so far:

- Wheat and cropping
- Beef
- Dairy
- Horticulture
- Sheep meat and wool
- Poultry meat and eggs
- Pork

Pick an industry you are interested in. For your industry, research and pick a career that you could imagine yourself doing in the future.

Design a factsheet to give to students in your school advertising and explaining the importance of the agricultural industry and your chosen career.

In your factsheet:

- List what the industry produces
- Identify where production occurs across Australia
- List markets for these products
- Name the career you investigated
- Briefly outline the role of this career
- Explain how this career contributes to the industry

2. Breed investigation

You have studied seven major Australian agricultural industries so far:

- Wheat and cropping
- Beef
- Dairy
- Horticulture
- Sheep meat and wool
- Poultry meat and eggs
- Pork

Conduct research to investigate 2 varieties of plants or 2 breeds of animals (depending on the industry) used for production in Australia.

Present your research to your class using a visual display method such as a video, poster or PowerPoint slide presentation.

3. Design a package for your hamburger

Your major project involves you designing and cooking a hamburger which uses at least one food type from each of the seven major Australian agricultural industries you have studied.

Design packaging that you would use if you would commercially produce your hamburger in your own restaurant business.

Things to consider:

- Your packaging must be produced using by-products from one or more of the seven agricultural industries. It also must be environmentally friendly and be able to be recycled
- You must design an eye-catching logo and graphics
- Your package or wrapper must be functional and economic to produce.

References and further reading:

Aboriginal fish traps made from rocks, Darling River, NSW

LaTrobe Picture Collection, 1938, '[Aboriginal fish traps made from rocks, Darling River, NSW](#)', LaTrobe Picture Collection, State Library of Victoria, <http://ergo.slv.vic.gov.au/image/aboriginal-fish-traps-made-rocks-darling-river-nsw>, viewed July 27 2018

Agriculture in Australia: growing more than our farming future

Landridge, P 2014, '[Agriculture in Australia: growing more than our farming future](#)', The Conversation, <https://theconversation.com/agriculture-in-australia-growing-more-than-our-farming-future-22843>, viewed 27 July 2018

All you need to know to get started with pigs

Pelletier, R 2014, "[All you need to know to get started with pigs](#)", The Weekly Times, <https://www.weeklytimesnow.com.au/agribusiness/farm-magazine/all-you-need-to-know-to-get-started-with-pigs/news-story/617a2ee7525e1feaa72a7dc20f7ee6e4>, viewed August 21 2018

Animal welfare at a glance

World Organisation for animal health, 2018, "[Animal welfare at a glance](#)", World Organisation for animal health, <http://www.oie.int/en/animal-welfare/animal-welfare-at-a-glance/>, viewed September 10 2018

Animal welfare in Australia

Australian Government, 2018, '[Animal welfare in Australia](#)', Australian Government, Department of Agriculture and Water Resources, <http://www.agriculture.gov.au/animal/welfare/animal-welfare-in-australia#governments-responsibility>, viewed September 11 2018

Facts and Figures

ACMF, 2018, '[Facts and Figures](#)', Australian Chicken Meat Federation, ACMF, <https://www.chicken.org.au/facts-and-figures/>, viewed September 24 2018

Get the Facts on your pork industry

Australian Pork, 2015, "[Get the Facts on your pork industry](#)", Australia Pork, http://australianpork.com.au/wp-content/uploads/2013/09/1113329_AustralianPork_Final-Cover_1-2_AustralianPork_Inner_1-2_Page-PDF-LoRes.pdf, viewed August 21 2018

Horticulture fact sheet

Department of Agriculture and Water Resources, 2016, '[Horticulture fact sheet](#)', Department of Agriculture and Water Resources, Australian Government, http://www.agriculture.gov.au/ag-farm-food/hort-policy/horticulture_fact_sheet, viewed August 6 2018

Introduction to the Australian sheep industry

Cottle, Daly, Hergenhan, 2014, '[Introduction to the Australian sheep industry](#)', Fundamentals of sheep and wool production, Woolwise, The Australian Wool Education Trust, <https://www.woolwise.com/wp-content/uploads/2017/07/WOOL-300-300-14-T-01.pdf>,

Lamb farms

Department of Agriculture and Water Resources ABARES, 2018, '[Lamb Farms](#)', Australian Government, Department of Agriculture and Water Resources ABARES, <http://www.agriculture.gov.au/abares/research-topics/surveys/lamb>, viewed September 5 2018

NSW Primary Industries Performance and data insights 2017

NSW Department of Primary Industries, 2017, '[NSW Primary Industries Performance and data insights 2017](#)', NSW Department of Primary Industries, https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0004/750352/nsw-dpi-performance-data-and-insights-2017.pdf, viewed July 13 2018

Organic, grass fed and hormone-free: does this make red meat any healthier?

Dowling, L, Dunn, L, (2018), '[Organic, grass fed and hormone-free: does this make red meat any healthier?](#)', The Conversation, <https://theconversation.com/organic-grass-fed-and-hormone-free-does-this-make-red-meat-any-healthier-92119>, viewed August 1 2018

Sheep statistics

Live Corp, 2018, '[Sheep statistics](#)', Live Corp, <http://www.livecorp.com.au/industry-information/industry-statistics/sheep-statistics>, viewed September 8 2018

What is the difference between red and white meat?

Lee, E, 2017, '[What is the difference between red and white meat?](#)', Health Knowledge, Artimondo, artisan excellence, <https://www.artimondo.co.uk/magazine/what-is-the-difference-between-red-and-white-meat/>, viewed October 3 2018

Wheat

AgriFutures Australia, 2017, '[Wheat](#)', AgriFutures Australia, <https://www.agrifutures.com.au/farm-diversity/wheat/>, viewed July 27 2018

Wool

Department of Agriculture and Water Resources, 2018, '[Wool](#)', Australian Government, Department of Agriculture and Water Resources, <http://www.agriculture.gov.au/ag-farm-food/meat-wool-dairy/wool#statistics-and-information>, viewed September 5 2018

The Five Food Groups

Eatforhealth.gov.au, 2015, '[The Five Food Groups](#)', National Health and Medical Research Council, Australian Government, Department of Health, <https://www.eatforhealth.gov.au/food-essentials/five-food-groups>, viewed July 27 2018

NSW Syllabus outcomes

Technology Mandatory 2017 Stage 4

Outcomes	Content
Agriculture and Food Technologies	
	Identifying and defining
TE4-1DP designs, communicates and evaluates innovative ideas and creative solutions to authentic problems or opportunities	<ul style="list-style-type: none"> investigate the importance of food and fibre production to Australia's food security and economy including Asia's imports and exports (ACTDEK029) investigate how food and fibre production is managed in environments as a system and how sustainability can be improved, for example: (ACTDEK032) ST <ul style="list-style-type: none"> plants and/or animal species grown in managed environments land management by Aboriginal and/or Torres Strait Islander Peoples boundaries, inputs, outputs, processes and feedback occurring in a managed environment evaluate environments that have been designed in consultation with community groups, for example: <ul style="list-style-type: none"> a bush tucker garden a school or community garden investigate the characteristics and properties of a variety of nutritious foods, for example: CT <ul style="list-style-type: none"> high in fibre, such as fruits and vegetables high in protein, such as meat and meat alternatives
TE4-2DP plans and manages the production of designed solutions	<ul style="list-style-type: none"> explore the nutritional needs of a group of people, eg adolescents, toddlers CT develop criteria to evaluate design ideas, processes and solutions, the functionality, aesthetics and a range of constraints, eg accessibility, cultural, economic, resources, safety, social, sustainability, technical (ACTDEP038, ACTDIP027, ACTDIP031) DT ST
TE4-3DP selects and safely applies a broad range of tools, materials and processes in the production of quality projects	<p>Researching and planning</p> <ul style="list-style-type: none"> design and plan a product associated with agricultural production (ACTDEP036) DT ST research legal and ethical requirements associated with agricultural production, eg keeping animals investigate ideal conditions for growth and development of an agricultural plant or animal (ACTDEK032) ST
TE4-5AG investigates how food and fibre are produced in managed environments	<ul style="list-style-type: none"> develop a schedule or calendar for ongoing care of a plant or animal species associated with an agricultural project (ACTDEP039) ST acquire and interpret data, for example: (ACTDIP025, ACTDIP026) CT ST <ul style="list-style-type: none"> local environmental and/or physical conditions, eg rainfall, temperature nutrition information panels, eg saturated fat, sugar content plan nutritious dish(es) to suit a group within society, for example: DT <ul style="list-style-type: none"> high calcium and iron for adolescents food for cultural celebrations
TE4-6FO explains how the characteristics and properties of food determine preparation techniques for healthy eating	<ul style="list-style-type: none"> identify a range of food preparation techniques and analyse the impact on nutrient value (ACTDEK033) CT investigate and communicate how a recipe can be improved to enhance nutritional value, and justify the recipe adjustment, for example: (ACTDEP039) DT <ul style="list-style-type: none"> using wholemeal flour instead of white flour for increased dietary fibre
TE4-10TS explains how people in technology related professions contribute to society now and into the future	<p>Producing and implementing</p> <ul style="list-style-type: none"> produce and implement an agricultural project and/or produce nutritious food (ACTDEP039) DT select, justify and use a range of appropriate tools and techniques in an agricultural project and/or food preparation (ACTDEK037) DT ST identify and apply safe and ethical work practices, for example: DT <ul style="list-style-type: none"> correct use of tools and equipment food safety and hygiene practices <p>Testing and evaluating</p> <ul style="list-style-type: none"> evaluate the effectiveness and suitability of choices made during the development and production of the solution assess the solution against the predetermined criteria

Engineered Systems

TE4-1DP designs, communicates and evaluates innovative ideas and creative solutions to authentic problems or opportunities

- investigate the way Aboriginal and/or Torres Strait Islander peoples used engineered solutions to serve community needs including those of cultural identity,