1 Rationale

Agriculture is a dynamic field of science that deals with plant agronomy, animal husbandry and sustainable management of agricultural production systems. The sophistication of agricultural production systems is constantly increasing to meet the changing needs of society. As human activities, industries and resource demands increase and diversify, agricultural scientists, managers and producers encounter opportunities and challenges associated with the sustainable management of resources. Harnessing Australia’s market advantage of clean production systems and continuing to manage agricultural resources effectively are important for the future success of the agricultural industry in Australia.

Agricultural Science provides opportunities for students to explore agricultural concepts and systems and to investigate agricultural issues and problems. Students engage with the agricultural industry through the integration of three areas of study: plant science, animal science and agribusiness. Sustainable resource management underpins the course of study as students consider factors impacting on agricultural production systems.

This syllabus enables inquiry-based learning as students conduct practical and research-based agricultural investigations. Students formulate questions, hypotheses and plans for agricultural investigations to collect, organise and analyse agricultural information. By comparing research results and agricultural industry standards, students simulate the work of agricultural scientists, managers and producers who attempt to meet and exceed industry standards. Students conclude investigations by evaluating information, making and justifying decisions and recommendations, and communicating with stakeholder audiences.

A course of study in Agricultural Science can establish a basis for further education and employment in the fields of agriculture, horticulture, agronomy, food technology, aquaculture, veterinary science, equine science, biotechnology, environmental management, business, marketing and agricultural education, research and development.
2 Dimensions and objectives

The dimensions are the salient properties or characteristics of distinctive learning for this subject. The dimensions are described through their objectives and it is these that schools are required to teach and that students should have the opportunity to learn. The objectives describe what students should know and be able to do by the end of the course of study.

Progress in a particular dimension may depend on the qualities and skills developed in other dimensions. Learning through each of the dimensions must increase in complexity to allow for greater independence of the learner over a four-semester course of study.

Schools must assess how well students have achieved the objectives. The standards have a direct relationship with the objectives, and are described in the same dimensions as the objectives.

The dimensions for a course of study in this subject are:

- Dimension 1: Knowledge and understanding
- Dimension 2: Investigation and analysis
- Dimension 3: Evaluation and communication.

2.1 Dimension 1: Knowledge and understanding

The dimension Knowledge and understanding involves students defining and describing agricultural concepts, explaining agricultural systems, and applying understandings to agricultural issues and problems.

2.1.1 Objectives

By the conclusion of the course of study, students should:

- define and describe agricultural concepts
- explain agricultural systems using agricultural concepts
- apply understandings to agricultural issues and problems.

When students define and describe agricultural concepts, they state the meaning of these concepts and provide an account of their features. Agricultural concepts are the basic or fundamental ideas that underpin this subject.

When students explain agricultural systems, they use agricultural concepts to demonstrate understanding. Students demonstrate understanding by identifying interrelationships between concepts within agricultural systems.

When students apply understandings, they use their knowledge of agricultural concepts and systems to identify and explain agricultural issues and problems. Agricultural issues are current and relevant topics that cause concern or that are open to discussion or debate. Agricultural problems are questions posed for possible solutions.

Knowledge and understanding of agricultural concepts and systems underpins the Investigation and analysis of agricultural issues and problems and the Evaluation and communication of agricultural information.

2.2 Dimension 2: Investigation and analysis

The dimension Investigation and analysis involves students planning inquiry-based investigations, collecting and organising agricultural information, and analysing and interpreting information from primary and secondary sources.
2.2.1 Objectives

By the conclusion of the course of study, students should:

- formulate questions, hypotheses and plans for agricultural investigations
- collect and organise agricultural information
- analyse agricultural information from primary and secondary sources
- interpret agricultural information to compare research results and agricultural industry standards.

When students formulate questions, hypotheses and plans, they devise or construct these to guide agricultural investigations, both experimental and research-based. Plans include methods, procedures, techniques or a progression of stages employed to accomplish a set goal.

When students collect and organise agricultural information, they gather knowledge and data and sequence it to achieve a purpose.

When students analyse agricultural information from primary and secondary sources, they identify relationships, trends and patterns. This may involve the identification of errors and anomalies. Students may use specific data points to support analyses. When students analyse secondary agricultural information, they may consider the validity of secondary sources.

When students interpret agricultural information, they make meaning of the relationships, trends and patterns identified through analysis. Students compare research results and industry standards to show similarities and differences between their findings and the accepted standards published by the agricultural industry.

2.3 Dimension 3: Evaluation and communication

The dimension Evaluation and communication involves students examining and judging agricultural information to draw and justify conclusions, and make and justify decisions and recommendations. Students communicate their findings to audiences for a particular purpose.

2.3.1 Objectives

By the conclusion of the course of study, students should:

- evaluate agricultural information to draw conclusions, and make decisions and recommendations
- justify conclusions, decisions and recommendations about agricultural issues and problems
- communicate using language conventions to suit audiences and purposes.

When students evaluate, they make judgments to draw conclusions, and make decisions and recommendations following the analysis and interpretation of agricultural information. Students consider a range of alternatives before making decisions and they look to the future when making recommendations. The evaluation of experimental agricultural investigations may lead to recommendations being presented as modifications to equipment and procedures.

When students justify conclusions, decisions and recommendations about agricultural issues and problems, they provide evidence or reasoning to support their findings.

When students communicate agricultural information, they select language conventions (spelling, punctuation, grammar, industry-specific terminology, genre, referencing) to convey the information to stakeholder audiences to achieve a purpose.
3 Course organisation

3.1 Course overview

The minimum number of hours of timetabled school time, including assessment, for a course of study developed from this syllabus is 55 hours per semester. A course of study will usually be completed over four semesters (220 hours).

This syllabus is designed to enable schools to develop a course relevant to both local and global agricultural issues and problems.

A four-semester course of study includes:

- four to eight units of work
- four sustainable resource management factors (see Section 3.1.1)
- three areas of study, each with two key concepts and associated key ideas (see Section 3.1.2)
- inquiry-based agricultural investigations (see Section 3.1.3)
- two organising principles (see Section 3.1.5).

3.1.1 Sustainable resource management factors

Sustainable resource management is central to agricultural industries. The efficiency of food and fibre production has become a central focus of agriculture in response to an increasing global population and climatic changes.

Sustainable resource management factors underpin a course of study in Agricultural Science (see Table 1). These factors encompass local, national and global agricultural and environmental priorities that impact on agricultural production systems.

As sustainable resource management is relevant to all agricultural contexts, sustainable resource management factors should be evident in each unit of work.

When developing a unit of work, at least two sustainable resource management factors should be evidenced through learning experiences. Where sustainable resource management factors are the focal point of a unit of work and assessment, they may be combined with one area of study.

Each sustainable resource management factor is explained in Table 1 with suggested examples. Examples are neither prescriptive nor exhaustive and should be selected and developed to suit the agricultural investigation.
<table>
<thead>
<tr>
<th>Sustainable resource management factor</th>
<th>Explanation with suggested examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SRM1</strong> Plant and animal management</td>
<td>Effective plant and animal management leads to the sustainability of natural resources (e.g. crop rotation, cell grazing, paddock rotation). Plant residue and animal waste management promote nutrient cycling and efficient production (e.g. stubble management, composting). The biosecurity of plants and animals can be preserved through the control of pest organisms (e.g. weeds, introduced species, diseases, parasites). Agricultural producers uphold high ethical standards in food production (e.g. animal welfare, live export, food safety).</td>
</tr>
<tr>
<td><strong>SRM2</strong> Soil and water management</td>
<td>The physical, chemical and biological properties of soil can be used to classify soils and are a good indicator of soil health. Soil texture and structure influences water movement and soil stability. Soil classification techniques have been developed (e.g. Australian Soil Classification) to determine soil health and potential for use in agricultural production systems. The management of nutrient cycles (e.g. carbon, nitrogen) can influence plant and animal health and productivity. Effective soil management techniques (e.g. use of legumes, soil additives) can promote sustainable production. Poor soil management leads to soil degradation (e.g. salinity, acidification, compaction, erosion, nutrient decline) resulting in poor soil health. Water management occurs through on-farm storage, storage in the soil profile, irrigation, recycling water and managing catchments. Plant and animal selection are important considerations for water efficiency (e.g. water-efficient crops).</td>
</tr>
<tr>
<td><strong>SRM3</strong> Climate and weather</td>
<td>Measuring climatic variables (e.g. temperature, precipitation, humidity, wind, evaporation, radiation) can assist in on-farm management on a daily and seasonal basis. Atmospheric cycles (e.g. water, carbon, nitrogen) impact on seasonal variability and climate (e.g. climate change). Climatic variables and climate modelling can be used to determine weather patterns (e.g. El Niño-Southern Oscillation [ENSO], Madden-Julian Oscillation [MJO]). Weather forecasting can assist in farm-management decision making. Local climatic variables determine microclimates, within which variables can be modified. El Niño and La Niña weather patterns influence agricultural production systems. Preparation for extreme weather events can reduce the impacts on agricultural production systems.</td>
</tr>
<tr>
<td><strong>SRM4</strong> Land management</td>
<td>Techniques for land management include precision farming (e.g. controlled traffic) and whole-farm planning (e.g. catchment management, fencing, wildlife corridors, land care). Effective land management supports sustainable production. Technologies can be used to assess land capability and use (e.g. Geographic Information Systems, Global Positioning Systems). Measurements over time can determine trends. Models can be used to analyse natural and managed systems. Social, cultural and political influences can affect land management (e.g. clearing of natural vegetation, land rights) and competition for land use (e.g. mining (coal seam gas), urbanisation, environmental protection). Aboriginal and Torres Strait Islander perspectives on land management can provide strategies for sustainable production systems (e.g. firestick farming).</td>
</tr>
</tbody>
</table>
3.1.2 Areas of study

In Agricultural Science, there are three areas of study: plant science, animal science and agribusiness.

Each area of study consists of two key concepts and associated key ideas (see Figure 1 below). The two key concepts of each area of study are core to a course of study in Agricultural Science.

Areas of study should be integrated across a course of study. At least two areas of study should be evident in each unit of work except where sustainable resource management factors are the focal point of a unit of work and assessment. In this case, sustainable resource management factors may be combined with one area of study.

When developing an inquiry-based unit of work, key concepts and associated key ideas from relevant areas of study are selected to suit the inquiry (see Section 3.1.3). The development of key concepts over the course of study should reflect the three organising principles (see Section 3.1.5).

Key concepts should be covered at least twice before verification and key ideas should be covered at least once (see Tables 2–4).

Figure 1: Areas of study in Agricultural Science

<table>
<thead>
<tr>
<th>Areas of study</th>
<th>Key concepts</th>
<th>Key ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant science (PS)</td>
<td>PS1 The potential of agricultural production systems is based on the anatomy and physiology of agricultural plants.</td>
<td>PS1.1–1.6</td>
</tr>
<tr>
<td></td>
<td>PS2 The agronomy of agricultural plants determines the efficiency of production systems.</td>
<td>PS2.1–2.5</td>
</tr>
<tr>
<td>Animal science (AS)</td>
<td>AS1 The potential of agricultural production systems is based on the anatomy and physiology of animals.</td>
<td>AS1.1–1.6</td>
</tr>
<tr>
<td></td>
<td>AS2 Animal husbandry and management determines the efficiency of animal production systems.</td>
<td>AS2.1–2.6</td>
</tr>
<tr>
<td>Agribusiness (AB)</td>
<td>AB1 Agriculture is central to national and international economies, supplying food, fibres and other products.</td>
<td>AB1.1–1.7</td>
</tr>
<tr>
<td></td>
<td>AB2 Management and strategic decision making across the supply chain determine short- and long-term success of an agricultural enterprise.</td>
<td>AB2.1–2.6</td>
</tr>
</tbody>
</table>
### Table 2: Plant science key concepts and associated key ideas

<table>
<thead>
<tr>
<th>Key concepts</th>
<th>Key ideas</th>
</tr>
</thead>
</table>
| **PS1** The potential of agricultural production systems is based on the anatomy and physiology of agricultural plants. Concepts relating to the anatomy and physiology of agricultural plants form the basis of plant science. These concepts are drawn together through the exploration of plant systems. Knowledge of plant systems allows agricultural scientists to identify and maximise the potential of agricultural production systems. | PS1.1 Plants consist of cells, tissues and organs organised into specialised systems which carry out specific functions (e.g. reproductive, transportation).  
PS1.2 Anatomical structures and physiological functions of plant systems determine the nutrient requirements and efficiency of plants (e.g. root systems, leaves, transpiration, translocation, photosynthesis, respiration, osmosis, diffusion).  
PS1.3 The identification and classification of plants allows for grouping according to distinct and observable characteristics (e.g. monocot, dicot) and allows for selection and variation within production systems.  
PS1.4 The growth and development of plants occurs in stages that are regulated by hormones (e.g. tropisms, growth, ripening).  
PS1.5 Anatomical structures and physiological functions of plant reproductive systems determine reproductive processes, strategies, stages and timing (e.g. meiosis, mitosis, asexual propagation, sexual reproduction, pollination, germination).  
PS1.6 Genotypic ratios can be predicted using genetic theory (e.g. complete and incomplete dominance, dihybrid crosses) based on DNA inheritance while phenotypic traits arise through a combination of genetic and environmental factors. |
| **PS2** The agronomy of agricultural plants determines the efficiency of production systems. Agronomy involves the application of knowledge to plant production systems. In order to meet and/or exceed industry standards, agricultural scientists need to understand and be able to manipulate factors related to plant nutrition and reproduction. | PS2.1 Growing conditions of plants vary according to the production system (e.g. hydroponics, organic farming, permaculture, mixed farming systems, conservation farming) and management practices (e.g. planting distance for weed control, water management, cultural practices).  
PS2.2 Plants require nutrients in specific quantities for healthy growth and development, because nutrients affect the quality and quantity of harvested products.  
PS2.3 Integrated pest management approaches (e.g. pesticides, quarantine) and soil management can improve crop health and increase productivity.  
PS2.4 Reproductive and DNA technologies can be used to increase the variation of plants and improve crop productivity and health (e.g. hybridisation, propagation techniques such as tissue culture).  
PS2.5 Stages in crop production drive decisions made in production systems (e.g. post-harvest, transport, ripening using hormones, handling the product). |
### Table 3: Animal science key concepts and associated key ideas

<table>
<thead>
<tr>
<th>Animal science (AS)</th>
<th>Key concepts</th>
<th>Key ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AS1</strong> The potential of agricultural production systems is based on the anatomy and physiology of animals.</td>
<td>AS1.1</td>
<td>Animals consist of cells, tissues and organs organised into specialised systems which carry out specific functions (e.g. reproductive, digestive, skeletal).</td>
</tr>
<tr>
<td>Concepts relating to the anatomy and physiology of agricultural animals form the basis of animal science.</td>
<td>AS1.2</td>
<td>Anatomical structures and physiological functions of animal systems determine the nutrient requirements and efficiency of animals (e.g. digestive system, reproductive systems, digestion, reproduction, respiration).</td>
</tr>
<tr>
<td>These concepts are drawn together by exploring animal systems. Knowledge of animal systems allows agricultural scientists to identify and maximise the potential of agricultural production systems.</td>
<td>AS1.3</td>
<td>The identification and classification of animals allows for selection and variety within animal production systems.</td>
</tr>
<tr>
<td>AS1.4</td>
<td>The growth and development of animals occurs in stages that are regulated by hormones (e.g. maturity, ovulation).</td>
<td></td>
</tr>
<tr>
<td>AS1.5</td>
<td>DNA, located within the nucleus of animal cells, holds the genetic code which can determine the genotype and phenotype of animals.</td>
<td></td>
</tr>
<tr>
<td>AS1.6</td>
<td>Genotypic ratios can be predicted using genetic theory (e.g. monohybrid cross, polygenetic inheritance, sex-linkage) while phenotypic traits arise through a combination of genetic and environmental factors.</td>
<td></td>
</tr>
<tr>
<td><strong>AS2</strong> Animal husbandry and management determines the efficiency of animal production systems.</td>
<td>AS2.1</td>
<td>The consideration of animal welfare and ethics is central to agricultural production systems.</td>
</tr>
<tr>
<td>Animal husbandry involves the application of knowledge to animal production systems. In order to meet and/or exceed industry standards, agricultural scientists need to understand and be able to manipulate factors related to animal nutrition and reproduction.</td>
<td>AS2.2</td>
<td>Animals require nutrients in specific quantities for healthy growth and development (e.g. feed analysis, feed rations), as nutritional deficiencies may impede the development and productivity of animals.</td>
</tr>
<tr>
<td>AS2.3</td>
<td>Market specifications are based on the quality of the products harvested from animals and can be affected by animal nutrition and health.</td>
<td></td>
</tr>
<tr>
<td>AS2.4</td>
<td>Managing animal pests and diseases using chemical, biological and management approaches can be used to increase animal growth and health (e.g. quarantine, paddock spelling, dung beetles).</td>
<td></td>
</tr>
<tr>
<td>AS2.5</td>
<td>Genetic information can be used and manipulated to breed progeny most suited to industry and market requirements (e.g. breed plans, estimated breeding value (EBV), genetic engineering).</td>
<td></td>
</tr>
<tr>
<td>AS2.6</td>
<td>Reproductive technologies can be used to increase variation, improve characteristics and develop new breeds (e.g. assisted reproductive technologies).</td>
<td></td>
</tr>
<tr>
<td>Key concepts</td>
<td>Key ideas</td>
<td></td>
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<tr>
<td>--------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>AB1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture is central to national and international economies, supplying food, fibres and other products.</td>
<td>AB1.1 Agricultural production systems impact on local and international economies as the trade of agricultural products generates economic activity in local and international contexts (e.g. imports, exports).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB1.2 Exporting products, value-adding to crops and livestock and diversifying within agricultural production systems has the potential to increase returns on investment (e.g. agricultural processing).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB1.3 Quality assurance processes align products to market specifications, determining the revenue potential of agricultural production systems (e.g. Cattlecare, Q-Dairy, Freshcare).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB1.4 Supply and demand rates cause market values to fluctuate, affecting the price of agricultural products and the potential revenue of agricultural production systems.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB1.5 Agricultural innovations provide alternatives to meet changing demands, with research organisations, including private enterprises, being central to achieving these goals (e.g. Department of Agriculture, Fisheries and Forestry (DAFF), CSIRO, universities, companies).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB1.6 Global agricultural production systems can be analysed to provide alternative perspectives on production and innovation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB1.7 Agricultural production systems and industries provide a variety of employment and economic opportunities.</td>
<td></td>
</tr>
<tr>
<td>AB2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management and strategic decision making across the supply chain determine short- and long-term success of an agricultural enterprise.</td>
<td>AB2.1 Business enterprises require financial and strategic management, including livestock and crop monitoring and control to track inputs, outputs and returns on investment (e.g. gross margin analysis).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB2.2 Risk management and decision making determine the short and long-term success of agricultural production systems (e.g. sustainability of production methods).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB2.3 Business management and ownership structures vary, with roles and responsibilities differing (e.g. partnership, companies, land tenure, family farms, succession).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB2.4 Budgeting, record keeping and business skills allow agricultural production systems to track returns on investment (e.g. cash-flow statements, financial reports, inventories).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB2.5 Marketing and innovation are key components of raising revenue from and increasing the status of agricultural production systems.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AB2.6 Marketing of Australian products should emphasise the unique nature of these production systems (e.g. clean production systems).</td>
<td></td>
</tr>
</tbody>
</table>
3.1.3 Inquiry-based learning

Agricultural Science enables inquiry-based learning through which students conduct primary and/or secondary research into agricultural issues and problems.

Inquiry-based learning is a process and a way of thinking when investigating agricultural issues and exploring problems (see Figure 2 on page 11). It is an effective strategy for:

- the development of higher-order thinking skills, including analysing, interpreting, evaluating and justifying
- increasing student involvement and ownership of the agricultural investigation
- embedding effective teaching and learning principles in Agricultural Science
- recognising and catering for difference, in both school location and student interests.

The guiding principles for inquiry-based learning are:

- effective inquiry is a skill that requires explicit teaching
- inquiry-based learning is not a linear process, as Figure 2 attempts to illustrate:
  - students often revisit stages of the inquiry-based investigation following periods of reflection and critical thinking
  - attending to one stage in the process may prompt students to return to a previous stage (e.g. inquiry-based investigations may give rise to further research questions)
- inquiry occurs within a context for learning that is authentic and relevant.

Developing contexts for inquiry-based investigations

Inquiry-based investigations provide students with opportunities to learn in circumstances that are relevant and interesting to them. Inquiry-based learning is used to bring the areas of study together in agricultural contexts.

A context can be developed through investigating agricultural issues or problems.

Examples include:

- local and global agricultural issues (e.g. animal welfare, climate change, food shortages)
- local and international agricultural production systems (e.g. feedlots, poultry, dairy, viticulture, grain cropping, aquaculture)
- the use of technologies in agricultural production systems (e.g. gene technology, genetically modified organisms)
- alternative agricultural production systems (e.g. organic, permaculture).

The selection of sustainable resource management factors, key concepts and associated key ideas from relevant areas of study should be based on the context for learning.

Further resources to support the development of inquiry-based investigations are available on the Agricultural Science subject page at [www.qsa.qld.edu.au/20318.html](http://www.qsa.qld.edu.au/20318.html).
Figure 2: Inquiry-based learning in Agricultural Science

**REFLECT**
Re-examine the question, the research method and the outcomes. The answer may be to begin the inquiry-based process again.
- Have solutions been proposed?
- Do new questions arise?
- Where to from here?
- What have I learnt that can inform future learning?

**DEFINE**
Establish, refine and frame the inquiry-based investigation by:
- applying knowledge and understanding
- conducting initial research and trials
- formulating research questions, hypotheses and/or plans for investigation (group/individual, teacher/student-directed).

**COMMUNICATE**
Produce an assessment response such as:
- extended agricultural investigation (EAI)
- report
- essay
- speech
- presentation.

**INVESTIGATE**
Conduct experimental and/or research-based investigations by:
- collecting primary and/or secondary agricultural information
- organising agricultural information.

**ANALYSE/INTERPRET**
Dissect to ascertain and examine constituent parts and make meaning of relationships, trends and patterns through:
- analysing agricultural information
- establishing relationships or connections between agricultural information
- comparing research and industry standards.

**EVALUATE/JUSTIFY**
Assign merit according to criteria and provide reasons or evidence to support statements by:
- evaluating agricultural information and methods to draw and justify conclusions
- making and justifying decisions and recommendations, including experimental modifications.
3.1.4 Planning a course of study

A four-semester course of study in Agricultural Science (see Figure 3) includes:

- four to eight units of work, ranging from 20 to 55 hours
- the four sustainable resource management factors, each covered twice by verification (see Section 3.1.1)
- an integration of the three areas of study: plant science, animal science and agribusiness (see Section 3.1.2)
- evidence of all key concepts being covered twice prior to verification, once in Year 11 and once in Year 12 (see Figure 1 on page 11)
- evidence of all key ideas being covered at least once
- at least one inquiry-based investigation of agricultural issues or problems per year (see Section 3.1.3)
- consideration of the organising principles: coherent sequencing and increasing independence (see Section 3.1.5).

Figure 3: Planning a course of study
Developing units of work

Four to eight units of work (see Figure 4) should be developed around:

- at least two sustainable resource management factors (see Section 3.1.1)
- key concepts and key ideas from at least two areas of study (see Section 3.1.2).

Where possible, schools are encouraged to develop inquiry-based investigations of agricultural issues and problems (see Section 3.1.3).

Where sustainable resource management factors are the focal point of a unit of work and assessment, they may be combined with one area of study.

Figure 4: Developing a unit of work

<table>
<thead>
<tr>
<th>Sustainable resource management factors</th>
<th>Unit/Inquiry</th>
<th>Areas of study</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRM1 Plant and animal management</td>
<td>20 to 55 hours</td>
<td>Plant science</td>
</tr>
<tr>
<td>SRM2 Soil and water management</td>
<td>key concepts and relevant key ideas</td>
<td>Animal science</td>
</tr>
<tr>
<td>SRM3 Climate and weather</td>
<td>an inquiry-based investigation of agricultural issues and problems where possible</td>
<td>$</td>
</tr>
<tr>
<td>SRM4 Land management</td>
<td></td>
<td>Agribusiness</td>
</tr>
</tbody>
</table>

3.1.5 Organising principles

There are two organising principles that underpin a course of study in Agricultural Science:

- coherent sequencing
- increasing independence.

Coherent sequencing

To ensure coherent sequencing, the key concepts and key ideas should be mapped across the four-semester course of study. Fundamental concepts should be taught before the introduction of more challenging concepts. Key concepts need to be explored in at least two different units of work, once in Year 11 and once in Year 12.

Increasing independence

Increasing independence develops as students are required to accept responsibility for their own learning across the course. Students plan, manage and evaluate their work to identify ways of improving agricultural investigations.

Learning experiences and assessment instruments must reflect the students’ progression through the stages of the course.

<table>
<thead>
<tr>
<th>Early in the course, students:</th>
<th>Increasingly independent students:</th>
</tr>
</thead>
<tbody>
<tr>
<td>conduct a broad examination of agricultural issues and problems</td>
<td>conduct an in-depth study of specific agricultural issues and case studies, some of which may be identified by students</td>
</tr>
<tr>
<td>apply agricultural concepts to simple systems and issues</td>
<td>apply agricultural concepts to complex, interconnected systems and issues</td>
</tr>
<tr>
<td>conduct group, assisted and modelled extended agricultural investigations (EAlS) with one variable.</td>
<td>conduct student-directed EAlS with multiple variables (where possible) with reduced teacher input.</td>
</tr>
</tbody>
</table>
3.2 Further considerations

Due to the practical and applied nature of Agricultural Science, and the use of animals for research, important factors relating to resourcing must be considered when planning a course of study. References to external agencies are supported by the Reference list located on the Agricultural Science subject page of the QSA website <www.qsa.qld.edu.au/20318.html>.

3.2.1 Agricultural resources

Schools should develop units of work that are compatible with available resources. In order to ensure equity, all students should be provided with equal access to resources. To extend the range of learning experiences and assessment opportunities, schools should consider sharing resources within regional areas.

3.2.2 Timing

The timing of agricultural investigations is an important consideration when planning a course of study. Breeding seasons, growing seasons and growth and development stages should be considered, especially when planning extended agricultural investigations (EAIs). Students should be given enough time to complete significant inquiry-based investigations so they can gather meaningful primary data. This may involve EAIs being conducted over a longer time. The timing of agricultural investigations may coincide with agricultural shows and competitions to allow for a broader application of the learning associated with the inquiry-based investigation.

3.2.3 Workplace health and safety

Agricultural Science is designed to give students exposure to the practical components of science through practical experiences in the laboratory and the field. These experiences expose students to a variety of hazards, from biological and poisonous substances to injury from agricultural equipment. Besides a teacher’s duty of care that derives from the Education (General Provisions) Act 2006, there are other legislative and regulatory requirements, for example the Work Health and Safety Act 2011, which will influence the nature and extent of practical work.

All practical work must be organised with student safety in mind. In Agricultural Science, there are many activities associated with handling biological materials — including live animal and plant specimens, microorganisms, and materials for dissection — that expose teachers and students to health hazards.

The current science safety requirements are clearly explained in the Department of Education, Training and Employment (DETE) Policy and Procedure Register.

It is the responsibility of all schools to ensure that their practices meet current legislation requirements.

3.2.4 Legislation and regulations

Relevant legislation and regulations that may affect the syllabus requirements must be considered when devising educational experiences. By observing appropriate legislation and regulations, schools will be able to deliver educational experiences that meet syllabus requirements and fulfil their duty of care. Relevant legislation and regulations include:

- Aboriginal Land Regulation 2011
- Aboriginal Cultural Heritage Act 2003
- Animal Care and Protection Act 2001
- Environmental Protection Act 1994
- National Environment Protection Council (Queensland) Act 1994
- Native Title (Queensland) Act 1993
3.2.5 Animal welfare and ethics

The Animal Care and Protection Act 2001 (the Act) and the accompanying Animal Care and Protection Regulation 2002 govern the treatment and use of all animals in Queensland. The Department of Agriculture, Fisheries and Forestry Queensland (DAFF), through Biosecurity Queensland, is responsible for enforcement of the legislation.

The purpose of the Act is to promote the responsible care and use of animals, provide standards for the care and use of animals, protect animals from unjustifiable, unnecessary or unreasonable pain, and ensure that the use of animals for scientific purposes is accountable, open and responsible.

“Scientific purposes” is defined as any activity performed to acquire, demonstrate or develop knowledge or a technique in a scientific discipline including teaching. Under the Act an animal is any live vertebrate or cephalopod. This includes amphibians, birds, fish, mammals (other than humans), reptiles and cephalopods (octopus, squid, cuttlefish and nautilus). This also includes live prenatal or prehatched creatures in the last half of gestation, including mammalian or reptilian foetus, prehatched avian, mammalian or reptilian young (eggs), and live marsupial young. It does not include invertebrates other than cephalopods; the eggs, spat or spawn of fish; and immature amphibians and fish prior to final metamorphosis. Further details of the categories covered by the Act can be obtained from DAFF.

The Act also requires mandatory compliance with the Australian code of practice for the care and use of animals for scientific purposes 7th edition 2004 (the Code), available from the National Health and Medical Research Council’s publications website.

The Code provides guidance for institutions, researchers, teachers and animal ethics committees on the ethical framework necessary to ensure that the welfare of animals used for research and teaching is given an appropriate level of consideration. National codes of practice are available for most livestock industries, and outline acceptable standards of husbandry and management. There are also model codes of practice available from the DAFF website that cover areas such as transporting livestock, saleyards and abattoirs.

In Queensland, the national livestock codes are used as the minimum standard. Codes of Practice are available from the CSIRO publishing website.

In order to comply with the Act, teachers or employing institutions intending to use animals for scientific purposes (which include teaching) must:

- register with the DAFF and nominate the Animal Ethics Committee (AEC) that will assess the animal use activity
- ensure the animal use activity is approved by the AEC before commencing the activity
- comply with the annual reporting requirements of the AEC and the DAFF for all approved activities in which animals were used.

Animals must not be used for scientific purposes in any Queensland school without prior written approval from the Queensland Schools Animal Ethics Committee (QSAEC).

The QSAEC is a cross-sector committee linking Education Queensland, Queensland Catholic Education Commission and Independent Schools Queensland, and includes members drawn from the scientific and wider community to bring a diversity of knowledge, values and beliefs to the committee. The QSAEC meets once a term, usually during the third week of each term. There are at least four meetings of the QSAEC each year.

The main task of the members of the QSAEC is to assess and monitor animal use in schools to safeguard the welfare of the animals involved. The QSAEC members decide whether proposed activities using animals are justified, that the “3Rs” (replacement, refinement and reduction) have been considered and that the welfare needs of the animals have been adequately met.

References to external agencies are supported by the Reference list located on the Agricultural Science subject page of the QSA website <www.qsa.qld.edu.au/20318.html>.
3.3 Advice, guidelines and resources

The following advice, guidelines and resources support the implementation of the syllabus. Where indicated further information may be obtained from the Agricultural Science subject page of the QSA website <www.qsa.qld.edu.au/20318.html>.

3.3.1 Aboriginal and Torres Strait Islander perspectives

The Queensland Government has a vision that Aboriginal and Torres Strait Islander Queenslanders have their cultures affirmed, heritage sustained and the same prospects for health, prosperity and quality of life as other Queenslanders. The QSA is committed to helping achieve this vision and encourages teachers to include Aboriginal and Torres Strait Islander perspectives in the curriculum.

The Queensland Studies Authority (QSA) recognises Aboriginal and Torres Strait Islander peoples, their traditions, histories and experiences from before European settlement and colonisation through to the present time. To strengthen students’ appreciation and understanding of the first peoples of the land, opportunities exist in the syllabus to encourage engagement with Aboriginal and Torres Strait Islander:

- frameworks of knowledge and ways of learning
- contexts in which Aboriginal and Torres Strait Islander peoples live
- contributions to Australian society and cultures.

Aboriginal and Torres Strait Islander peoples have a long-held affinity with the land. Relying on the land for food and resources, the first peoples of Australia developed sustainable management practices that ensured the continual abundance of a range of organisms. The resource management strategies of Aboriginal and Torres Strait Islander peoples should be considered across the course. Where possible, courses should be developed in collaboration with local Aboriginal and Torres Strait Islander communities to ensure that the course has mutual benefits for both the student and the community.

Subject-specific resources are available on the Agricultural Science subject page. In addition, guidelines about Aboriginal and Torres Strait Islander perspectives and resources for teaching are available on the QSA website <www.qsa.qld.edu.au/577.html>.

3.3.2 Composite classes

This syllabus enables teachers to develop a course of study that caters for a variety of ways to organise learning, such as combined Years 11 and 12 classes, combined campuses, or modes of delivery involving periods of student-managed study. This resource provides guidelines about composite classes.

3.3.3 Embedding educational equity in the course of study

Equity means fair treatment of all. In developing work programs from this syllabus, schools need to provide opportunities for all students to demonstrate what they know and what they can do. All students, therefore, should have equitable access to educational programs and human and material resources.

In addition to the subject-specific resources available on the Agricultural Science subject page, guidelines about educational equity and resources for devising an inclusive work program are available on the QSA website <www.qsa.qld.edu.au/10188.html>.
3.3.4 Language education in Agricultural Science

It is the responsibility of teachers to develop and monitor students’ abilities to use the forms of language appropriate to their own subject areas. This involves providing opportunities for the development of students’ abilities in:

- selection and sequencing of information required in various forms (such as reports, essays, interviews and seminar presentations)
- use of technical terms and their definitions
- use of correct grammar, spelling, punctuation and layout.

3.3.5 Learning experiences and sample resources

This resource provides guidelines for learning experiences and sample resources, which may include unit/s of work.

3.3.6 Mathematical concepts in Agricultural Science

It is the responsibility of teachers to develop and monitor students’ abilities to use mathematical concepts appropriate to their own subject areas. This involves providing opportunities for the development of students’ abilities to:

- comprehend basic concepts and terms underpinning the areas of number, space, probability and statistics, and measurement
- extract, convert or translate information given in numerical forms, or as diagrams, maps, graphs or tables
- calculate and apply procedures
- use skills or apply concepts from one problem or one subject to another.

3.3.7 Reference materials

This resource provides links to reference materials, text and reference books, websites, newspaper reports, periodicals, electronic media and learning technology, and organisations and community resources for the subject.

3.3.8 Work program requirements

A work program is the school’s plan of how the course of study will be delivered and assessed, based on the school’s interpretation of the syllabus. It allows for the special characteristics of the individual school and its students. Work program requirements are available on the Agricultural Science subject page of the QSA website <www.qsa.qld.edu.au/20318.html>. Instructions for online submission of work programs are available from <https://www.qsa.qld.edu.au/wponline/login.qsa>. 
4 Assessment

Assessment is an integral part of the teaching and learning process. For Years 11 and 12 it is the purposeful, systematic and ongoing collection of information about student learning outlined in the senior syllabuses.

In Queensland, assessment is standards based. The standards for each subject are described in dimensions, which identify the valued features of the subject about which evidence of student learning is collected and assessed. The standards describe the characteristics of student work.

The major purposes of assessment in senior Authority subjects are to:

- promote, assist and improve learning
- inform programs of teaching and learning
- advise students about their own progress to help them achieve as well as they are able
- give information to parents, carers and teachers about the progress and achievements of individual students to help them achieve as well as they are able
- provide comparable levels of achievement in each Authority subject which may contribute credit towards a Queensland Certificate of Education
- provide base data for tertiary entrance purposes
- provide information about how well groups of students are achieving for school authorities and the State Minister responsible for Education.

4.1 Principles of exit assessment

All the principles of exit assessment must be used when planning an assessment program and must be applied when making decisions about exit levels of achievement.

A standards-based assessment program for the four-semester course of study requires application of the following interdependent principles:

- information is gathered through a process of continuous assessment, i.e. *continuous assessment*
- balance of assessment is a balance over the course of study and not necessarily a balance over a semester or between semesters, i.e. *balance*
- exit levels of achievement are devised from student achievement in all areas identified in the syllabus as being mandatory, i.e. *mandatory aspects of the syllabus*
- assessment of a student’s achievement is in the significant aspects of the course of study identified in the syllabus and the school’s work program, i.e. *significant aspects of the course of study*
- selective updating of a student’s achievement is undertaken over the course of study, i.e. *selective updating*
- exit assessment is devised to provide the fullest and latest information on a student’s achievement in the course of study, i.e. *fullest and latest information*. 
4.1.1 Continuous assessment

Judgments about student achievement made at exit from a course of study must be based on an assessment program of continuous assessment.

**Continuous assessment** involves gathering information on student achievement using assessment instruments administered at suitable intervals over the developmental four-semester course of study.

In continuous assessment, all assessment instruments have a formative purpose — to improve teaching and student learning and achievement.

When students exit the course of study, teachers make a summative judgment about their levels of achievement in accordance with the standards matrix.

The process of continuous assessment provides the framework in which the other five principles of exit assessment operate: balance, mandatory aspects of the syllabus, significant aspects of the course of study, selective updating, and fullest and latest information.

4.1.2 Balance

Judgments about student achievement made at exit from a course of study must be based on a balance of assessments over the course of study.

**Balance** of assessment is a balance over the course of study and not a balance within a semester or between semesters.

Balance of assessment means judgments about students’ achievements of the dimensions and objectives are made a number of times using a variety of assessment techniques and a range of assessment conditions over the developmental four-semester course of study.

See also Section 4.6, Verification folio requirements.

4.1.3 Mandatory aspects of the syllabus

Judgments about student achievement made at exit from a course of study must be based on mandatory aspects of the syllabus.

The **mandatory aspects** are:

- the dimensions Knowledge and understanding, Investigation and analysis and Evaluation and communication
- the three areas of study: plant science, animal science and agribusiness.

To ensure that the judgment of student achievement at exit from a four-semester course of study is based on the mandatory aspects, the exit standards for the dimensions stated in the standards matrix must be used (see Section 4.8.2, Awarding exit levels of achievement).

4.1.4 Significant aspects of the course of study

Judgments about student achievement made at exit from a course of study must be based on significant aspects of the course of study.

**Significant aspects** are those areas described in the school’s work program that have been selected from the choices permitted by the syllabus to meet local needs.

The significant aspects must be consistent with the objectives of the syllabus and complement the developmental nature of learning in the course of study over four semesters.
4.1.5 Selective updating

Judgments about student achievement made at exit from a course of study must be selectively updated throughout the course of study.

Selective updating is related to the developmental nature of the course of study and works in conjunction with the principle of fullest and latest information.

As subject matter is treated at increasing levels of complexity, assessment information gathered at earlier stages of the course of study may no longer be representative of student achievement. Therefore, the information should be selectively and continually updated (and not averaged) to accurately represent student achievement.

Schools may apply the principle of selective updating to the whole subject group or to individual students.

Whole subject-group

A school develops an assessment program so that, in accordance with the developmental nature of the course of study, later assessment information based on the same groups of objectives replaces earlier assessment information.

Individual student

A school determines the assessment folio for verification or exit (post-verification). The student’s assessment folio must be representative of the student’s achievements over the course of study. The assessment folio does not have to be the same for all students; however, the folio must conform to the syllabus requirements and the school’s approved work program.

Selective updating must not involve students reworking and resubmitting previously graded responses to assessment instruments.

4.1.6 Fullest and latest information

Judgments about student achievement made at exit from a course of study must be based on the fullest and latest information available.

- **Fullest** refers to information about student achievement gathered across the range of objectives.
- **Latest** refers to information about student achievement gathered from the most recent period in which achievement of the objectives is assessed.

As the assessment program is developmental, fullest and latest information will most likely come from Year 12 for those students who complete four semesters of the course of study.

The fullest and latest assessment information on mandatory and significant aspects of the course of study is recorded on a student profile.
4.2 Planning an assessment program

To achieve the purposes of assessment listed at the beginning of this section, schools must consider the following when planning a standards-based assessment program:

- dimensions and objectives (see Section 2)
- course organisation (see Section 3)
- principles of exit assessment (see Section 4.1)
- variety in assessment techniques and conditions over the four-semester course of study (see Section 4.5)
- verification folio requirements, i.e. the range and mix of assessment instruments necessary to reach valid judgments of students’ standards of achievement (see Section 4.6)
- post-verification assessment (see Section 4.6.1)
- exit standards (see Section 4.7).

In keeping with the principle of continuous assessment, students should have opportunities to become familiar with the assessment techniques that will be used to make summative judgments. Further information can be found on the Agricultural Science subject page of the QSA website <www.qsa.qld.edu.au/20318.html>.

4.3 Special provisions

Guidance about the nature and appropriateness of special provisions for particular students are described in QSA’s Policy on Special Provisions for School-based Assessments in Authority and Authority-registered Subjects (2009), <www.qsa.qld.edu.au/2132.html>.

This statement provides guidance on responsibilities, principles and strategies that schools may need to consider in their school settings. Reasonable adjustments to students with specific educational needs must be planned and negotiated as early as possible so that students can be provided with appropriate support in order to commence, participate and complete course of study requirements. The special provisions might involve alternative teaching approaches, assessment plans and learning experiences.

4.4 Authentication of student work

It is essential that judgments of student achievement be made on genuine student assessment responses. Teachers should ensure that students’ work is their own, particularly where students have access to electronic resources or when they are preparing collaborative tasks.

The QSA’s A–Z of Senior Moderation contains a strategy on authenticating student work <www.qsa.qld.edu.au/10773.html>. This provides information about various methods teachers can use to monitor that students’ work is their own. Particular methods outlined include:

- teachers seeing plans and drafts of student work
- student production and maintenance of evidence for the development of responses
- student acknowledgment of resources used.

Teachers must ensure students use consistent accepted conventions of in-text citation and referencing, where appropriate.

4.5 Assessment techniques

The assessment techniques relevant to this syllabus are identified in Figure 5, and described in detail in Sections 4.5.3 and 4.5.4.

Figure 5: Agricultural Science assessment techniques

Schools design assessment instruments from the assessment techniques relevant to this syllabus. For each assessment instrument, schools develop an instrument-specific standards matrix by selecting the syllabus standards descriptors for the dimension/s to be assessed. The matrix is used as a tool for making judgments about the quality of students’ responses to the instrument and is informed by the syllabus standards descriptors. Assessment is designed to allow students to demonstrate the range of standards (see Section 4.8.2, Awarding exit levels of achievement). Teachers give students an instrument-specific standards matrix for each assessment instrument.

Where students undertake assessment in a group or team, instruments must be designed so that teachers can validly assess the work of individual students and not apply a judgment of the group product and processes to all individuals.

The assessment instruments students respond to in a Year 11 assessment program should support those included in Year 12.

The conditions of assessment, possible modes for assessment and supporting evidence are identified and described below.

4.5.1 Conditions of assessment

Over a four-semester course of study, students are required to complete assessment under a range of conditions (see Section 4.1.2, Balance).

Conditions may vary according to assessment. Conditions should be stated clearly on assessment instruments and may include:

- whether supervised or unsupervised
- indicating individual, group or team
- stating time allowed (with perusal time as needed)
- stating length required
- using seen or unseen questions
- using sources or technologies.
Where support materials or technologies (e.g. notes, calculators or computers) are used under supervised conditions, schools must ensure that the purpose of supervised conditions (i.e. to authenticate student work) is maintained.

4.5.2 Modes of assessment

Assessment techniques may be presented in a variety of modes, e.g. written, spoken/signed and multimodal. An assessment response is communicated to an audience for a particular purpose which may influence the type of text, language features and other textual features used in the response. Purposes may include analysing; persuading; arguing; informing; presenting investigative, experimental or field-based findings; creating; performing; showcasing; reviewing a text or situation; completing calculations or solving problems.

Referencing conventions must be followed regardless of the mode of assessment.

Written responses

Written responses require students to communicate a written assessment response to an audience for a particular purpose.

Spoken responses

Spoken responses require students to present a spoken assessment response to a live or virtual audience (i.e. through the use of technology) for a particular purpose.

Multimodal responses

A multimodal response uses a combination of at least two modes to communicate an assessment response to a live or virtual audience for a particular purpose.

Modes include:
- written
- spoken/signed
- nonverbal, e.g. physical, visual, auditory.

Each of the selected modes contributes significantly to the multimodal response.

Different technologies may be used in the creation or presentation of the response. Replication of a written document into an electronic or digital format does not constitute a multimodal response.

When making judgments about multimodal responses, teachers apply the standards to the entire response — that is to all modes used to communicate the response.

Supporting evidence

Supporting evidence is required to substantiate decisions made on spoken and multimodal responses for monitoring, verification and exit purposes. Evidence to support spoken or multimodal responses may include:
- research/data analyses
- notes or annotations
- summary of findings
- journal entries or log book
- seminar brief or conference paper
- a recording of the response (as appropriate).
4.5.3 Extended response

Assessment technique: Extended response

Purpose

Extended response assesses the sustained application of higher order cognition (analysis, interpretation, evaluation, and development and justification of conclusions, decisions and recommendations) in responding to research or stimulus materials. Students analyse, interpret and evaluate data and information regarding agricultural issues and problems to develop and justify conclusions, decisions and recommendations.

Dimensions to be assessed

The dimensions to be assessed should be clearly stated on assessment instruments. This assessment technique is best used to determine student achievement in objectives from the dimensions:

- **Knowledge and understanding**
- **Investigation and analysis**
- **Evaluation and communication.**

Types of extended response

Extended research response

- An extended research response involves students collecting, selecting, organising and using information that goes beyond the data students have been given and the knowledge they currently possess.
- An extended research response occurs over a set period of time. Students may use class time and their own time to conduct research and develop a response.
- An extended agricultural investigation is a specialised extended research response relevant to this subject.

Specialised extended research response: Extended agricultural investigations (EAIs)

- Students investigate an open-ended practical research question using laboratory or field-based methods to collect primary data.
- EAIs follow an inquiry-based investigation process. The total time taken for the various parts of the process would usually be several weeks. The process includes student research, primary data collection and the development of a response.
- In conducting EAIs, students:
  - formulate research questions, hypotheses and plans for investigation if appropriate (development of these may be group or individual, and teacher or student-directed)
  - complete risk assessments to identify potential hazards and ensure animal welfare and ethics requirements are met
  - collect, select and organise agricultural information from primary and/or secondary sources
  - analyse information and interpret agricultural information to compare research results and agricultural industry standards if relevant
  - evaluate information to draw conclusions and make decisions and recommendations, including modifications to equipment and procedures
  - justify conclusions, decisions and recommendations
  - communicate to audiences through a written, spoken or multimodal research response
  - maintain a scientific journal to accompany the research response.
- The main aims of the scientific journal are to:
  - maintain a log of the stages of the inquiry-based investigation, including modifications to equipment and procedures
  - note the primary data collected by the student in the laboratory or field.
- Scientific journals do not contribute to the word limit, but may be used to support judgments about the objectives. The journal or sections of the journal may be included in the verification folio if required to substantiate teacher judgments.
- Common elements of scientific journals may include:
  - research questions and/or hypotheses
Assessment technique: Extended response

- plans for agricultural investigations including modifications
- primary data, including qualitative and quantitative data
- conclusions, decisions and recommendations.

Extended response to stimulus

- An extended response to stimulus involves students responding to stimulus materials related to agricultural issues or problems.
- Stimulus materials are known or provided materials/sources and concepts. This may include case studies, media articles, quotes, statistics, images or industry standards/data.
- An extended response to stimulus occurs over a set period of time. Students may use class time and their own time to develop a response.
- While research may occur in the writing of the extended response to stimulus, it is not the focus of this technique.
- Students respond to a seen question or statement using data, researched information, primary and/or secondary sources.

Possible assessment instruments

Assessment instruments that may be developed to assess extended response include:
- essay, e.g. analytical, persuasive/argumentative, informative
- report, e.g. investigative, experimental, field-based, practical
- article, e.g. magazine or journal, may be analytical, persuasive, informative
- speech, e.g. analytical, persuasive/argumentative or informative
- interview or debate
- news segment or documentary
- webcast or podcast
- a presentation combining speaking with data presentation or slide show
- a seminar combining speaking with visual prompts, e.g. posters, brochures, handouts
- a digital presentation or documentary combining images, sound bites, blog entries and embedded videos.

Assessment conditions

<table>
<thead>
<tr>
<th></th>
<th>Year 11</th>
<th>Year 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>extended research response</td>
<td>800–1000 words</td>
</tr>
<tr>
<td></td>
<td>extended response to stimulus</td>
<td>600–1000 words</td>
</tr>
<tr>
<td>Spoken:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3–4 minutes</td>
<td>4–5 minutes</td>
</tr>
<tr>
<td>Multimodal:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3–5 minutes</td>
<td>5–7 minutes</td>
</tr>
</tbody>
</table>

Further guidance

Teachers who wish to offer an extended response as a test (supervised conditions) should refer to the assessment technique: Examination (see Section 4.5.4).
### 4.5.4 Examination

**Assessment technique: Examination**

**Purpose**

This technique assesses the application of a range of cognition (knowledge, understanding, application, analysis, evaluation) to responses completed under supervised conditions.

**Dimensions to be assessed**

The dimensions to be assessed should be clearly stated on assessment instruments. This assessment technique is best used to determine student achievement in objectives from the dimensions:
- *Knowledge and understanding*
- *Investigation and analysis*
- *Evaluation and communication.*

**Types of examination**

**Short response test**

- Short response tests typically consist of a number of items, which involve students responding to questions, issues or problems.
- Short response tests occur under supervised conditions as students produce work individually and in a set time to ensure authenticity.
- Items will be in response to questions or statements, which are typically unseen. If seen, teachers must ensure the purpose of this technique is not compromised.
- Stimulus materials may also be used and may be seen or unseen.
- Unseen questions, statements or stimulus materials should not be copied from information or texts that students have previously been exposed to or have directly used in class.
- Items may include activities that require:
  - explanations longer than one sentence
  - ideas maintained, developed and justified
  - full sentence responses, constructing a piece of prose that may have one or several paragraphs.
- Items may require students to construct, use, interpret or analyse primary or secondary data, graphs, tables or diagrams.
- Items may also include multiple-choice and sentence answers. These types of questions, while useful for assessing content knowledge, are difficult to construct if trying to elicit meaningful higher order cognitive responses.

**Extended response test**

- Extended response tests require students to demonstrate sustained analysis, synthesis and evaluation in their responses.
- Extended response tests occur under supervised conditions where students produce work individually in a set time to ensure authenticity.
- Students respond to stimulus (materials/sources/concepts) that may be seen or unseen, and a seen or unseen question or statement.

<table>
<thead>
<tr>
<th>Assessment conditions</th>
<th>Year 11</th>
<th>Year 12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended duration:</strong></td>
<td>1–1.5 hours</td>
<td>1.5–2 hours</td>
</tr>
<tr>
<td><strong>Short response test:</strong></td>
<td>50–250 words per response</td>
<td>50–250 words per response</td>
</tr>
<tr>
<td><strong>Extended response test:</strong></td>
<td>400–600 words per response</td>
<td>600–800 words per response</td>
</tr>
</tbody>
</table>

**Further guidance**

Teachers who wish to offer an extended response but not as a test (i.e. not under supervised conditions) should refer to the assessment technique: Extended response (see Section 4.5.3).
4.6 Verification folio requirements

A verification folio is a collection of a student’s responses to assessment instruments on which the interim level of achievement is based. For students who are to exit after four semesters, each folio should contain the range of assessments for making summative judgments as stated below.

Students’ verification folios for Agricultural Science are to contain a minimum of four and a maximum of six assessment instruments and the relevant student responses. Each folio must include:

- evidence of student work from Year 12 only
- evidence of each instrument assessing at least two dimensions, with each dimension being assessed at least three times
- one extended agricultural investigation assessing all three dimensions (see Section 4.5.3)
- one examination (see Section 4.5.4)
- a student profile completed to date.

For information about preparing monitoring and verification submissions, schools should refer to QSA’s *Moderation handbook for Authority subjects*, <www.qsa.qld.edu.au/10773.html>.

4.6.1 Post-verification assessment

In addition to the contents of the verification folio, there must be at least one subsequent summative assessment in the exit folio completed after verification. For this syllabus, students are to complete an assessment response which assesses all three dimensions.

4.7 Exit standards

Exit standards are used to make judgments about students’ levels of achievement at exit from a course of study. The standards are described in the same dimensions as the objectives of the syllabus. The standards describe how well students have achieved the objectives and are stated in the standards matrix.

The following dimensions must be used:

Dimension 1: *Knowledge and understanding*
Dimension 2: *Investigation and analysis*
Dimension 3: *Evaluation and communication.*

Each dimension must be assessed in each semester, and each dimension is to make an equal contribution to the determination of exit levels of achievement.

Each dimension must be assessed in each year of the course, and each dimension is to make an equal contribution to the determination of exit levels of achievement.
4.8 Determining exit levels of achievement

When students exit the course of study, the school is required to award each student an exit level of achievement from one of the five levels:

- Very High Achievement (VHA)
- High Achievement (HA)
- Sound Achievement (SA)
- Limited Achievement (LA)
- Very Limited Achievement (VLA).

All the principles of exit assessment must be applied when making decisions about exit levels of achievement.

Exit levels of achievement are summative judgments made when students exit the course of study. For most students this will be after four semesters. For these students, judgments are based on exit folios providing evidence of achievement in relation to all objectives of the syllabus and standards.

For students who exit before completing four semesters, judgments are made based on the evidence of achievement to that stage of the course of study and the principles of exit assessment.

4.8.1 Determining a standard

The standard awarded is an on-balance judgment about how the qualities of the student’s responses match the standards descriptors in each dimension. This means that it is not necessary for the student responses to have been matched to every descriptor for a particular standard in each dimension.

4.8.2 Awarding exit levels of achievement

When standards have been determined in each of the dimensions for this subject, Table 5 below is used to award exit levels of achievement, where A represents the highest standard and E the lowest. The table indicates the minimum combination of standards across the dimensions for each level.

<table>
<thead>
<tr>
<th>Level</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHA</td>
<td>Standard A in any two dimensions and no less than a B in the remaining dimension</td>
</tr>
<tr>
<td>HA</td>
<td>Standard B in any two dimensions and no less than a C in the remaining dimension</td>
</tr>
<tr>
<td>SA</td>
<td>Standard C in any two dimensions and no less than a D in the remaining dimension</td>
</tr>
<tr>
<td>LA</td>
<td>At least Standard D in any two dimensions and an E in the remaining dimension</td>
</tr>
<tr>
<td>VLA</td>
<td>Standard E in the three dimensions</td>
</tr>
</tbody>
</table>

### 4.8.3 Standards matrix

<table>
<thead>
<tr>
<th>Knowledge and understanding</th>
<th>Standard A</th>
<th>Standard B</th>
<th>Standard C</th>
<th>Standard D</th>
<th>Standard E</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
</tr>
<tr>
<td></td>
<td>• thorough definition and description of agricultural concepts</td>
<td>• definition and detailed description of agricultural concepts</td>
<td>• definition or simple description of agricultural concepts</td>
<td>• statement of aspects of agricultural concepts</td>
<td>• statement of aspects of agricultural systems or systems somewhat related to agricultural issues or problems.</td>
</tr>
<tr>
<td></td>
<td>• thorough explanation of agricultural systems using agricultural concepts</td>
<td>• detailed explanation of agricultural systems using agricultural concepts</td>
<td>• explanation of agricultural systems using agricultural concepts</td>
<td>• simple explanation of agricultural systems using some agricultural concepts</td>
<td>• statement of aspects of agricultural systems</td>
</tr>
<tr>
<td></td>
<td>• discerning and systematic application of understandings to agricultural issues and problems.</td>
<td>• systematic application of understandings to agricultural issues and problems.</td>
<td>• application of understandings to agricultural issues and problems.</td>
<td>• simple application of understandings to agricultural issues and problems.</td>
<td>• statement of aspects of agricultural concepts or systems somewhat related to agricultural issues or problems.</td>
</tr>
<tr>
<td>Investigation and analysis</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
</tr>
<tr>
<td></td>
<td>• formulation of purposeful and relevant questions and hypotheses, and thorough plans for agricultural investigations</td>
<td>• formulation of relevant questions and hypotheses, and detailed plans for agricultural investigations</td>
<td>• formulation of questions, hypotheses and plans for agricultural investigations</td>
<td>• use of given questions or plans for agricultural investigations</td>
<td>• use of given questions or plans for agricultural investigations</td>
</tr>
<tr>
<td></td>
<td>• purposeful and methodical collection and organisation of agricultural information</td>
<td>• methodical collection and organisation of agricultural information</td>
<td>• collection and organisation of agricultural information</td>
<td>• partial collection of agricultural information</td>
<td>• identification of basic relationships or patterns</td>
</tr>
<tr>
<td></td>
<td>• thorough analysis of agricultural information from reliable and valid primary and secondary sources</td>
<td>• detailed analysis of agricultural information from valid primary and secondary sources</td>
<td>• analysis of agricultural information from primary and secondary sources</td>
<td>• simple analysis of agricultural information</td>
<td>• statement of results.</td>
</tr>
<tr>
<td></td>
<td>• thorough interpretation and comparison of research results and industry standards.</td>
<td>• detailed interpretation and comparison of research results and industry standards.</td>
<td>• interpretation and comparison of research results and industry standards.</td>
<td>• simple interpretation or comparison of research results and industry standards.</td>
<td></td>
</tr>
<tr>
<td>Evaluation and communication</td>
<td>Standard A</td>
<td>Standard B</td>
<td>Standard C</td>
<td>Standard D</td>
<td>Standard E</td>
</tr>
<tr>
<td>------------------------------</td>
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</tr>
<tr>
<td></td>
<td>The student work has the following characteristics:</td>
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<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
<td>The student work has the following characteristics:</td>
</tr>
<tr>
<td></td>
<td>• thorough evaluation of agricultural information to draw logical conclusions and make purposeful and relevant decisions and recommendations</td>
<td>• detailed evaluation of agricultural information to draw logical conclusions and make relevant decisions and recommendations</td>
<td>• evaluation of agricultural information to draw conclusions and make decisions and recommendations</td>
<td>• simple conclusions drawn or basic recommendations made</td>
<td>• statement of opinions</td>
</tr>
<tr>
<td></td>
<td>• reasoned and valid justification of conclusions, decisions and recommendations about agricultural issues and problems</td>
<td>• valid justification of conclusions, decisions and recommendations about agricultural issues and problems</td>
<td>• justification of conclusions, decisions and recommendations about agricultural issues and problems</td>
<td>• simple justification of conclusions or recommendations</td>
<td>• inconsistent use of evidence that supports opinions</td>
</tr>
<tr>
<td></td>
<td>• coherent and clear communication using well-chosen language conventions suited to purposes and audiences.</td>
<td>• clear communication using appropriate language conventions suited to purposes and audiences.</td>
<td>• communication using language conventions suited to purposes and audiences.</td>
<td>• communication using inconsistent language conventions.</td>
<td>• communication using language conventions which impede meaning.</td>
</tr>
</tbody>
</table>
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>accurate</td>
<td>precise, exact and correct</td>
</tr>
<tr>
<td>analyse</td>
<td>dissect to ascertain and examine constituent parts for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences</td>
</tr>
<tr>
<td>apply</td>
<td>employ/use knowledge in a particular situation</td>
</tr>
<tr>
<td>appropriate</td>
<td>fitting, suitable to the context</td>
</tr>
<tr>
<td>audience</td>
<td>the intended group of readers, listeners or viewers that the writer or speaker is addressing</td>
</tr>
<tr>
<td>basic</td>
<td>fundamental; elementary or simple</td>
</tr>
<tr>
<td>clear</td>
<td>plain and open, without ambiguity</td>
</tr>
<tr>
<td>coherent</td>
<td>rational with parts that are harmonious, well-structured and that make sense</td>
</tr>
<tr>
<td>collect</td>
<td>gather</td>
</tr>
<tr>
<td>communicate</td>
<td>convey information about, make known, clearly reveal or make known</td>
</tr>
<tr>
<td>compare</td>
<td>display recognition of similarities and differences and recognise the significance of these similarities and differences</td>
</tr>
<tr>
<td>concept</td>
<td>in the context of Agricultural Science, a concept is a basic or fundamental idea; may include facts and terminology specific to the subject</td>
</tr>
<tr>
<td>conclusion</td>
<td>a judgment based on evidence</td>
</tr>
<tr>
<td>considered</td>
<td>thought about or decided upon with care</td>
</tr>
<tr>
<td>consistent</td>
<td>accordant; in agreement or harmony; congruent</td>
</tr>
<tr>
<td>context</td>
<td>a framework for the development of meaningful learning experiences which provide students with opportunities to learn in circumstances that are relevant and interesting to them and are used to bring aspects of the areas of study together in real-world scenarios</td>
</tr>
<tr>
<td>decision</td>
<td>a choice or determination formed following the consideration of alternatives</td>
</tr>
<tr>
<td>define</td>
<td>state the precise meaning of</td>
</tr>
<tr>
<td>describe</td>
<td>provide an account of features</td>
</tr>
<tr>
<td>detailed</td>
<td>including numerous facts or aspects</td>
</tr>
<tr>
<td>discerning</td>
<td>showing good judgment; selected for value or relevance</td>
</tr>
<tr>
<td>effective</td>
<td>meeting the assigned purpose</td>
</tr>
<tr>
<td>explain</td>
<td>provide additional information that demonstrates understanding</td>
</tr>
<tr>
<td>evaluate</td>
<td>examine and judge the merit or significance of something according to criteria</td>
</tr>
<tr>
<td>formulate</td>
<td>devise; the construction of an idea or concept</td>
</tr>
<tr>
<td>given</td>
<td>known or provided</td>
</tr>
<tr>
<td>impede</td>
<td>hamper, limit, block or decrease the action or function of</td>
</tr>
<tr>
<td>Term</td>
<td>Explanation</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>inconsistent</td>
<td>lacking harmony between the different parts or elements; discrepant; incongruous</td>
</tr>
<tr>
<td>information</td>
<td>knowledge or data gained through experimentation, research and the use of primary and secondary sources</td>
</tr>
<tr>
<td>inquiry</td>
<td>a process involving the application of research techniques to the investigation of issues (see Section 3.1.3 for more detail)</td>
</tr>
<tr>
<td>interpret</td>
<td>explain the meaning of information</td>
</tr>
<tr>
<td>investigation</td>
<td>a process of answering a question, solving a problem or exploring an issue</td>
</tr>
<tr>
<td>issues</td>
<td>current and relevant topics that cause concern or that are open to discussion or debate</td>
</tr>
<tr>
<td>justify</td>
<td>provide reasons or evidence to support a statement</td>
</tr>
<tr>
<td>language conventions</td>
<td>the features of language that support meaning and help convey meaning (e.g. spelling, industry-specific terminology, vocabulary, grammar, punctuation, sentence structure, paragraphing, referencing, genre)</td>
</tr>
<tr>
<td>logical</td>
<td>rational and valid, internally consistent</td>
</tr>
<tr>
<td>methodical</td>
<td>arranged or proceeding in regular, systematic order</td>
</tr>
<tr>
<td>modification</td>
<td>change or alteration in form, design or practice</td>
</tr>
<tr>
<td>partial</td>
<td>incomplete</td>
</tr>
<tr>
<td>pattern</td>
<td>an arrangement of corresponding parts; may be based on a representative sample</td>
</tr>
<tr>
<td>plans</td>
<td>methods, procedures, techniques or a progression of stages employed to accomplish a set goal</td>
</tr>
<tr>
<td>primary data</td>
<td>information created by the person or persons directly involved in a study, mainly generated through experimentation</td>
</tr>
<tr>
<td>problem</td>
<td>a question proposed for possible solutions</td>
</tr>
<tr>
<td>provided</td>
<td>given</td>
</tr>
<tr>
<td>purpose</td>
<td>the reason for which something is done, to achieve an intended result</td>
</tr>
<tr>
<td>purposeful</td>
<td>intentional, determined, meeting an aim</td>
</tr>
<tr>
<td>range</td>
<td>a number of different things of the same general type</td>
</tr>
<tr>
<td>reasoned</td>
<td>logical and sound thinking</td>
</tr>
<tr>
<td>recommendation</td>
<td>a proposal for an appropriate course of action</td>
</tr>
<tr>
<td>relationship</td>
<td>the connection or association between ideas or between components of systems and models</td>
</tr>
<tr>
<td>relevant</td>
<td>applicable, important and correct</td>
</tr>
<tr>
<td>reliable</td>
<td>dependable, consistent</td>
</tr>
<tr>
<td>representation</td>
<td>words, images, symbols or signs used to convey meaning</td>
</tr>
<tr>
<td>secondary data</td>
<td>information that has been compiled from primary sources by a person or persons not directly involved in the study, collected through researching the studies and works of others</td>
</tr>
<tr>
<td>Term</td>
<td>Explanation</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>significant</td>
<td>important in effect or meaning</td>
</tr>
<tr>
<td>simple</td>
<td>may concern a single or a basic aspect, few steps, obvious data/outcomes, limited or no relationships</td>
</tr>
<tr>
<td>specific</td>
<td>intended for, applying to, or suited to a particular purpose, explicitly set forth</td>
</tr>
<tr>
<td>superficial</td>
<td>apparent and sometimes trivial</td>
</tr>
<tr>
<td>systematic</td>
<td>methodical, organised and logical</td>
</tr>
<tr>
<td>systems</td>
<td>groups of interacting concepts or processes that form an integrated whole</td>
</tr>
<tr>
<td>techniques</td>
<td>specialised methods and procedures used in a specific field to achieve a set purpose</td>
</tr>
<tr>
<td>thorough</td>
<td>demonstrating depth and breadth, inclusive of relevant detail</td>
</tr>
<tr>
<td>trend</td>
<td>the general direction in which something (namely data) tends to move</td>
</tr>
<tr>
<td>understandings</td>
<td>in the context of Agricultural Science, understandings refer to the demonstrated knowledge of agricultural concepts and systems when identified and explained in the context of an agricultural issue/problem</td>
</tr>
<tr>
<td>valid</td>
<td>applicable, legitimate and defensible</td>
</tr>
<tr>
<td>well-chosen</td>
<td>carefully selected to produce a desired effect</td>
</tr>
</tbody>
</table>