Stage 5 Agricultural Technology — Year 9 Unit 4: Growing plants hydroponically

Description: Hydroponics is becoming increasingly important in Australia as land and other resources become more valuable and limited. This topic will introduce students to a number of plant related issues including: plant structure and function, basic requirements – nutrition, climate/limiting factors, types of systems: adv/disadv, management techniques, pests and diseases, intensive production, chemical use, storage and safety. Students will be involved in numerous practical activities including: establishing and maintaining a small scale hydroponic system; selecting growing medium; selecting and transplanting seedlings; mixing up nutrient solution and applying when necessary; evaluating the efficiency of the system and making recommended changes; harvesting plant produce; identifying plant parts and function; measuring pH and temperature of growing medium; monitoring the rainfall and air temperature over the growing period; reading a chemical label; using and storing chemicals safely.
Why does this learning matter? The study of growing plants hydroponically will allow students to experience different methods of plant production, develop skills that could be used at home and develop attitudes promoting sustainable production.
Suggested duration: 20 periods of 1-hour duration (8 weeks). The theory side of this unit shouldn't take long but the practical side is ongoing. This would be a good enterprise to slot in anywhere because it is not really seasonal.

Targeted outcomes
A student:

5.3.1 investigates and implements responsible production systems for plant and animal enterprises
5.3.3 explains and evaluates the impact of management decisions on plant production enterprises
5.5.1 designs, undertakes, analyses and evaluates experiments and investigates problems in agricultural contexts
5.6.1 applies Occupational Health and Safety requirements when using, maintaining and storing chemicals, tools and agricultural machinery
5.6.2 performs plant and animal management practices safely and in cooperation with others

Resources

Text books
Dynamic Agriculture 1 and 2, 2nd ed.
Senior Australian Agriculture (SAA), 1st, 2nd and 3rd editions.
Other books
Teaching some basic skills in Horticulture, Curriculum Ideas.
Hydroponics Unit 0703, Agricultural Science Materials Project (ASMP).
Illustrated Rural Studies, p. 39.
Growing with Horticulture, p. 69.
Primary Industries Horticulture book (orange one)

Carruthers, S. *Hydroponic Gardening*
Senior science program
Internet
www.hydroponicsonline.com,
www.abc.net.au/widebay/stories/5896654htm
Other
Agfacts
Videos
Hydroponic Gardening Step by Step (30 min)
Hydroponics explained (40 min)

Assessment

A number of tasks have been listed for this topic, 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 Ref: *Dynamic Agriculture 1,* pp. 303–305. Define hydroponics. List advantages and disadvantages of hydroponic systems. **Words to know** hydroponics, growing medium (vermiculite and perlite), nutrient solution, deficient, toxic, nutrients (macro, micro and trace elements), transplant, climatic control, pests, diseases.		
b. intensive and extensive production systems for a plant or an animal product (5.3.1)	**b**. identify plants relevant to agricultural production (5.3.3)	**Intensive and extensive systems** Ref: *SAA, 3rd ed.,* pp. 16–18; *Dynamic Agriculture* 2, p. 24. Revise intensive and extensive plant production systems. Include advantages and disadvantages. List plants suitable for either system.		
a. plant structure and function (5.3.3)		**Plant structure and function** Revise parts of a plant including: roots, stem, leaves, flowers, fruit and seeds. Relate structure to function. Table.		
a. the basic requirements of agricultural plants and animals (5.3.1)		**Basic requirements: Nutrition** Other general requirements have been covered in earlier untis, e.g. wheat. Revise basic plant requirements: sunlight, water, nutrients, climate etc. Name the elements required by plants and classify as macro, micro and trace. Outline the role of N, P, K. Describe symptoms of deficiency and toxicity (slides, pictures, SAA table, Agfacts etc).	**Research assignment:** Elements and deficiency/toxicity symptoms plants show.	

Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
a. plant and animal management practices (5.6.2)	**a**. grow and monitor plants and animals (5.3.1) **b**. apply production systems to a plant or animal product (5.3.1) **a**. perform management operations for a plant enterprise (5.3.3) **a**. perform procedures in the management of plants and animals (5.6.2) **b**. work cooperatively to perform management operations (5.6.2)	**Setting up a hydroponic system** List the requirements for a hydroponic garden (growing medium, nutrient solution: micro, macro and trace elements, climate control, pH etc). Explain the difference between liquid culture and aggregate culture systems. Ref: *Dynamic Agriculture 1*, pp. 305–306. Draw a generalised hydroponic system. Design a hydroponic system (given a list of available equipment). **Prac:** • Establish and maintain a small scale hydroponic system. • Select and transplant seedlings. • Mix nutrient solutions (home made directions in ASMP book or commercially available preparations) and apply when necessary, following OHS principles. • Keep management records and regularly monitor plants for growth, deficiency symptoms, diseases etc. • Measure and monitor pH levels and climatic conditions. • Evaluate the efficiency of the system and make changes if necessary. • Harvest plant produce.	**Research assignment:** Technology in hydroponics: • nutrient solutions • growing mediums • lighting systems • nutrient solution flow regulation methods • other. **Prac:** Design a hydroponic kit. **Prac:** Present farm diary showing records of: • management procedures performed, e.g. mixing and applying nutrient solution, transplanting seedlings etc. • plant growth and development • temp • pH. **Prac:** Effort, working cooperatively, system maintenance.	

Students learn about:	Students learn to:	Teaching and learning strategies:	Assessment	Reg
b. the management and control of significant pests and diseases (5.3.3)	**d**. identify common plant pests and diseases (5.3.3) **e**. implement and evaluate strategies for the management and control of plant pests and diseases for a chosen agricultural enterprise (5.3.3)	**Pests and diseases** Revise pest and disease definitions, including deficiencies as a disease. Discuss their effects on plant production systems. List and describe some common plant pests and diseases, particularly in hydroponic systems. Implement a management strategy for the control of a pest (if a pest becomes a problem in the system). Evaluate this management strategy. Implement a management strategy for the control of a disease (if a disease becomes a problem in the system). Evaluate this management strategy.	**Assignment:** • Describe in detail one pest and one disease of hydroponically grown plants, including management strategies. • Research the use of genetically engineered plants suited for hydroponic growth.	
a. planning and conducting first-hand investigations in agricultural situations (5.5.1)	**a**. investigate an agricultural problem and develop possible solutions (5.5.1)	**Experimental design and analysis** Revise reasons why experiments are carried out in Agriculture. List examples. Revise the importance of incorporating randomisation, replication, standardisation and a control in the design of every experiment. Design an experiment to investigate the effects of *one* of the following: nutrient deficiency, different growing mediums, different commercially available nutrient solutions, e.g. organic vs chemical, different species or varieties etc. As a class, select and conduct *one* of the above experiments.	**Assignment:** Design an experiment to investigate the effect of … on hydroponically grown plants.	
a. the safe handling and storage of agricultural chemicals (5.6.1)	**a**. interpret chemical labels (5.6.1)	**Agricultural chemicals** Read and interpret chemical/nutrient labels. Worksheet: answer questions. Measure and mix nutrient solutions following OHS principles. Convert volumes to appropriate amounts. Locate chemical storage area at farm: farm walk. Outline the importance of safe chemical storage and handling.		

Student name / assessment task	Research assignment: – elements and deficiency/toxicity symptoms plants show.	Research assignment: technology in hydroponics	Prac: Design a hydroponic kit.	Prac: Farm diary showing records	Prac: Effort, working co-op'tly, system maintenance	Assignment: Pest and disease mgmt strategies. Research Genetically eng. plants	Assignment: Design an experiment to investigate the effect of …	Unit test
Outcomes	5.3.1	5.6.2	5.3.1 5.6.2	5.6.2	5.6.2	5.3.3	5.5.1	5.3.1 5.3.3 5.5.1 5.6.1