



Stage 5 Agricultural Technology

Year 9 Unit 2: Worms

Description: Worms are becoming increasingly important in Australia as people are more environmentally aware and interested in utilising organic fertilisers. This enterprise will introduce students to a variety of worm related issues including: breeds, basic requirements, such as nutrition, monogastric digestive system, reproduction, husbandry techniques, climate/limiting factors, intensive production, pest control, interactions, markets, social and ethical issues and experimental design and analysis. Students will be involved in numerous practical activities including: establishing and maintaining a worm farm; selecting breed and number; feeding worms; measuring pH and temperature of bedding material; watering worms when necessary; identifying mating worms; identifying worm capsules/eggs; conducting experiments: food preferences, bedding preferences, covering materials. Students will participate in an excursion to two different worm farms with two distinct markets.

Why does this learning matter? The study of worms will allow students to experience alternative animal production and investigate the importance of this humble little creature. This is an enterprise that develops skills that students can easily use at home to establish and produce a useable product for the flower or vegetable garden, indoor plants, fishing bait etc. It also develops attitudes of sustainable production through the recycling of household and garden wastes. Inverell has at least two businesses that utilise worms to produce a saleable product. *Beaulieu Rum* targets the broad scale market while *Black Magic* targets the home gardener. Students will participate in excursions to both these businesses and compare their operations.

Suggested duration: 10 periods of 1 hour duration (4 weeks)



Targeted outcomes

A student:

- 5.1.1 explains why identified pl. species and animal breeds have been used in agri. enterprises and developed for the Australian environment and/or markets
- 5.1.2 explains the interactions within and between agricultural enterprises and systems
- 5.2.1 explains the interactions within and between the agricultural sector and Australia's economy, culture and society
- 5.3.1 investigates and implements responsible production systems for plant and animal enterprises
- 5.3.2 investigates and applies responsible marketing principles and processes
- 5.3.4 explains and evaluates the impact of management decisions on animal production enterprises
- 5.4.2 evaluates management practices in terms of profitability, technology, sustainability, social issues and ethics
- 5.5.1 designs, undertakes, analyses and evaluates experiments and investigates problems in agricultural contexts
- 5.6.2 performs plant and animal management practices safely and in cooperation with others

Resources

Text books

Bannerman et al, *Enterprising Agriculture*, pp. 289–299.

Other books

Brown, A., *Earthworms Unlimited* CSIRO Australia, *Earthworms for Gardeners and Fishermen*, Discovering Soils Series.

Murphy, D., *Earthworms in Australia*

Windust, A., *Worm Farming Made Simple and Worms Downunder Downunder*

The Weekly Times, *Beyond Broadacres – Successful Small Farming*, p. 54.

Internet

www.ento.csiro.au/ECowatch/Annelids.htm

www.dropbears.com/b/broughsbooks/nature/earthworms.htm

www.agric.nsw.gov.au/reader/soilsense/ss493-earthworms

www.biodiversity.csiro.au/2nd_level/3rd_level/fact_sheet_earthworms.htm

www.heyne.com.au/gardencentre/factsheets/factsheet.php/Earthworms

Contacts

Aust. Worm Growers Assoc. (AWGA) (02) 6365 3372 Allan Raymond
(Secretary) PO Box 281 Orange 2800

Assessment

A number of tasks have been listed for this unit, both theory and practical based (see assessment column). Tasks have been listed in the grid (on the last page) indicating where each outcome is addressed and enabling the tracking of students in meeting these outcomes.

Evaluation



Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
		Introduction and words to know: castings (vermicasts), vermicompost recycling, compost, soil degradation, invertebrate, clitellum, segments, setae, pH, hermaphrodite, bedding material, aeration, egg (capsule)		
a. the interactions between plants, animals, soils, climate and micro-organisms (5.1.2) g. the interaction between plant and animal production systems (5.3.4)	a. identify and discuss interactions within and between agricultural enterprises on the school farm (5.1.2) b. use drawings, diagrams and flow charts to show relationships between plants, animals, soils, climate and micro-organisms for specific enterprises studied (5.1.2)	Enterprise interactions Revise the terms enterprise, system, inputs, processes and outputs. Ref: <i>Dynamic Agriculture 1</i>, Ch. 7. Give specific worm enterprise examples of each. Revise the interactions between plants, animals, soils, climate and micro-organisms on the school farm. Draw systems diagrams illustrating these interactions, including the importance of worms in the soil.	System diagram: interactions.	
b. intensive and extensive production systems for an animal product (5.3.1)		Intensive and extensive systems Revise intensive and extensive types of production, include advantages and disadvantages. Ref: SAA, 3rd ed., pp. 16–18, <i>Dynamic Agriculture 2</i>, p. 24. List animals suitable for either system. Assignment: Investigate the different types of worm farm set ups. Ref: <i>Earthworms Unlimited</i>, pp. 35–41.	Assignment: Investigate the different types of worm farm set ups.	
		Parts of a worm Recognise and label parts of a worm. Prac test: Identify parts on a worm.	Prac test: Id. parts of a worm.	



Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
a. animal breeds specific to chosen agricultural enterprises (5.1.1) a. breed selection (5.3.4)	a. identify the characteristics of animal breeds specific to chosen enterprises (5.1.1) a. identify breeds relevant to a specific enterprise (5.3.4)	Breeds Name and describe a variety of worm breeds/species. Ref: <i>Worm Farming Made Simple</i>, pp. 46–69. Make a list of the native and introduced breeds/species. Explain why some breeds/species are used for various purposes, e.g. compost worms for creating vermicastings; tiger worms are unsuitable for fishing because they have an inbuilt defence mechanism that when they are threatened, they exude a fetid, foul smelling yellow liquid. Ref: <i>Worm Farming Made Simple</i>, pp. 29, 46–69.	Assignment: Breeds and characteristics.	
a. animal management practices (5.6.2)	f. perform simple animal husbandry operations (5.3.4) a. grow and monitor animals (5.3.1) b. apply production systems to animal product (5.3.1) a. perform procedures in the management animals (5.6.2) b. work cooperatively to perform management operations (5.6.2)	Factors influencing animal production The ability of animals to produce is affected by a number of factors including: management, climate, genetics (reproduction), nutrition, and pests and diseases. Management/husbandry operations Pracs: • set up a simple worm farm • assess the moisture content of the bedding material (squeeze test) • measure pH of the worm farm and correct if necessary.	Farm diary: Showing records of management activities performed: • feeding • checking moisture content • pH and temp.measurements • worm activity.	



Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
b. climatic factors affecting animal production including: – humidity – solar radiation – wind patterns – temperature – rainfall (5.1.1) d. climatic management in the production cycle (5.3.4) i. management techniques used to modify climate for their specific enterprise (5.3.4) b. reproductive systems of monogastric animals (5.3.4) a. the basic requirements of agricultural animals (5.3.1) b. digestive systems of monogastric animals (5.3.4)	b. measure and assess climatic factors affecting animal production (5.1.1) c. tabulate and graph climatic conditions in the local region relative to a chosen enterprise (5.1.1) b. identify and outline the functions of animal reproductive systems (5.3.4) b. identify and outline the functions of animal digestive systems (5.3.4)	Climate Describe the locations different breeds/species of worms prefer and give reasons. Describe how the following climatic factors limit production: humidity, solar radiation, wind patterns, temperature and rainfall. Ref: <i>Dynamic Agriculture 2</i>, p. 183. Outline various methods farm managers use to modify climate in worm farms including different covering materials. Prac: Measure the air and bedding temperature in the worm farm over a period of time and graph the results. Assess the moisture content of the bedding material (squeeze test) and water if necessary. Reproduction Recognise and label reproductive system. Outline the functions of the parts of the reproductive systems. Draw mating worms. Draw an egg/capsule. Describe the process of fertilisation, formation of the mucous ring, capsules and process of worm hatching. Ref: <i>Worms Downunder</i>, pp. 18–19. Prac: Identify and observe mating worms and worm capsules/eggs. Nutrition Discuss the nutritional needs of worms. Ref: <i>Earthworms Unlimited</i>, pp. 47–48; <i>Worm Farming Made Simple</i>, pp. 30, 79, 93–101. Compare different diets of worms used for different purposes, e.g. high protein feed for fishing worm production. Prac: Prepare worm food and feed worms. Monogastric digestion Recognise and label the worm monogastric digestive system. Ref: <i>Worms Downunder</i>, p. 12. Outline the functions of the parts of the worm monogastric digestive system. Prac: Observe a worm breaking off particles of food with its pharynx and explain why they do it.	Prac report: Measure air and bedding temperature and pH in the worm farm over a period of time and graph the results.	



Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
c. the management and control of significant pests and diseases (5.3.4)	c. identify common animal pests and diseases (5.3.4)	Pests and disease Revise definitions of pests and disease. Describe the main pests affecting worms: ants, rats mice, mites, birds. Ref: <i>Earthworms Unlimited</i> , pp. 66–67; <i>Worms Downunder</i> , pp. 33–34.		
a. planning and conducting first-hand investigations in agricultural situations (5.5.1)	b. conduct a controlled experiment to investigate an enterprise-related problem (5.5.1)	Experimental design and analysis Outline the reasons for doing experiments. List examples. Explain the importance of a control, randomisation, replication and standardisation in experimental design. Design an experiment to investigate the effects of one of the following: food preferences, different bedding materials, different covering materials, different species or varieties etc. As a class, select and conduct one of the above experiments.	Experimental report	
b. different markets available for a chosen agricultural product (5.3.2) b. relevant export and domestic markets (5.2.1)	b. investigate different types of markets available to enterprise production (5.3.2) c. select transport, handling and packaging methods for marketing a chosen agricultural product (5.3.2) a. investigate the significance of agricultural industries and products produced in the local region and their intended markets (5.2.1)	Markets: domestic and export Discuss the importance of markets. Ref: <i>Worm Farming Made Simple</i> , pp. 36, 119–132. List various markets available for worms. Investigate two worm businesses in Inverell (excursion). Discuss the markets for <i>Beaulieu Rum</i> and <i>Black Magic</i> worm products. Discuss the transport, handling and packaging methods for <i>Beaulieu Rum</i> and <i>Black Magic</i> worm products. Pracs: • harvest worms to sell. • harvest vermicompost. • design a logo and packaging for IHS worm farm products. • discuss and select transport and handling methods for IHS worm farm products.		
a. the impact of community demands and attitudes on sustainable agriculture (5.4.2)		Sustainable agriculture Define sustainability. Outline how worms improve sustainability, including the effects worms have on soils.		



Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
b. social issues and ethics involved with the production of chosen agricultural enterprises (5.4.2)		Social issues/ethics Discuss any social/ethical issues related to worm production.		
c. profitability as a measure of management success (5.4.2)	c. assess the profitability of a local agricultural enterprise (5.4.2)	Profitability and gross margins Investigate the costs and returns associated with worms. Revise the uses of a gross margin. Calculate a simple gross margin for a worm enterprise.		
		Excursion: Two local worm farm businesses: <i>Beaulieu Rum</i> targets the broad scale market while <i>Black Magic</i> targets the home gardener.	Excursion report: • management methods • marketing • sustainability • profitability.	



Student name/assessment task	Systems diagram: interactions	Assign: investigate the different types of worm farm set ups	Prac test: Id. Parts of a worm	Assign: breeds and characteristics	Farm diary: Showing records of mgmt activities performed.	Prac report: – temp. and pH – tabulate and graph	Experimental report	Excursion report	Unit test
Outcomes	5.1.2 5.3.4		5.1.5 5.3.4	5.1.1 5.3.4 5.6.2	5.1.1 5.6.2	5.3.1	5.5.1	5.2.1 5.3.2 5.4.2	5.1.1 5.1.2 5.3.1 5.3.2 5.3.4 5.4.2