FOOD PRODUCTION THROUGH PROTECTED CROPPING

COURSE BOOKLET

Yr 9 Geography

gtav

Primary Industries Education Foundation Australia

Hort Innovation

Student Information

In this unit, you will be learning about the horticulture industry and, in particular, protected cropping. The lessons aim to develop your understanding of how the conditions for crop growth can be controlled for successful farming and about the challenges that farmers must overcome.

You will need to explore a variety of sources then apply a range of geography skills to further your understanding and improve your ability to critically analyse and understand the many factors affecting this industry.

- **Use the Answer Workbook or the Learning Journal PowerPoint to record all of your answers.**
- There is a MS Word and a PDF version of the document.
- The Learning Journal is in PPT only.

Refer to this before moving on to each new section and, where possible, to check your progress. Make any corrections with a different coloured pen or font.

LESSON 1

What is Horticulture?

Horticulture is derived from the Latin *hortus*, “Garden”, and *colere* “to cultivate”. Therefore, the study of horticulture looks into the cultivation of many plants that include vegetables, fruits and ornamental plants.

In this unit you will be looking at the processes surrounding Protected Cropping. This is the production of horticultural crops where the conditions for their growth is closely controlled and modified to protect from pests and adverse weather conditions.

Shelters, nutrient supply and technology is all used to varying degrees to make optimum growth conditions possible. The level of control measures varies broadly within Australia and around the world.

Activity 1A

1) Follow the link to Google Maps street view.

a) https://tinyurl.com/horticultureintro
b) Describe all the things you can see along the street to your right (“virtually walk” along the road).

Landscape: _____

_____

Buildings: _____

_____

Vegetation: _____

_____

Number of people: _____

_____

Equipment: _____

2) Go out of street view to a satellite view of the same area https://tinyurl.com/horticulturemap Observe the size of the buildings from a zoomed-out satellite view.

a) Using the scale on the map, how large do you think the greenhouses are?

b) Approximately how far is the greenhouse from Adelaide?

c) What would be some of the positives and negatives of having a greenhouse so far away from a city?

Positives	**Negatives**

3) Read the article at this link: https://watersource.awa.asn.au/business/partnerships/high-tech-greenhouses-the-key-to-growing-a-new-australian-export-industry/

a) What makes Australia an ideal location for high tech greenhouses?

b) Where would a lot of the Australian produce be sold?

c) What challenges would face farmers in this style of industry?

Activity 1B

There are many different types of agriculture and horticulture.

1) Match up the types of farming with location and produce. Use the clues to help you fill in the table from the words in the word box.

Word Box:

Produce	Locations
Blueberries	Australia
Palms	Borneo
Cattle/Sheep	Kenya
Cattle/Sheep	Western USA
Guava	Amazon Basin

Clues:

- *In Borneo they have had big problems with a lack of plant diversity where the rainforest has been cleared. One plant dominates the landscape with little biodiversity.*
- *Mono means one.*
- *Tribes in the Amazon need to constantly move their farming in order to have enough fertility in the soil to grow crops.*
- *A nomad is constantly on the move and suggests they do not tend to have a permanent address.*
- *The Northern Highbush Blueberry grows best in a cooler temperate climate.*
- *Some people believe that the Orangutan is endangered due to Palm Oil plantations.*
- *Guava is a fruit grown in tropical and subtropical regions of the world.*
- *Kenya has a very changeable rainfall pattern and cattle will need to move to the best grazing land produced from the rain.*
- *Cowboys can work on livestock ranches and manage animals over large areas of land.*

Type of Food Production	Where	Produce	Description
Horticulture	Australia		
Shifting Cultivation		Guava	
Pastoral Nomadism			

Livestock Ranching			Cattle ranchers raise cattle over large areas of land. They are based in one location, but the animals will move around within the large space.
Monoculture		Palms	

What Challenges Do Australian Farmers Face When Growing Crops?

This section looks at problems faced within and outside of Australia and the different approaches that are taken to make sure the crops produce the maximum yield for the minimum outlay.

Australian farmers face a myriad of challenges that they must overcome on a daily basis. Things like ongoing drought, decline in market prices, extreme weather events, pest or disease outbreaks, lack of transport, financing, rising supplier costs, and much more make farming tough.

While living with problems is normal to farmers and they're able to quickly adapt to change, even the most resilient growers can find it difficult to cope when multiple issues hit the farm at the same time.

Activity 1C

Match up 4 boxes to complete stories of 3 challenges facing different Australia farmers. Watch the videos and read the articles linked below. They will give you all the information you need.

You can number each of the boxes or colour them all in the same colour to show which link together.

The boxes detail the challenge, crops at risk in link, damage details and the location of the story.

- Supercell hailstorm causes millions of dollars of damage to Sunshine Coast crops - https://tinyurl.com/threatstohorticulture1
- Industry responds to damaging pests - https://tinyurl.com/threatstohorticulture3
- New strawberry farm opens using hydroponics - https://tinyurl.com/threatstohorticuluture3

Strawberry	Smashed crop causing millions of dollars' worth of damage	Virus & Drought
Serpentine Leaf Miner	Plants are destroyed by the feeding larvae underneath the leaf.	Lychees, avocados, macadamias, custard apples and pumpkins
Farmers affected by limited land to grow on to produce profitable crop.	Western Sydney and South East Queensland	Broccoli, beet, spinach, peas, beans, potatoes and cut flowers.
Hail Storm	Sunshine Coast	South Australia

Types Of Crop Protection

There are many ways conditions can be managed by humans in order to improve the growing conditions of the crop.

Crop protection is the process or activity of protecting the produce that a farm grows from weather, animals, pests, weeds, plant diseases, and other organisms. All these problems can be responsible for the loss of, or damage to a farmer's crops. To make sure that they get the maximum amount of produce to sell and the best price, farmers need to protect their crops from these pests. Damage can affect the farm's profitability, so protection is extremely important before, during and after cultivation.

Activity 1D

Read about the challenges faced by the different farms in the examples below and try to match up a solution (shown as a link in the table below) that you think would best solve the problem. Complete the table to show your answers.

Problem 1

In Florida, USA, the Sweetcorn Farm industry alone is worth an estimated $227million. The crop itself can be easily wiped out by freezing cold air. The frost can completely destroy the crop. The frost is formed when the cold dense air collects under the warmer air which is 50 feet above the fields.

Problem 2

Wine Makers in Barossa Valley South Australia (and in France) were finding the grapes were producing too much sugar with the extreme day temperatures, with too much direct sunlight. This was negatively affecting the alcohol content of the wine the grapes produced.

Problem 3

Farmers in Queensland, Australia lose their crops of strawberry due to heavy rain. In Jan 2019, one farm lost eight tonnes of fruit in a week.

Problem 4

Small scale blueberry farmers in Coffs Harbour, New South Wales have lost large amounts of their crops to birds, bats and possums. They need a solution that will not cost them too much but does not harm the animals in anyway.

The Problem - summarise	Suggested Solution	Solution Used In Article
		https://tinyurl.com/protectedcrops1
		https://tinyurl.com/protectedcrops2
		https://tinyurl.com/protectedcrops3
		https://tinyurl.com/protectedcrops4

Answer the following questions:

- Why might some farmers with a frost problem not use the helicopter method? What issues are there that might put off farmers? Try and list at least 3.

- To what extent would the French method of a solar power shading covers be considered sustainable?

- One article refers to wildlife friendly netting. What makes netting wildlife friendly and how do you test to see that it is?

Extension Activity

Read through the word list below. Work out what the words mean. Once you are happy with your definitions, write them into the glossary below without looking at your completed worksheet.

Horticulture:

Protected Cropping:

Shifting Cultivation:

Livestock Ranching:

Pastoral Nomadism:

Monoculture:

Agri Tourism:

In this lesson you will have begun to understand some of the challenges faced by farmers and the ways in which they are solving them to improve the farming system. In a rapidly changing world with population growth and climate change amongst many key issues, it is vital that countries try and secure their food supply for the future. This is called “food security”. The challenge to maintain the food security is one that many countries across the world face or will face in the future.

LESSON 2

Blueberries

Blueberries were first grown in Australia during the 1950s but initial trials were unsuccessful. It wasn't until the 1970s that they were tried again in Victoria. This time more successfully. A blueberry bush grows to around 1 - 2 m tall when fully grown. Blueberries belong to the Ericaceae family and are related to cranberries and huckleberries. Blueberries are a relatively easy crop to grow but are labour intensive to pick. They have very few pests and diseases.

Blueberries are currently very popular to use in healthy smoothies, deserts and snacks. Increasingly, people are embracing their health benefits because they contain high concentrations of antioxidants in their deep blue fruit.

On average, a mature blueberry bush will produce up to 4 to 5 kg or more of berries during a season.

Where And When Do Blueberries Grow?

Blueberry plants have a shallow root system and need irrigation throughout their growing season. They are not very drought tolerant and will not produce much fruit if they are allowed to get too dry. They are grown all across Australia.

In this task you will look to locate the areas where they are grown and the climate at each of these locations. You will be asked to analyse climate graphs as well as make graphs of your own before looking at the manufacturing processes of this fruit.

Activity 2A

Watch this 1 Minute video looking at a farmer: https://tinyurl.com/horticulturejimmy and answer the following questions:

1. Who eats blueberries?

2. What did the plant and farm look like?

3. What challenges do you think he was talking about?

4. Where is his blueberry farm?

Activity 2B

Below is a list of places where blueberries are grown in Australia and the months they are grown.

Mark on the blank Australian map where these are located using either an atlas or an online map. Make sure the BOLTSS mapping format is implemented (Border, Orientation, Legend, Title, Scale, Source).

Locations:

1) Atherton, Queensland – April - September
2) Bundaberg/Munduberra Queensland - May - October
3) Coffs Harbour/Northern Rivers New South Wales – June - February
4) Tumbarumba New South Wales – January - March
5) Victoria – December - February
6) Tasmania – January - April
7) Margaret River, Western Australia – November - March
8) Geraldton West, Western Australia – June - November
9) SE South Australia – December – March

Having marked these on the map you can see that they have a big spread across the country.

1) Suggest a reason why they are grown at different months of the year at different locations?

2) Why might the spread of blueberry harvest be good for the consumers of blueberries in Australia? Think about cost, availability and carbon footprint.

Activity 2C

What climate do the blueberries best grow in?

1. Look at the map of locations you have created then use the link to the Bureau of Meteorology to complete the table below. You will need to select the “Köppen – all classes map”

https://tinyurl.com/climateblueberry

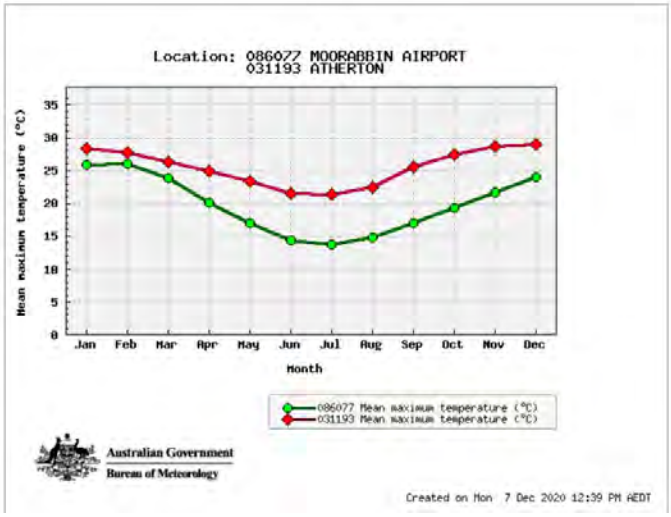
- List all the types of climates that Blueberries are grown in.

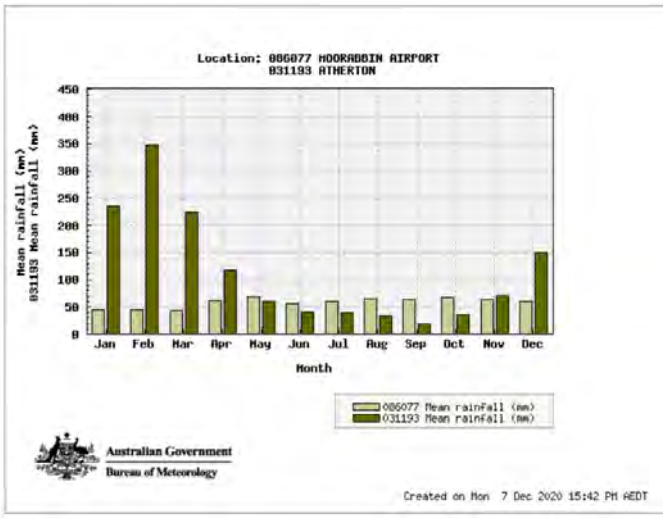
- To what extent is location of blueberry farms and climate spatially associated?

- What other factors would be important for a location of a Blueberry farm?

2. Look at the two graphs below comparing Moorabbin Airport, Victoria and Atherton, Queensland climate data, (http://www.bom.gov.au/climate/data/). Use this data to answer the following question.

- Based on Qn 2B, what are the best temperatures and amounts of rainfall for blueberries to grow?





Why Are Blueberries Important?

Commercial sale of blueberries began in Victoria in 1974. It has since spread across approximately 2,500 hectares of land in all states from 300 growers of the crop. The majority of the blueberries produced are consumed within Australia with less than 5% being exported to countries including several in South East Asia. New South Wales grows more Blueberries than any other state.

Activity 2D

1. Using the table showing the values of blueberry production in Australia, create a bar graph to show the growth of the industry. Year on the X axis and Value on the Y axis.

Growing Year (Financial Year)	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Local Value of Production ($Million)	50	95	120	145	148	148	244

Based upon your graph:

1. Describe the change in value of blueberry production referring to the graph created.
    - What is the overall pattern – change in value $
    - In what years is there most growth or loss?

2. Why might the value and production rates change from year to year?

There has been a steady growth in the Australian blueberry industry, as more varieties of blueberries are being established that can thrive in a larger variety of climatic locations. This means farmers are less restricted as to where they can grow the crops, as long as the soil is acidic and well drained with full sunlight. Although it can be expensive to grow blueberries, with high development costs and high labour expenses, blueberries can be harvested quickly from original establishment and offer high returns in profits.

How Are Conditions For Growth Controlled For Blueberries?

As you have already seen there are many challenges with the growth of blueberries. Farmers have developed a number of ways to protect their crops from these problems and have also developed ways to maximise their crop yields by changes to farming practice and new technology.

Activity 2E

1. Watch this video and summarise the challenges faced with the growth of blueberries and the solutions to these problems. https://tinyurl.com/horticulturedesert

Challenges
Solutions

2. Using the links below, read the article and watch the videos within it to outline the challenges faced and the solution to this problem in both Australia and America to deal with pests humanely and effeciently.

- https://tinyurl.com/horticulturebirdproblem
- https://tinyurl.com/horticulturebirdproblem2

Challenges
Solutions

3. Netting is often used to keep birds away from the blueberries. What would be some advantages and disadvantages of this compared to the method outlined in the previous question?

4. Ever wondered how blueberries are harvested? As blueberries are grown on a bush and are easily bruised, there are a range of different ways that farmers can pick them. Research how manual vs machine picking differs and fill in the table below to list the positive and negative aspects of each.

Manual Harvesting (Hand)	**Machine Harvesting (Automated)**
Pros	Pros
Cons	Cons

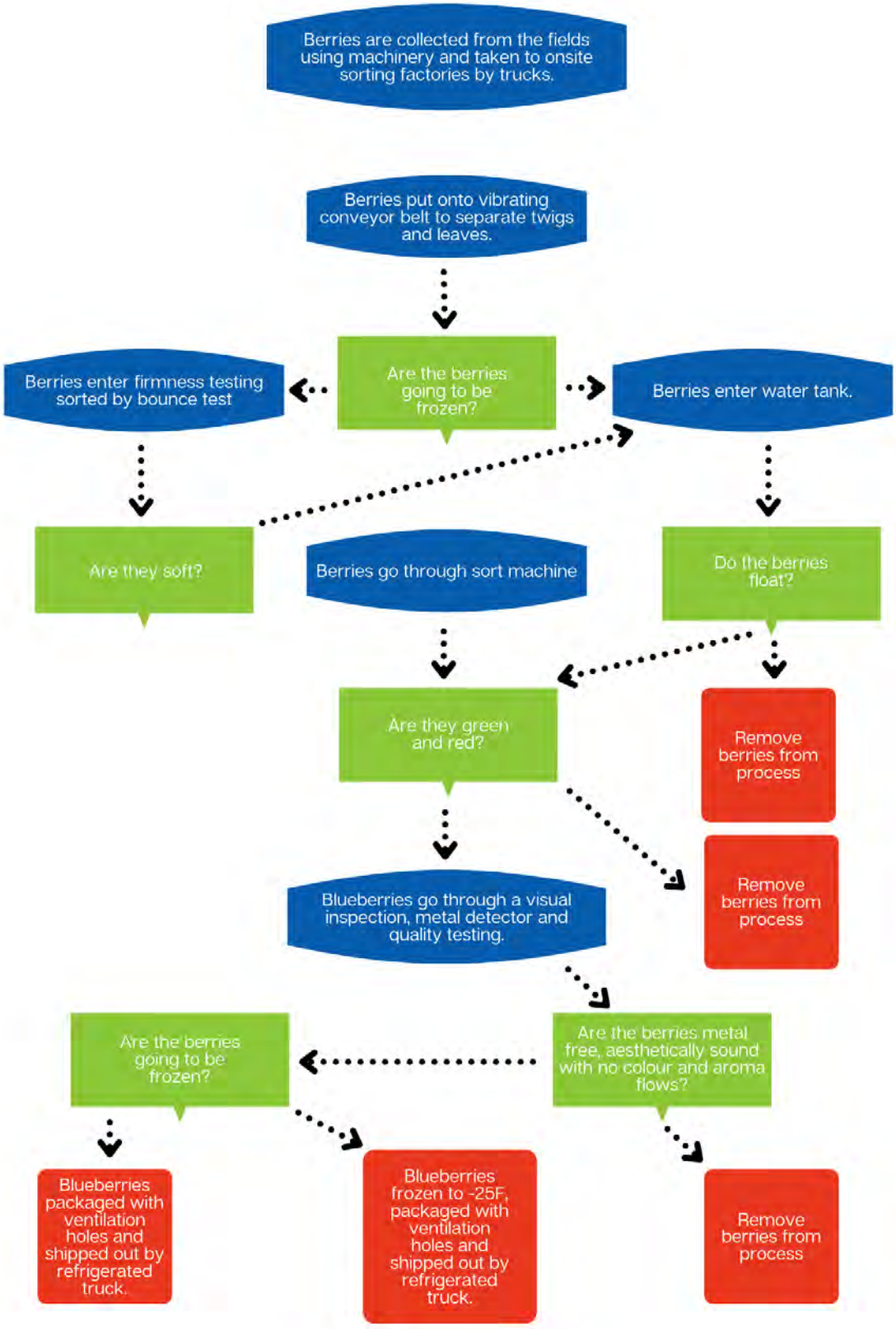
The Farming Process

The blueberry industry tries to be efficient and controlled throughout the entire farm to consumer process. Even after the fruit is harvested, the packaging, transport and storage of the fruit is a very intensive procedure to ensure the quality of the product is maintained

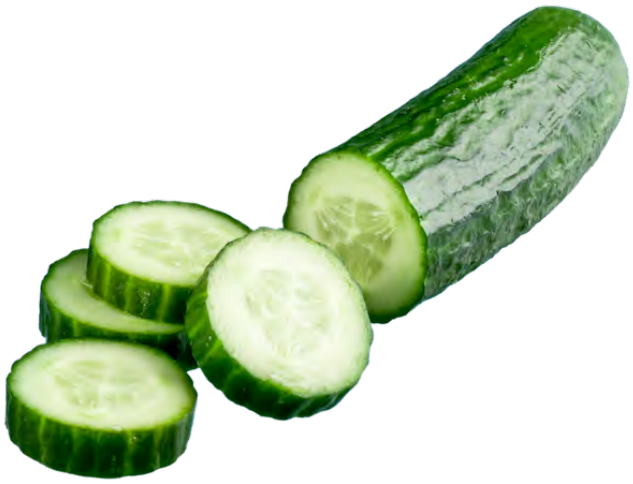
Activity 2F

Watch the following video and complete the missing information on the flow chart. Each of the Green diamonds is a decision box with a yes/no question. Fill out Yes or No in the correct place on each of the black arrows coming from the diamond.

- How It's Made Blueberries - https://tinyurl.com/horticultureprocessing


Berries are collected from the fields using machinery and taken to onsite sorting factories by trucks.
Berries put onto vibrating conveyor belt to separate twigs and leaves.
Are the berries going to be frozen?
Berries enter firmness testing sorted by bounce test
Berries enter water tank.
Are they soft?
Berries go through sort machine
Do the berries float?
Are they green and red?
Remove berries from process
Remove berries from process
Blueberries go through a visual inspection, metal detector and quality testing.
Are the berries going to be frozen?
Are the berries metal free, aesthetically sound with no colour and aroma flows?
Blueberries packaged with ventilation holes and shipped out by refrigerated truck.
Blueberries frozen to -25F, packaged with ventilation holes and shipped out by refrigerated truck.
Remove berries from process

LESSON 3



Cucumber and Protected Cropping

Cucumbers are a popular salad vegetable but there are many different varieties. Some types are grown specifically for pickling or for making into gherkins. They grow on a vine that can spread across the ground or up trellises.

Popular varieties include Lebanese, Continental, Baby and Gherkin.

Fun fact: Cucumbers are 95% water.

The growth of cucumbers has a significant contribution to the Australian economy. The production of cucumbers across Australia has increased, and although they are mainly harvested in the months from December to February, they are able to grow throughout the year but tend to be larger and more plentiful in summer months.

New South Wales has the largest cucumber industry, but each state and territory has a growing area of the crop. As well as domestic consumption the export industry has grown by 62% from 2009/2010 – 2014/2015.

Data collection like this is critical as so many people's lives will be impacted from the changes that occur and it may help identify future trends. The Australian Bureau of Agriculture and Resource Economics and Sciences, (ABARES) collected the data used in the activity below.

Activity 3A

1. Use the information in the table to produce a bar graph to show the value of the export industry from 2009 – 2015.

Year	2009/2010	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015
Value (approx.)	$200,000	$250,000	$240,000	$350,000	$360,000	$330,000

Value

Year

2. Describe the change in value of cucumber production referring to the graph created.

   - What is the overall pattern – change in value $
   - What year is there most growth?
   - What year is there the most loss?

3. Look at the list of statements below and describe how they might link to the changes you can see in the graph. Is there any evidence of these?

   - Land has been over worked and less nutrients in the soil.
   - More machinery used has reduced the need for workers on farms.
   - Farms have increased in size and smaller farms can't compete.
   - Climate change has reduced yield of crops
   - Farmers have more land to use and have become less intensive with the use of the land.
   - Diseases and /or pests have decreased the yield.

4. Below data showing the yields of a cucumber crop over a two-year period. Work out the percentage change in crop yield using the data and the formula given.

   Formula

   A – B = ***X***

   X */ A* = ***Y***

   Y x 100 = % Change

   A = Yield 2008/9 = 26,156 Kg

   B = Yield 2013/4 = 19,227 Kg

   Your Answer:

Activity: 3B

Where Are Cucumbers Harvested?

With the use of enclosed cropping, the regions where cucumber growth can take place has expanded across Australia. Add the locations listed below onto the blank Australian map and make sure the BOLTSS mapping format is implemented (Border, Orientation, Legend, Title, Scale, Source).

Locations:

Queensland: *Bowen, Burdekin, Bundaberg, Lockyer Valley.*

South Australia: *North Adelaide Plains, Riverland.*

New South Wales: *Greater Sydney Basin (Central Coast to Bargo, with epicentre in Western Liverpool),*

Mid North Coast (including Coffs Harbour, Wardell and Woolgoolga

Far west NSW centred in Gol Gol (adjacent to Sunraysia district of Vic

Victoria: *Sunraysia, Melbourne Metro.*

Western Australia: *Geraldton, Metro outer areas.*

Northern Territory: *Humpty Doo.*

https://www.tridge.com/guides/cucumber/AU

How Are Growing Conditions Of Cucumbers Controlled?

Much of the cucumber industry uses greenhouse structures to modify the growing conditions to maintain a consistent yield. There are a huge variety of these greenhouses and the processes used in each of these systems varies from farm to farm. There are over 1000 greenhouse enterprises throughout Australia producing cucumbers.

Activity 3C

Watch the following video that focusses on a New South Wales cucumber farm that has embraced a more technological approach to farming. Answer the questions about the video.

https://tinyurl.com/horticulutreglasshouse

1. Why do you think they have to suit up in the greenhouse?

2. What advantages are mentioned with regard to using a greenhouse and not an open field?

3. What natural ways are used to reduce flies and mosquitoes?

4. What would be a benefit of growing multiple varieties of cucumbers?

5. Reflect on the video:

    - Did the process seem to use a lot of people in the system?

    - What did the greenhouse look like?

    - What were the crops being grown in?

    - What would be the main costs of a farming system like this?

6. You can find the location of the farm by searching the following G.P.S coordinates:

- -33.32980717855362, 151.23758133316568
- Search for this in Google Earth Pro. At this site you can see a satellite image and see how the farm has expanded from 2017. The new glass house is still not been added to satellite mapping.
- Use the historical image icon to look back at the different stages of the farm's growth. You can also use measuring tools to look at the size of the structures and the distance to nearby markets/settlements for labour.

- Answer these questions about the satellite image:

  a. List any observations you make from comparing the images. Zoom out and look at the region surrounding the farm. Consider new structures, irrigation, land use around structures, distance from towns, size of farm.

b. Look at the following link of the new glasshouse featured in the video. Read through the website and list the technology used within the glasshouse to control growth conditions.
https://familyfreshfarms.com.au/the-glasshouse/

c. Choose one of these features and explain how it controls the growing condition.

d. Can you work out from the image gallery where the new glasshouse is located on the farm?
https://familyfreshfarms.com.au/gallery/

LESSON 4

The Future Of Horticulture

Australia has already embraced the technological side of protected horticulture, but there have been other huge developments around the world that are increasing the level of control over the growing of fruit and vegetables to an even higher scientific and technological level.

In this lesson you will look at the many ways in which farming practice is changing going into the future and assess the level of impact this will have socially, economically and environmentally.

Activity 4A

The use of drones in agriculture

1. Look at the 2 videos linked below. Both videos show how drones are being used in agriculture to improve farming efficiency. Complete the activities once you have watched both videos.

- https://tinyurl.com/dronehorticulture1
- https://tinyurl.com/dronehorticulture2

2. Fill in the benefits within the appropriate part of the Venn diagram. If you can think of additional impacts not mentioned on the video, then you should add these as well.

- Social Impacts – Try and look at how people are impacted by the drone's use.
- Economic Impacts – Listen out for how this may impact the amount of money either spent or made on the use of the drones.
- Environmental Impacts – How do you think the environment of the farmland as well as the surrounding area was impacted? This could be both positive and negative.

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Activity 4B

The Rise In Hydroponics

Hydroponics is the agriculture system of growing crops without the use of soil. Although this style of farming is seen as a newer form of farming and a method that might dominate in the future, it has in fact been practiced across the world for thousands of years, but the addition of new technology has refined the effectiveness.

The idea of growing without soil is that you can deliver the nutrients to the crop directly and the plant uses less energy to find nutrients and waste and can therefore focus its growth on the crop above the ground. It also removes the potential for soil borne diseases/pests and does not have weeds competing for growth.

1. Read the following article and video that look at a modern approach to hydroponics in an urban environment. The site used for growing crops is a brownfield location (an area that was built on previously).

- https://tinyurl.com/horticulturehydroponics
- https://tinyurl.com/horticulturehydroponics2

2. Answer the following questions based on the article.

a. What was the land used for previously and what benefits does this bring by changing its use?

b. What was a key goal of the founding members of Thomas and Myers? Why did they see a need to set up this enterprise?

c. What part of the system is highlighting as a high economic cost?

d. Why might some environmentalists have an issue with the project?

e. What environmental benefits does is mention as part of the “sustainable approach”?

f. What are the social impacts of the project within the local community?

g. In the first photo of the article there is a picture of the vertical garden with the salad plants stacked on top of each other. What is a benefit of doing this?

Activity 4C

Where Should Australia's Agricultural Focus Be In The Future?

In this final activity, think about how Australia should manage its food security in the future. To do this you need to decide what you think the biggest challenge to food production is, and then establish the best way to solve this. You may choose one of the suggestions below as your answer or you may make up your own mind. They are not matched up and are meant just to get you thinking.

a) Using the information you collect, write a 500-word report that discusses your chosen problem. You should include the positive and negative aspects when presenting your ideas.

Problems Facing Australia	**Possible Solutions**
Climate Change causing extreme weather events making crop growth difficult, (droughts, flooding, cyclones, bushfires)	Drone use on farms
Population Growth leading to a shortage of food.	Hydroponics
Land Degradation due to intense farming reducing fertility of land and crop yields.	Organic Farming
Cheaper Imports from other countries means demand for Australian grown crops is too low.	Urban Farms
Alien Invasion from pests, diseases and weeds makes farming inefficient.	Satellite
Shortage of labour as more people move to cities to work. Farms will no longer have the workforce to produce the crops.	Robots, GM Crops

Links to help you start your research:

- https://tinyurl.com/horticultureurbanfarm
- https://tinyurl.com/horticultureurbangreen
- https://tinyurl.com/horticulturerobots
- https://preview.tinyurl.com/horticulturesatelliteimages
- https://preview.tinyurl.com/horticultureregmcrops
- https://tinyurl.com/horticultureplasticproblem
- https://tinyurl.com/horticulturelaboursshortage

b) Based on your chosen problem, answer these questions:

- How do you think we should address the problem you have chosen?
- How effective do you think this will be?
- Advantages and disadvantages
- How effective will this be in Australia
- Could this be used worldwide?
- Challenges faced by this.

c) Complete the table below by adding possible solutions.

Problems Facing Australia	**Possible Solutions**
Climate Change causing extreme weather events making crop growth difficult, (droughts, flooding, cyclones, bushfires)	
Population Growth leading to a shortage of food.	
Land Degradation due to intense farming reducing fertility of land and crop yields.	
Cheaper Imports from other countries means demand for Australian grown crops is too low.	
Alien Invasion from pests, diseases and weeds makes farming inefficient.	
Shortage of labour as more people move to cities to work. Farms will no longer have the workforce to produce the crops.	

End of Unit - Reflection

Congratulations on completing the lessons on horticulture in Australia. Hopefully you are more aware now of the very diverse industry that impacts so many people around Australia and the world, and can see how it is a constantly evolving industry looking to make the processes more efficient to benefit the environment, the people and the economy.

How much did I know about protected cropping before this unit?	1_____10
How much do I understand now?	1_____10
How important will protected cropping be to food security in the future?	1_____10