Stage 5 Agricultural technology – native plant production

## Summary

Native plant production provides students with opportunities to develop an understanding of plant production in the context of a plant-based enterprise. This includes the environmental sustainability, financial viability, marketing, available technologies and ethical considerations of plant enterprises. Students are provided with opportunities to gain firsthand practical experience in pre-treating, growing, harvesting and processing of native plants.

## Duration

10 Weeks

## Outcomes

A student:

* **AG5-5** investigates and applies responsible marketing principles and processes
* **AG5-6** explains and evaluates the impact of management decisions on plant production enterprises
* **AG5-8** evaluates the impact of past and current agricultural practices on agricultural sustainability
* **AG5-9** evaluates management practices in terms of profitability, technology, sustainability, social issues and ethics
* **AG5-11** designs, undertakes, analyses and evaluates experiments and investigates problems in agricultural contexts
* **AG5-12** collects and analyses agricultural data and communicates results using a range of technologies
* **AG5-13** applies Work Health and Safety requirements when using, maintaining and storing chemicals, tools and agricultural machinery
* **AG5-14** demonstrates plant and/or animal management practices safely and in collaboration with others

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## Unit overview

Students will develop knowledge and understanding of agricultural enterprises and the practices and skills required to produce native plants and related products. Students develop skills in the effective management of sustainable production and marketing practices that are environmentally and socially responsible.

As part of this unit, students will undertake a range of practical tasks, including, but not limited to:

* Propagation
* Preparation of media for propagation
* Soil testing
* Seed preparation and storage
* Growing of native plants

## Resources overview

The resources and links listed below are referenced within the program but is not an exhaustive list of resources available. Teachers can add to these resources as needed.

### Physical resources

* NSW Department of Primary Industries [Food and Fibre Production An Aboriginal Perspective eBook](https://www.nswdpi-schools-program.com/aboriginal-food-fibre-stage-6)
* Computer, printer, digital camera
* Soil testing equipment, including but not limited to, pH test kits, pH probes, glass jars, hand spades, shovels, soil thermometers
* Butchers paper
* Native plant seeds, cuttings and plants
* Plant propagation materials such as potting mix and components of potting mix, fertilisers, punnets, glasshouse, secateurs.
* Seed collection materials such as paper bags, tweezers and beakers
* Dissection materials including trays, scalpels and tweezers

### Websites

* Understanding pesticide chemical labels
	+ [apvma.gov.au/sites/default/files/images/understanding\_labels\_booklet\_2.pdf](https://apvma.gov.au/sites/default/files/images/understanding_labels_booklet_2.pdf)
	+ [apvma.gov.au/sites/default/files/images/understanding\_labels\_poster.pdf](https://apvma.gov.au/sites/default/files/images/understanding_labels_poster.pdf)
	+ [mytrainingbc.ca/assistantapplicator/pdf/Lesson2.pdf](https://mytrainingbc.ca/assistantapplicator/pdf/Lesson2.pdf)
* Growing Australian Plants, Australian National Herbarium - [cpbr.gov.au/growing-plants/index.html](http://www.cpbr.gov.au/growing-plants/index.html)
* Commercial wildflower growing PDF - [wildflowersaustralia.com.au/](http://www.wildflowersaustralia.com.au/__files/f/18670/Getting%20into%20wildflower%20growing%20v.%202013.pdf)
* Markets for native plants and their products - [abc.net.au/news/rural](https://www.abc.net.au/news/rural/2017-08-30/native-bush-food-demand-outstripping-supply-says-industry/8855058)
* Online Nursery examples
	+ [sydneywildflowernursery.com.au/](https://www.sydneywildflowernursery.com.au/)
	+ [harvestseeds-nativeplants.com.au/](https://www.harvestseeds-nativeplants.com.au/)
* The function of plant parts -  [qldscienceteachers.com/junior-science/biology/functions-of-plant-parts](https://www.qldscienceteachers.com/junior-science/biology/functions-of-plant-parts)
* Guide to texture by feel - [nrcs.usda.gov](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311)
* Native plant diseases; Department of Primary Industries and Regional Development; Government of Western Australia - [agric.wa.gov.au/diseases/native-plant-diseases](https://www.agric.wa.gov.au/diseases/native-plant-diseases?page=0%2C0%20)
* Native plant pests; Department of Primary Industries and Regional Development; Government of Western Australia - [agric.wa.gov.au](https://www.agric.wa.gov.au/pest-insects/native-plant-pests?page=0%2C1%20)
* Evolution of Australian agriculture from cultivation to no till - Jim Pratley and Lewis Rowell [www.csu.edu.au/\_\_data/assets/pdf\_file/0005/2805521/Chapter1\_PratleyRowell.pdf](https://www.csu.edu.au/__data/assets/pdf_file/0005/2805521/Chapter1_PratleyRowell.pdf)
* Indigenous culture and intellectual property - [www.artslaw.com.au/info-sheets/info-sheet/indigenous-cultural-and-intellectual-property](https://www.artslaw.com.au/info-sheets/info-sheet/indigenous-cultural-and-intellectual-property-icip-aitb/)
* Market Fresh, Get to know Australian natives - [marketfresh.com.au/get-to-know-australian-natives/](http://www.marketfresh.com.au/get-to-know-australian-natives/)
* Celery transpiration - [fizzicseducation.com.au/150-science-experiments/botany-experiments/celery-transpiration/](https://www.fizzicseducation.com.au/150-science-experiments/botany-experiments/celery-transpiration/)
* Germination of Acacia seeds PDF - [guidelinesonlearning.com/](http://www.guidelinesonlearning.com/userfiles/Native%20seed%20germination%20Prac%202010%281%29.pdf)
* Bruce Pascoe: Aboriginal agriculture, technology and ingenuity - [education.abc.net.au/](https://education.abc.net.au/home#!/digibook/3122184/bruce-pascoe-aboriginal-agriculture-technology-and-ingenuity)
* Agrifutures Australia: Finger Limes - [agrifutures.com.au/farm-diversity/finger-lime/](https://www.agrifutures.com.au/farm-diversity/finger-lime/)
* NSW Landcare Gateway - [landcare.nsw.gov.au/groups/landcare-nsw/](https://landcare.nsw.gov.au/groups/landcare-nsw/)
* Youtube
	+ [Soil texture by feel](https://www.youtube.com/watch?v=GWZwbVJCNec) duration 4:04
	+ [GCTV2: integrated pest management](https://www.youtube.com/watch?v=OiKuPLCLs9g&list=PL5BC991F931DFFD9C) duration 5:46
	+ [Beat sheet sampling with Hugh Brier](https://www.youtube.com/watch?v=56OB-tE3x18&list=PLECdk_iZddkYpwlF2l5goMEDDYGMTTJJ_) duration 2:41
	+ [How to test soil structure- Central West Local Lands Services](https://www.youtube.com/watch?v=Z9J6sWeblK8) duration 5:06
	+ [Understanding soil types and soil texture](https://www.youtube.com/watch?v=AUhOBxVFcFk) duration 9:00
	+ [Soil pH testing using Manute pH test kit](https://www.youtube.com/watch?v=S6AizqoDe5Y) duration 4:41
	+ [Layers of soil for kids](https://www.youtube.com/watch?v=ysIm7ImsK6c) duration 6:14

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| Content | Teaching and learning | Evidence of learning | Adjustments and registration |
| **Week 1** * Identify plants relevant to agricultural production
* Identify the characteristics of animal breeds and plant types specific to chosen enterprises
 | **Introduction to the unit:****Teacher:*** Overview of Native plant production unit and assessment tasks.

**Teacher and students:*** Brainstorm native plants and take a walk through the school and identify native plants growing in the environment.
* Take photos and create a poster of native plants or sort picture cards into native and not native plants as a game.

**Students:*** Research using the internet, the local nursery, botanic gardens or horticulturalists guest speaker, native plants that are commercially produced in Australia and your specific region.
	+ [sydneywildflowernursery.com.au/](http://www.sydneywildflowernursery.com.au/)
	+ [harvestseeds-nativeplants.com.au/](http://www.harvestseeds-nativeplants.com.au/)
* Create a photo or species board of native species relevant to agricultural production. Include common name, scientific name, photo and uses in commercial production (for example, fresh flower market, fresh food industry).

**Optional extension:*** For each species identified on the photo or species board, list the market they are most likely to end up in today’s industry, for example fresh flower market, landscaping as well as the range of uses for each by Indigenous people, for example medicine, food.
* Research how to preserve plant specimens. Collect and preserve a range of native plant specimens, label with the common and scientific name.
 | * Students demonstrate prior knowledge by being able to identify names and examples of native plants from their local area.
* Students selection of a native plant species relevant to agricultural production show understanding of commercial production.
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| **Week 2*** Explain the function and structure of plants related to the enterprise
 | **Teacher and students:*** Revise the parts of a plant. Draw a labelled diagram of both a typical plant and a typical flower.

**Teacher:*** Discuss the functions of each plant structure and their importance to the growth and development of the plant.

**Students:*** Complete a table of structure and functions from the discussion (a good resource is [qldscienceteachers.com](http://www.qldscienceteachers.com/junior-science/biology/functions-of-plant-parts))
* Draw and label monocotyledon and eudicotyledon plants, relate structure to function.
* Draw and label the stages of germination.

**Extension:*** Research the xylem and phloem and their functions in plants.
* Conduct experiments to demonstrate transpiration in plants and how water moves through the xylem, for example, celery transpiration (a good resource is [fizzicseducation.com.au](http://www.fizzicseducation.com.au/150-science-experiments/botany-experimentsh)).
 | * Students are able to identify structures of a typical plant and flower from diagrams.
* Students are able to articulate the functions of plant structures and the role these structures play in the growth and reproduction of a plant.
* Students are able to distinguish the differences between monocotyledons and eudicotyledons.
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| **Week 3*** Investigate and analyse soil quality indicators, e.g. soil texture, structure, pH and soil profiles
 | **Teacher and students:*** Investigate factors influencing soil fertility including:
	+ soil texture
	+ soil structure
	+ pH
	+ soil profiles

**Students:*** Create a definition for each of the dot points above, include a diagram to support understanding.
* Explain the effects of each soil quality indicator in soil fertility.

**Demonstration:*** Teacher demonstrates techniques to test soil fertility including:
	+ soil texture using both ribbon method and texture triangle
	+ soil structure, testing slaking and dispersion of soils
	+ pH using test kits or pH probes
	+ Soil profiles by digging through several layers to see the difference between layers.
* Useful links for techniques to test soil fertility:
	+ [nrcs.usda.gov](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054311)
	+ [Soil texture by feel](https://www.youtube.com/watch?v=GWZwbVJCNec) (duration 4:04)
	+ [Understanding soil types and soil texture](https://www.youtube.com/watch?v=AUhOBxVFcFk) (duration 9:00)
	+ [How to test soil structure](https://www.youtube.com/watch?v=Z9J6sWeblK8) (duration 5:06)
	+ [Soil pH testing](https://www.youtube.com/watch?v=S6AizqoDe5Y) (duration 4:41)
	+ [Layers of soil](https://www.youtube.com/watch?v=ysIm7ImsK6c) (duration 6:14)

**Practical:** * Students conduct these tests on the soils used for propagation and in the field.
 | * Students record definitions for all soil terms in their workbooks.
* Students are observed during practical activities following correct procedures and collecting appropriate data.
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| **Week 4*** Identify and describe common plant pests and diseases
* Evaluate strategies for the management and control of plant pests and diseases (ACTDEP050)
* Evaluate current agricultural methods relevant to the chosen plant enterprise in terms of environmental sustainability (ACTDEK044)
 | **Teacher and students:*** Watch the video clip [GCTV2 Integrated pest management](https://www.youtube.com/watch?v=OiKuPLCLs9g&list=PL5BC991F931DFFD9C) (duration 5:45) as a class.
* Brainstorm the benefits of using IPM. Create a definition for IPM.
* Evaluate the effect of IPM on short- and long-term environmental sustainability.

**Students:*** Look up one native plant pest and one native plant disease relevant to a plant growing in your area or linked to the practical activities in this unit. Identify and describe each, creating a one-page reference guide for identification. Suitable resources include [WA Department Primary industries and rural development – native plant diseases](https://www.agric.wa.gov.au/diseases/native-plant-diseases?page=0%2C0).
* For each pest and disease, create an IPM plan. Evaluate its effectiveness at controlling this pest/disease at each step.

**Practical:*** Watch the [Beat Sheet Sampling with Hugh Brier video](https://www.youtube.com/watch?v=56OB-tE3x18&list=PLECdk_iZddkYpwlF2l5goMEDDYGMTTJJ_) (duration 2:41). Create your own form of 'beat sheet' and conduct your own trials in the field to determine what pests are present in your crop.
* Collect and create an insect collection.

**Optional extension:*** Link the IPM for the native plant pest to the lifecycle of the pest. Evaluate why each step is effective for each stage of the lifecycle.
* Develop an IPM for your school crop and carry out. Keep a record of the number of pests and diseases affecting your crop throughout the growing period.
 | * Students use appropriate specialist terminology in the development of reference guides and management plans.
* Students are able to follow instructions to conduct accurate and safe trials to collect data in the field.
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| **Week 5*** Investigate current agricultural systems and Aboriginal land management practices
* Explore the effect of European and Aboriginal agricultural practices on agricultural production and environmental sustainability (ACTDEK040)
* Understand ethical responsibilities surrounding intellectual property, including Indigenous cultural and intellectual property
 | **Teacher and students:*** Read through ['Food and Fibre Production: An Aboriginal Perspective](https://www.nswdpi-schools-program.com/aboriginal-food-fibre-stage-6)' as a class and watch the video series from ABC Education Digi book, ‘[Bruce Pascoe: Aboriginal agriculture, technology and ingenuity](http://education.abc.net.au/home#!/digibook/3122184/bruce-pascoe-aboriginal-agriculture-technology-and-ingenuity)’.
* Discuss agricultural land management practices and how these are similar or different to today’s practices.

**Students:*** Complete activities from the end of the ['Food and Fibre Production: An Aboriginal Perspective](https://www.nswdpi-schools-program.com/aboriginal-food-fibre-stage-6)' booklet.

**Teacher and students:*** Read through the ['Indigenous cultural and intellectual property](https://www.artslaw.com.au/information-sheet/indigenous-cultural-and-intellectual-property-icip-aitb/)' website and watch the associated videos from the site. Develop a class definition for 'Intellectual property".

**Students:** * Create a list of property that Indigenous cultural and intellectual property laws cover.
* Create a list of property that Indigenous cultural and intellectual property does not cover.

**Teacher and students:*** Discuss as a class some of the ethical responsibilities surrounding intellectual property when developing products or ideas.

**Extension:*** Students research the evolution of Australian agriculture, create a timeline showing advances in agricultural practices and outline their effect on environmental sustainability. Include Aboriginal perspectives.
 | * Students are able to articulate the effects of Aboriginal and European agricultural practices on sustainability.
* Students are able to articulate what intellectual property is.
* Students are able to distinguish between what property is and is not covered by ICIP law.
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| **Week 6*** Research the markets available for chosen plant agricultural products
* Assess the market specifications required to market chosen plant agricultural products
 | **Teacher:*** Identify the native plants to be grown on the school farm as part of this unit. An example could include- tube stock of native trees for the rehabilitation of local areas, native plants chosen for flower production, bush tuck plants for food harvest such as native ginger, warrigal greens or native rosella.

**Teacher and students:*** Discuss the importance of commercial native plant production in Australia using Australian bureau of agricultural and resource economics and sciences (ABARES) statistics.

**Students:*** Create graphs and identify trends on native plant production, native flower production etc.
* Research the chosen plant and the markets available both locally and for export. Create a list of potential markets or buyers.
* For the chosen plant research the market specifications for size or age of tube stock, as well as packaging; size, colour and formation of flowers for cut flower industry or size, colour and shape of harvested material for 'bush tucker'. Suitable resources include:
	+ [Marketfresh – Australian natives](http://www.marketfresh.com.au/get-to-know-australian-natives)
	+ [Agrifutures – finger-lime](https://www.agrifutures.com.au/farm-diversity/finger-lime)

**Students/practical:*** For the product grown in the native plant enterprise, assess harvested produce against market specifications researched.

**Optional extension:*** Excursion to a central market for fresh produce or flower produce e.g. Flemington, Newcastle produce markets, local markets or similar.
* Develop a checklist to assess the quality of harvested produce against produce bought from a supplier such as a supermarket or wholesaler.
 | * Students can distinguish between native and non-native plants for production during enterprise.
* Students can access and manipulate data and identify relevant trends.
* Students use appropriate terminology in identifying market specifications for a chosen product.
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| * Evaluate the social and ethical issues that would be confronted in the chosen plant enterprise (ACTDEK040)
 | **Teacher:*** Explain that in some cases or for some native species, producers will require a 'Protected Native Plant License' to harvest and grow these plants for commercial production.

**Teacher and students:*** Discuss why some plants require these licenses and others do not.

**Students:*** Research one native plant that requires a "protected native plant license". Create a fact sheet to improve the general public’s knowledge about this plant and why it is important to buy from a licensed grower.
* Outline why it is on the list to be protected. Use a map to show its distribution in the wild. Explain the issues that could arise if it is harvested or grown illegally. A suitable resource is [environment.nsw.gov.au](https://www.environment.nsw.gov.au/licences-and-permits/protected-native-plant-licences).
* Evaluate the use of licenses to control the issues raised.
 | * Students use appropriate specialist terminology in the production of a fact sheet about Protected Native Plant Licenses.
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| **Week 7*** Research an agricultural issue relevant to the plant enterprise chosen and propose possible solutions (ACTDEK044)
 | **Teacher and students:*** Brainstorm a range of agricultural issues that may be relevant to native plant production enterprises. For example, water availability or rising costs of inputs.

**Students:*** For one of the agricultural issues brainstormed, research the causes and effects of the issue on native plant enterprises and other relevant enterprises in Australia. Propose possible solutions to alleviate or fix this issue and present in a short presentation to the class.

**Optional extension:*** Research the land degradation issues caused by native vegetation clearing for creation of open farmland. For a local or statewide initiative aimed at regenerating native vegetation areas outline the goals and activities of the group and evaluate their progress. Examples could include [NSW Landcare gateway](http://www.landcare.nsw.gov.au/groups/landcare-nsw).
 | * Students are able to identify a range of agricultural issues relevant to the chosen industry and propose relevant solutions.
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| * Evaluate the profitability of an agricultural plant enterprise
* Investigate technologies that assist in record-keeping and monitoring of the plant enterprise and its performance (ACTDEK047)
* Collect accurate evidence and record relevant data relating to the plant enterprise
* Select and use appropriate software to analyse and present agricultural data related to the plant enterprise (ACTDEP052)
 | **Teacher:*** Explain why farm records are required to be kept, including physical records for plant production such as yield, sowing rates, fertiliser usage, chemical records for storage and use, and financial records, including input costs, wages and sale prices. A suitable resource is [wildflowers Australia](http://www.wildflowersaustralia.com.au/for-growers-and-value-chain-members/cost-of-production-for-10-major-wildflower-crops-grown-in-australia.html).

**Teacher and students:*** Determine the profitability of the native plant enterprise conducted at school by collecting data on input costs such as seed purchases, fertiliser costs and other costs related to the industry. Subtract these costs from the sales received at harvest and determine if the enterprise was profitable.

**Students/practical:*** Collect and record physical, chemical and financial data using relevant technologies such as farm diary, spreadsheets, cloud-based technology or industry-specific software and Apps.

**Students:*** Based on financial data collected for the enterprise, analyse where the highest costs are and suggest possible ways to reduce the inputs to improve profits or make a profit. Use technology to present your data, show the trends identified and explain ideas to improve the profitability of the enterprise.

**Optional extension:*** Using the financial data collected and physical records for the enterprise, identify areas for improvement. Implement one or more changes into the enterprise and compare profitability from the existing enterprise and the improved enterprise. Present your findings to the class.
* Design a record-keeping system for the native plant enterprise conducted at school to keep a record of materials used, costs of inputs such as fertiliser and growing media, income received from sales.
 | * Students completed costing and materials lists accurately and reflect the enterprise undertaken.
* Students can articulate the difference between inputs and outputs and how improvements can improve profits.
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| **Week 8*** Conduct a controlled agricultural experiment based on a plant-related hypothesis
* Plan and undertake procedures in the management of a plant enterprise (ACTDEP048, ACTDEP050)
 | **Teacher:*** Explain that some Australian native plants require their seeds to undergo extreme heat in order to germinate successfully. For example, Acacia species.

**Teacher and students:*** As a class decide on the experimental aim. Examples could include:
	+ Determine the best temperature of 'heat shock' to stimulate germination of wattle seeds
	+ How does the time of heat exposure (at a given temperature) affect the germination response of wattle seeds?

**Teacher:*** Explain the components necessary for a controlled experiment in agriculture. Consider dependent, independent and standardised variables.

**Students/practical:*** Create a hypothesis, plan and undertake an experiment to test the aim.
* Report on the results of the experiment.
 | * Students are observed actively participate in the development of experimental aims and hypothesis.
* Students are observed during practical activities, following correct experimental design and accurate data collection.
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| **Week 9*** Identify and apply ethical and WHS practices (ACTDEP050)
* Implement soil-management operations for a chosen plant enterprise (ACTDEK046)
* Work collaboratively to perform plant enterprise management activities (ACTDEP050, ACTDEP052)
* Manage and monitor crops to raise/grow products on the school farm
 | **Teacher:*** Explain WHS practices when working in a greenhouse and with common nursery tools and materials. For example, opening potting mixes in well-ventilated areas and using correct PPE.
* Explain and show examples of the different media available for propagation and their characteristics, including sand, vermiculite, perlite or similar.

**Demonstration:*** Teacher mixes appropriate media for seed germination, cuttings and potting on.

**Practical:*** Mix and use a range of propagation media for different purposes.

**Teacher:*** Explain seed dormancy in native plants and breaking seed dormancy.
* Identify the range of techniques used for breaking seed dormancy and discuss how nursery producers use these in industry.

**Demonstration:*** Demonstrate safe seed collection, cleaning and storage. Show the range of pre-germination treatments for different native species. For example, heat, soaking, scarifying and smoking.

**Students:*** Identify appropriate native species to propagate.

**Practical:*** Collect, clean and store seeds from native plants in the school or Ag farm.
* Conduct pre-treatments on a range of identified seeds before planting.
* Using appropriate media and pre-treated seeds from prior activities, plant native seeds for propagation of tube stock.

**Teacher:*** Outline the reproductive abilities of plants, identifying both sexual and asexual techniques. List the benefits and disadvantages of sexual and asexual reproduction.

**Practical:** * Collect and dissect flowers; identify the male and female organs and verbally explain how sexual reproduction occurs in flowering plants. Identify how pollen can move from anther to stigma of the same flower and/or other flowers.

**Demonstration:*** Show a range of asexual propagation techniques. For example, cuttings, division, layering and grafting.

**Practical:*** Use the range of asexual reproduction techniques demonstrated to prepare and grow native plants on the school farm.

**Optional extension:*** Create a range of media and test their effectiveness for seed germination.
 | * Students are observed during practical activities using the correct PPE and following safe operating procedures.
* Students are able to follow plans to accurately mix a range of propagation media and conduct a range of pre-germination treatments on native seeds.
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| **Week 10*** Conduct safe handling and storage of agricultural chemicals by interpreting chemical labels and correctly calibrating equipment
 | **Teacher and students:*** As a class discuss why safe use of chemicals is necessary for the applicator, the general public and the environment.
* Using the ['Understanding pesticide chemical labels poster](https://apvma.gov.au/node/11041)' and the ['Understanding pesticide labels](https://apvma.gov.au/node/11041)' information book, locate all of the important features of a chemical label and discuss what they mean and how an applicator would use this information when spraying.

**Students:*** Create an infographic outlining the requirements of pesticide labels.
 | * Students complete a series of activities on the safe use of chemicals and reading chemical labels.
* Students use appropriate specialist terminology to create an infographic about pesticide labels.
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## Evaluation

Evaluation of learning activities should be an ongoing process that happens throughout the delivery of this unit. Teachers should document their evaluation of learning activities throughout the program. The space provided below is to evaluate the overall unit of work.

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