

**22273VIC**  
**Diploma of Agronomy**

**1 July 2014 to 30 June 2019**

**22273VIC Accreditation extended to 30 June 2021**

Version 1.1

This course has been accredited under Parts 4.4 and 4.6 of the Education and Training Reform Act 2006

**Accredited for the period 1 July 2014 to 30 June 2019**

**22273VIC Accreditation extended to 30 June 2021**



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### Modification history

Version	Date	Details
1.1	June 2020	Extended accreditation period to 30 June 2021
1.1	May 2019	Extended accreditation period to 30 June 2020
1.1	Oct 2017	Imported units updated to a later equivalent version, including core and elective units
1	June 2014	Initial release


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## Section A: Copyright and course classification information

<b>1. Copyright owner of the course</b>	Copyright of this document is held by the Department of Education and Training, Victoria © State of Victoria 2017.
<b>2. Address</b>	<p>Executive Director, Engagement Participation and Inclusion Higher Education and Skills Department of Education and Training (DET) GPO Box 4367 Melbourne Victoria 3001</p> <p>Organisational contact: Manager Training Products Higher Education and Skills Telephone: (03) 7022 1619 Email: <a href="mailto:course.enquiry@edumail.vic.gov.au">course.enquiry@edumail.vic.gov.au</a></p> <p>Day to day contact: Primary Industries Curriculum Maintenance Manager Email: <a href="mailto:annewiltshire@melbournepolytechnic.edu.au">annewiltshire@melbournepolytechnic.edu.au</a> Telephone: (03) 9269 1063</p>
<b>3. Type of submission</b>	The course is submitted for reaccreditation. It replaces and has equivalent outcomes to 21972VIC Diploma of Agronomy.
<b>4. Copyright acknowledgement</b>	<p>Copyright of this material is reserved to the Crown in the right of the State of Victoria.</p> <p>© State of Victoria (Department of Education and Training) 2017</p> <p>Copyright of the following units of competency from nationally endorsed training packages is administered by the Commonwealth of Australia.</p> <p>© Commonwealth of Australia</p> <p>AHC Agriculture, Horticulture and Conservation and Land Management Training Package</p> <ul style="list-style-type: none"> <li>• AHCBAC507 Develop production plans for crops</li> <li>• AHCBAC503 Manage integrated crop and pasture production</li> <li>• AHCBAC505 Plan and manage long-term weed, pest and/or disease control in crops</li> <li>• AHCBUS508 Prepare and monitor budgets and financial reports</li> <li>• AHCAGB501 Develop climatic risk management strategies</li> <li>• AHCIRG504 Develop an irrigation and drainage management plan</li> <li>• AHCWRK503 Prepare reports</li> <li>• AHCWRK505 Manage trial and/or research material</li> <li>• AHCBAC504 Plan and manage stored grain program</li> <li>• AHCBUS502 Market products and services</li> </ul>
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<b>6. Course accrediting body</b>	Victorian Registration and Qualifications Authority (VRQA)						
<b>7. AVETMISS information</b>	<p>AVETMISS classification codes</p> <table border="1" data-bbox="523 862 1453 1048"> <tr> <td data-bbox="531 862 1023 922"><b>ANZSCO</b> <i>[Australian and New Zealand Standard Classification of Occupations]</i></td> <td data-bbox="1031 862 1445 922">234100 Agricultural and Forestry Scientists</td> </tr> <tr> <td data-bbox="531 934 1023 994"><b>ASCED Code</b></td> <td data-bbox="1031 934 1445 994">0503 Horticulture and Viticulture</td> </tr> <tr> <td data-bbox="531 1005 1023 1048"><b>National course code</b></td> <td data-bbox="1031 1005 1445 1048">22273VIC</td> </tr> </table>	<b>ANZSCO</b> <i>[Australian and New Zealand Standard Classification of Occupations]</i>	234100 Agricultural and Forestry Scientists	<b>ASCED Code</b>	0503 Horticulture and Viticulture	<b>National course code</b>	22273VIC
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<b>ASCED Code</b>	0503 Horticulture and Viticulture						
<b>National course code</b>	22273VIC						
<b>8. Period of accreditation</b>	1 July 2014 to 30 June 2020						



## Section B: Course Information

<b>1. Nomenclature</b>		<b>Standard 1 AQTF Standards for Accredited Courses</b>
<b>1.1 Name of the qualification</b>	22273VIC Diploma of Agronomy	
<b>1.2 Nominal duration of the course</b>	1040-1210 hours	
<b>2. Vocational or educational outcomes Standard 1 AQTF Standards for Accredited Courses</b>		
<b>2.1 Purpose of the course</b>	<p>This course provides training in the high-level practical skills needed to provide technical information and advice on plant nutrition and fertiliser application for grain, pasture and fodder crops, appropriate crop varieties, crop rotations, weed, pest and disease management and effective soil testing.</p> <p>This qualification is intended for individuals who require technical and applied skills and knowledge in agronomy in the areas of sales, advisory services, research or farming. The qualification is appropriate for farmers wishing to develop their skills and knowledge and those seeking formal qualifications. Graduates may find work as consultant agronomists, employment with agricultural merchandise companies and chemical, fertiliser and seed companies. The qualification could also be used by government bodies such as the Department of Environment and Primary Industries to train new graduates or technical assistants.</p> <p>Although not its primary purpose, the industry has noted that while degree graduates have valuable research and scientific skills, they often lack the technical and applied skills required for a career in agronomy. This qualification may also be used to address the needs of this client group.</p>	
<b>3. Development of the course</b>		<b>Standards 1 and 2 AQTF Standards for Accredited Courses</b>
<b>3.1 Industry /enterprise/ community needs</b>	<p>The Australian Government's white paper, <i>Australia in the Asian Century</i> (October 2012), reports that there are substantial opportunities for Australia's agriculture and food sector emerging from Asia's rise. This could have a positive impact on Australia's economic and social prosperity, particularly in supporting jobs and income in rural and regional communities.</p> <p>The white paper reports that population and income growth in Asia is driving increased demand for food—in quantity, quality and product integrity. The real value of global food demand is expected to rise by around 35 per cent by 2025 from 2007 levels, with most demand coming from Asia. Although Asia contains some of the world's largest agricultural economies, the projected increase in consumption in the region will require greater food imports. Demand is likely to outpace food production over coming decades based on recent global agricultural productivity performance and emerging environmental constraints.</p> <p>Australia's agriculture and food sector is well-placed to build on its strengths: proximity to markets in Asia, complementarity in</p>	

production systems, a robust biosecurity system, a record of innovation and a reputation for producing high-quality and safe food products. The AgriFood Industry Skills Council's (AISC) 2013 Environmental Scan also cites that the new Asian urban middle class represents the greatest single factor shaping the future of Australian agriculture.

The AISC's Environmental Scan found that a significant gap exists between the current business and supply chain capability that industry will require if it is to compete effectively in the emerging Asian market. Traditional business models and the existing skills base will not be sufficiently agile or productive to compete in a dynamic, evolving environment.

Around Australia, producers are rethinking business plans in response to a changing climate. 2013 has set a new record for the highest national average temperature with the Bureau of Meteorology adding new temperature bands to denote 50-54°C - once considered off the scale. Natural resource management skills – soil, water, biodiversity and biosecurity – are essential to the survival of agricultural businesses.

The AISC identified the following major challenges and trends for industry:

- evolving job roles which require higher, often technology orientated skills
- building adaptive capacity of enterprises underpinned by new technologies and world class research and development
- building environmentally sustainable production systems capable of delivering strong economic returns.

The AISC reports a long standing national shortage of agronomists based on its consultation and review of multiple industry and government reports and inquiries (eg. Farm Institute, National Farmers' Federation, Office of the Chief Scientist). The AISC reports a growing demand for higher education graduates to undertake Diploma or Advanced Diplomas of Agriculture in order to gain practical experience and for degree offerings to become far more integrated into real work.

One of the major demands on the agronomy industry is to increase productivity while using fewer and, in future, scarcer resources. The ability to produce food is affected by global warming, competition from biofuel production and producing feed for animals. Ultimately this means that the need for an efficient, knowledgeable industry is vital. This course is providing training for agronomists who will have the high-level practical skills to provide technical information and advice on plant nutrition and fertiliser application for grain, pasture and fodder crops and on appropriate crop varieties, crop rotations, chemical selection and application, pest and disease identification and control and effective soil testing.

Although the AHC10 Agriculture, Horticulture and Conservation and Land Management Training Package addresses many of the skills needed by modern agronomists, there are gaps such as developing fertiliser and plant nutrition programs, the ability to research and apply application technology, the application of plant biology to agronomic practice, the use of agricultural technology and the application of soil science for sustainable production.

	<p>Enrolments in the superseded course averaged just over fifty (50) students per year and it is anticipated that enrolments will continue at this level. The AISC reports chronic labour shortages in agriculture. The National Farmers' Federation (NFF) suggests there are 50,000 unfilled jobs in the industry. Modest projections are that 15,000 additional employees across the industry will be needed per year for the next five years to replace workers who leave the industry. A proportion of these potential employees will need to be trained agronomists to assist enterprises to deal effectively with the challenges the industry confronts.</p> <p>Members of the steering committee were:</p> <table border="0"> <tr> <td>Robert Sonogan</td> <td>Agrivision Consultants</td> </tr> <tr> <td>Kent Wooding</td> <td>Agrivision Consultants</td> </tr> <tr> <td>Caroline Welsh</td> <td>Birchip Cropping Group Board</td> </tr> <tr> <td>John Stuchbery</td> <td>JSA Independent</td> </tr> <tr> <td>Stephen Drum</td> <td>Provider representative Longerenong College</td> </tr> <tr> <td>Nicola Cooley</td> <td>Provider representative NMIT</td> </tr> <tr> <td>Matthew Beddison</td> <td>SMS Rural Horsham, former student</td> </tr> </table> <p>The Project Manager was Kate Bryce, Primary Industries Curriculum Maintenance Manager, Northern Melbourne Institute of TAFE.</p>	Robert Sonogan	Agrivision Consultants	Kent Wooding	Agrivision Consultants	Caroline Welsh	Birchip Cropping Group Board	John Stuchbery	JSA Independent	Stephen Drum	Provider representative Longerenong College	Nicola Cooley	Provider representative NMIT	Matthew Beddison	SMS Rural Horsham, former student
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<p><b>3.2 Review for re-accreditation</b></p>	<p><i>Standards 1 and 2 for Accredited Courses</i></p> <p>22273VIC Diploma of Agronomy is equivalent to and replaces 21972VIC Diploma of Agronomy.</p> <p>As part of the ongoing course maintenance process, superseded units from the Amenity Horticulture RTF03 and Rural Production RTC03 Training Packages have been replaced by equivalent units from AHC10 Agriculture/Horticulture/ Conservation and Land Management Training Package.</p> <p>As part of the review for reaccreditation a skills profile was approved by the steering committee, in order to review and validate the core skills required for employment in the industry. Surveys were distributed to industry representatives and the results of the skills profile provided the steering committee direction in terms of which competencies should be included in the core.</p> <p>No further enrolments should be made into 21972VIC Diploma of Agronomy from 1 July 2014.</p> <p><b>Transition arrangements</b> Refer to the following table for the mapping of units in the superseded 21972VIC Diploma of Agronomy against units in the current course.</p>
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Units in superseded courses	Units in current courses	Relationship
AHCBAC507A Develop production plans for crops	AHCBAC507 Develop production plans for crops	Equivalent
AHCBAC503A Manage integrated crop and pasture production	AHCBAC503 Manage integrated crop and pasture production	Equivalent





AHCBAC505A Plan and manage long-term weed, pest and/or disease control in crops	AHCBAC505 Plan and manage long-term weed, pest and/or disease control in crops	Equivalent
AHCBUS508A Prepare and monitor budgets and financial reports	AHCBUS508 Prepare and monitor budgets and financial reports	Equivalent
AHCAGB501A Develop climatic risk management strategies	AHCAGB501 Develop climatic risk management strategies	Equivalent
AHCIRG504A Develop an irrigation and drainage management plan	AHCIRG504 Develop an irrigation and drainage management plan	Equivalent
AHCWRK503A Prepare reports	AHCWRK503 Prepare reports	Equivalent
AHCWRK505A Manage trial and/or research material	AHCWRK505 Manage trial and/or research material	Equivalent
AHCBAC504A Plan and manage stored grain program	AHCBAC504 Plan and manage stored grain program	Equivalent
VBP148 Manage soils to enhance sustainability	VU21626 Manage soils to enhance sustainability	Equivalent
VBP153 Select and implement a Geographic Information System (GIS) for sustainable agricultural systems	VU21629 Select and use agricultural technology	Not equivalent
VPAU464 Design and manage a crop and pasture nutrition program	VU21627 Design and manage a crop and pasture nutrition program	Equivalent
VPAU465 Manage application technology	VU21628 Manage application technology	Equivalent
VPAU807 Apply plant biology to agronomic practice	VU21630 Apply plant biology to agronomic practice	Equivalent
	AHCBUS502 Market products and services	New unit

#### 4. Course outcomes *Standards 1, 2, 3 and 4 AQTF Standards for Accredited Courses*

<p><b>4.1 Qualification level</b></p>	<p>This course is consistent with the AQF level 5 as defined in the Australian Qualifications Framework. The Diploma qualifies individuals who apply integrated technical and theoretical concepts in a broad range of contexts to undertake advanced skilled or paraprofessional work and as a pathway for further learning.</p> <p><b>Knowledge</b></p> <p>Graduates of a Diploma will have technical and theoretical knowledge and concepts, with depth in some areas within a field of work and learning as in a detailed understanding of plant morphology and physiology relevant to crop and pasture production.</p> <p><b>Skills</b></p> <p>Graduates of a Diploma will have:</p> <ul style="list-style-type: none"> <li>• cognitive and communication skills to identify, analyse, synthesise and act on information from a range of sources as in the implementation and adoption of new technology for remote testing and analysis of pest infestation</li> <li>• cognitive, technical and communication skills to analyse, plan, design and evaluate approaches to unpredictable problems and/or management requirements as in developing, communicating and evaluating a soil health and nutrition program relevant to local conditions and production goals and constraints</li> <li>• specialist technical and creative skills to express ideas and perspectives as in preparing written plans and procedures</li> </ul>
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	<p>for implementation in consultation with land managers that are consistent with production goals</p> <ul style="list-style-type: none"> <li>• communication skills to transfer knowledge and specialised skills to others and demonstrate understanding of knowledge as in communicating and negotiating orally and in writing with staff, managers, contractors, consultants and customers in the development of management plans</li> </ul> <p><b>Application of knowledge and skills</b></p> <p>Graduates of a Diploma will demonstrate the application of knowledge and skills:</p> <ul style="list-style-type: none"> <li>• with depth in some areas of specialisation, in known or changing contexts as in calculating cost and spatial and logistical requirements of components of a plant nutrition program using production data, weather forecasts and geographical information system data</li> <li>• to transfer and apply theoretical concepts and/or technical and/or creative skills in a range of situations as in conducting literature and consultative research in the application of new and emerging technology relevant to production, and collating and analysing findings to support decision making in the selection of appropriate and cost effective technology</li> <li>• with personal responsibility and autonomy in performing complex technical operations with responsibility for own outputs in relation to broad parameters for quantity and quality as in interpreting, analysing and extracting information from a range of sources and adjusting production plans in order to enhance both profitability and sustainability</li> <li>• with initiative and judgement to organise the work of self and others and plan, coordinate and evaluate the work of teams within broad but generally well defined parameters as in communicating instructions about plans for managing crop production and the scheduling of operations.</li> </ul> <p><b>Volume of learning</b></p> <p>The volume of learning for this qualification is typically between 1 and 2 years and incorporates structured training delivery and unstructured learning activities such as:</p> <ul style="list-style-type: none"> <li>• research and evaluate of new technology and its application to production agriculture</li> <li>• practice the use of plant keys and other references to the identification of plants used in agronomy</li> </ul>
<p><b>4.2 Employability skills</b></p>	<p><i>Standard 4 for Accredited Courses</i></p> <p><b>Diploma of Agronomy</b></p> <p><u>Communication</u></p> <ul style="list-style-type: none"> <li>• listening to and understanding client’s needs</li> <li>• speaking clearly and directly to colleagues and clients</li> <li>• reading and interpreting workplace related documentation</li> <li>• writing to meet the needs of the audience</li> <li>• interpreting the needs of internal/external clients</li> </ul>

- establishing and using agronomy networks
- sharing technical information and data with internal and external clients

#### Teamwork

- working with different individuals and groups
- applying knowledge of own role as a part of a team
- applying teamwork skills to a range of situations
- identifying and using the strengths of other team members
- coaching, mentoring and giving feedback

#### Problem solving

- solving problems in teams
- developing practical solutions to deal with plant pests and diseases
- using mathematics including budgeting and financial management to solve problems
- developing practical and creative solutions to workplace problems
- applying a range of strategies in workplace problem solving
- listening to and resolving concerns in relation to workplace issues

#### Initiative and enterprise

- adapting to new situations as a result to changes in climate
- developing a strategic long-term vision
- translating ideas into action
- generating a range of options for responding to workplace issues
- developing innovative solutions
- evaluating new technology and its application to agricultural production

#### Planning and organisation

- managing time and priorities – eg. setting timelines, coordinating tasks for self and others
- taking initiative and making decisions within workplace role
- adapting resource allocations to cope with contingencies
- establishing clear project goals and deliverables
- predicting - weighing up risk, evaluating alternatives, applying evaluation criteria
- collecting, analysing, and organising information

#### Self-management

- having knowledge and confidence in own ideas and vision
- articulating own ideas and vision
- taking responsibility for own work performance
- evaluating and reflecting on own work performance

#### Learning

- managing own learning
- contributing to the learning community at the workplace
- using a range of mediums to learn - mentoring, peer support, networking, IT, courses
- applying learning to technical issues (e.g. products) and people issues (e.g. interpersonal)

	<ul style="list-style-type: none"> <li>• being willing to learn in any setting, on and off the job</li> <li>• being open to new ideas and techniques</li> <li>• being prepared to invest time and effort in learning new skills</li> </ul> <p><u>Technology</u></p> <ul style="list-style-type: none"> <li>• applying IT as a management tool</li> <li>• using IT to organise and communicate data</li> <li>• learning new IT skills</li> <li>• applying occupational health and safety knowledge to the use of technology</li> </ul>
<b>4.3 Recognition given to the course (if applicable)</b>	<i>Standard 5 for Accredited Courses</i> Not applicable
<b>4.4 Licensing/ regulatory requirements (if applicable)</b>	<i>Standard 5 for Accredited Courses</i> At the time of accreditation no licensing or regulatory requirements apply.

5. Course rules		Standards 2, 6,7 and 9 AQTF Standards for Accredited		
<b>5.1 Course structure</b>				
To be eligible for the award of 22273VIC Diploma of Agronomy, learners must successfully complete a total of 10 units comprising: 5 core units 5 elective units				
Elective units may be selected from this or any other accredited course or training package from units first packaged at an AQF level 4 or 5 in the source curriculum or training package and should not duplicate the outcomes of the core units. Electives selected must be consistent with the vocational outcomes of this qualification. Learners who do not successfully complete all the required units for the qualification will be issued with a Statement of Attainment for completed units.				
Unit of competency code	Field of Education code (6-digit)	Unit of competency title	Pre-requisite	Nominal hours
<b>Core units</b>				
AHCBAC507		Develop production plans for crops	nil	140
		<b>OR</b>		
AHCBAC503		Manage integrated crop and pasture production	nil	120
		<b>Plus the following four units</b>		
VU21626	010709	Manage soils to enhance sustainability	nil	100
VU21627	010709	Design and manage a crop and pasture nutrition program	nil	100
AHCBAC505		Plan and manage long-term weed, pest and/or disease control in crops	nil	130
AHCBUS508		Prepare and monitor budgets and financial reports	nil	140
<b>Sub-total</b>				<b>590-610</b>
<b>Elective units - Select five elective units.</b> Elective units may be selected from the list below or any other accredited course or training package from units first packaged at an AQF level 4 or 5 in the source curriculum or training package and should not duplicate the outcomes of the core units. Electives selected must be consistent with the vocational outcomes of this qualification.				
VU21628	059901	Manage application technology	nil	100
VU21629	050101	Select and use agricultural technology	nil	100
AHCAGB501		Develop climatic risk management strategies	nil	120
AHCWRK503		Prepare reports	nil	60
AHCWRK505		Manage trial and/or research material	nil	140
AHCBAC504		Plan and manage a stored grain program	nil	100
AHCIRG504		Develop an irrigation and drainage management plan	nil	120
VU21630	050301	Apply plant biology to agronomic practices	nil	90
AHCBUS502		Market products and services	nil	120
<b>Nominal duration</b>				<b>1040-1210</b>

<p><b>5.2 Entry requirements</b></p>	<p><i>Standard 9 for Accredited Courses</i></p> <p>There are no entry requirements for the 22273VIC Diploma of Agronomy although participants would be best equipped to achieve the course outcomes if they have minimum language, literacy and numeracy skills that are equivalent to Level 4 of the Australian Core Skills Framework (ACSF). More information is available <a href="#">here</a>. Learners with language, literacy and numeracy skills at lower levels than those suggested will require additional support to successfully undertake the qualification.</p>
<p><b>6. Assessment</b> <span style="float: right;"><b>Standards 10 and 12 AQTF Standards for Accredited Courses</b></span></p>	
<p><b>6.1 Assessment strategy</b></p>	<p><i>Standard 10 for Accredited Courses</i></p> <p>All assessment will be consistent with: Standard 1.2 of the <i>Australian Quality Training Framework Essential Conditions and Standards for Continuing (or Initial) Registration</i> More information is available <a href="#">here</a>.</p> <p>Assessment methods should be flexible, valid, reliable and fair. Consistent with Standard 1, Element 5 of <i>the Australian Quality Training Framework Essential Conditions and Standards for Continuing (or Initial) Registration</i>, RTOs must ensure that Recognition of Prior Learning (RPL) is offered to all applicants in determining competency for Credit.</p> <p>Assessment of units requires evidence of satisfactory performance being sought for each element and its performance criteria and the required skills and knowledge through a variety of tasks depending on the criteria specified.</p> <p>The following principles should be used as a guide to the assessment approach:</p> <ul style="list-style-type: none"> <li>• assessment tasks/activities should be grounded in a relevant context and not be culturally biased</li> <li>• students should be assessed across a wide range of tasks integrated into practice, in order to increase reliability and validity of assessment. One-off assessment tasks do not provide a reliable and valid measure of competence</li> <li>• instructions for assessment tasks should be clear, explicit and ordered. Students must know what is expected and the criteria by which they will be judged</li> <li>• time allowed to complete a task should be reasonable and specified, and should allow for preparation and re-drafting as appropriate to the task</li> <li>• assessment should be validated. Moderation is likely to be a critical tool in validation. A range of validation strategies should be used, for example, mentoring, client satisfaction surveys, peer review and co-assessments</li> <li>• appropriate reference materials should be available to students during assessment, e.g. personal word lists, dictionaries, thesaurus, calculators.</li> </ul>

	<p>Assessment tools must meet the rules of evidence. To meet the rules, evidence must be:</p> <ul style="list-style-type: none"> <li>• valid, for example, address the elements and performance criteria, reflect the skills and knowledge described in the unit of competency, show application in the context described in the Range Statement</li> <li>• current, for example, demonstrate the candidate's current skills and knowledge</li> <li>• sufficient, for example, demonstrate competence over a period of time, demonstrate repeatable competence, not inflate the language, literacy and numeracy requirements beyond those required in performing the task and</li> <li>• authentic, for example: be the work of the learner, be corroborated / verified.</li> </ul> <p>A variety of assessment methods and evidence gathering techniques may be used with the overriding consideration being that the combined assessment must stress demonstrable performance by the student</p> <p>The Critical Aspects of Evidence section of each unit provides essential guidance on acceptable evidence.</p> <p>The evidence collected must relate to a number of performances assessed at different points in time, and, in a learning and assessment pathway, these must be separated by further learning and practice.</p> <p>Evidence requirements are specified in units in each qualification. Where appropriate, training providers are encouraged to take a holistic approach to assessment, by assessing more than one element concurrently, or combining the final assessment for more than one unit.</p> <p>The identification of plants to species level assessed in <i>VU21630 Apply plant biology to agronomic practice</i> must include plants grown <i>in situ</i>.</p> <p>When assessing units of competency from Training Packages, the evidence gathering and assessment must be carried out in accordance with the relevant Training Package guidelines.</p>
<p><b>6.2 Assessor competencies</b></p>	<p><i>Standard 12 for Accredited Courses</i></p> <p>The <i>Australian Quality Training Framework Essential Conditions and Standards for Continuing (or Initial) Registration</i>, Standard 1.4 states the requirements for the competence of persons assessing the course. More information is available <a href="#">here</a>.</p> <p>Assessors of the imported units of competency must meet the guidelines of the relevant Training Package and/or accredited course documentation.</p> <p>The Standards require that assessors:</p> <ul style="list-style-type: none"> <li>• have the training and assessment competencies as determined by the National Skills Standards Council (NSSC) or its successor, and</li> <li>• have the relevant vocational competencies at least to the level being delivered or assessed, and</li> </ul>

	<ul style="list-style-type: none"> <li>• can demonstrate current industry skills directly relevant to the training/assessment being undertaken and</li> <li>• continue to develop their VET knowledge and skills as well as their industry currency and trainer/assessor competence.</li> </ul> <p>Assessors should also have appropriate interpersonal and communication skills.</p> <p>Alternatively, a panel, team or partnership approach involving assessors and technical experts whereby the assessment is conducted by a team/panel/partnership in which at least one assessor has the competencies determined by the NSSC (or its successor) and the other assessor(s) have the relevant competencies, at least to the level being assessed.</p>
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**7. Delivery** *Standards 11 and 12 AQTF Standards for Accredited Courses*

<p><b>7.1 Delivery modes</b></p>	<p><i>Standard 11 for Accredited Courses</i></p> <p>Delivery of units of competency from the relevant Training Packages must be consistent with the guidelines of the relevant Training Package.</p> <p>All units of competency in the courses may be delivered in a variety of modes: classroom delivery, workplace projects, practical work, self-paced learning and case studies.</p> <p>Delivery options, including grouping of learners and learning activities, should recognise the varying learning needs, educational backgrounds, preferred learning styles and constraints of the individual learner and the specific requirements of each unit.</p> <p>Some areas of content may be common to more than one unit and therefore integration may be appropriate. Delivery strategies should actively involve the learner and learning should be experiential, relevant and age appropriate.</p> <p>This course is available for full or part-time study. Providers should be flexible in the way the training is delivered to ensure they meet the needs of the client group.</p>
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<p><b>7.2 Resources</b></p>	<p><i>Standard 12 for Accredited Courses</i></p> <p>Resources include teachers/trainers who meet the <i>Australian Quality Training Framework Essential Conditions and Standards for Continuing (or Initial) Registration</i> Standard 1.4. More information is available <a href="#">here</a>.</p> <p>Participants must have access to:</p> <ul style="list-style-type: none"> <li>• an appropriate agronomy workplace or an environment that reproduces normal work conditions of an operational farm or commercial agricultural industry environment</li> <li>• equipment, machinery and technology normally used in the agronomy workplace</li> <li>• documentation normally used in the agronomy workplace</li> <li>• personal protective clothing and equipment.</li> </ul> <p>Access is required to a classroom, library, computer and appropriate technology.</p>
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<p><b>8. Pathways and articulation</b></p>	<p><i>Standard 8 for accredited courses</i></p> <p>Imported units of competency give individuals automatic recognition for those units within a range of training packages. Individuals will receive credit for units in qualifications within the following Training Packages:</p> <ul style="list-style-type: none"> <li>• AHC Agriculture, Horticulture and Conservation and Land Management Training Package</li> </ul> <p>The course may enable individuals to enter further education with an agricultural focus. Examples of further training include:</p> <ul style="list-style-type: none"> <li>• AHC60316 Advanced Diploma of Agribusiness Management</li> <li>• AHC60415 Advanced Diploma of Conservation and Land Management</li> </ul> <p>There are no formalised articulated arrangements with Higher Educations Providers at time of publication.</p> <ul style="list-style-type: none"> <li>• Bachelor of Agricultural Science</li> <li>• Bachelor of Environmental Management</li> <li>• Bachelor of Environmental Management and Ecology</li> <li>• Bachelor of Conservation Biology and Ecology</li> <li>• Bachelor of Ecology and Sustainability</li> </ul>
<p><b>9. Ongoing monitoring and evaluation</b></p>	<p><i>Standard 13 for accredited courses</i></p> <p>Ongoing monitoring and evaluation of the course is the responsibility of the Primary Industries Curriculum Maintenance Manager (PICMM). PICMM will ensure that the content remains relevant and that teaching strategies are appropriate to the content.</p> <p>A formal review will take place once during the period of accreditation and will be informed by feedback from users of the curriculum and will consider at a minimum:</p> <ul style="list-style-type: none"> <li>• any changes required to meet emerging or developing needs</li> <li>• changes to any units of competency from nationally endorsed training packages or accredited curricula.</li> </ul> <p>Any significant changes to the courses will be notified to the VRQA.</p>

## Section C: Units of competency

### Core units

- AHCBAC507 Develop production plans for crops
- AHCBAC503 Manage integrated crop and pasture production
- AHCBAC505 Plan and manage long-term weed, pest and/or disease control in crops
- AHCBUS508 Prepare and monitor budgets and financial reports
- VU21627 Design and manage a crop and pasture nutrition program
- VU21626 Manage soils to enhance sustainability

### Elective Units

- AHCAGB501 Develop climatic risk management strategies
- AHCIRG504 Develop an irrigation and drainage management plan
- AHCWRK503 Prepare reports
- AHCWRK505 Manage trial and/or research material
- AHCBAC504 Plan and manage stored grain program
- AHCBUS502 Market products and services
- VU21629 Select and use agricultural technology
- VU21628 Manage application technology
- VU21630 Apply plant biology to agronomic practice

## VU21627

## Design and manage a crop and pasture nutrition program

### Unit Descriptor

This unit of competency specifies the outcomes required to assess soil and design a soil health and plant nutrition program in the agricultural industry. Program design requires consideration of site factors, plant species requirements, soil and plant tissue analysis, use of soil ameliorants and nutrient application strategies as well as the monitoring of occupational health and safety (OHS/WHS) hazards and environmental impacts. The unit involves the application of a broad knowledge base to identify and apply solutions to a range of problems. It involves the application of knowledge including plant morphology and physiology, plant nutrition requirements, fertilisers, soil and water.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Employability skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. Refer to the employability skills summary to identify employability skill requirements.

### Application of the Unit

This unit of competency applies to work in a range of agricultural or support enterprises, such as agronomists, consultants and rural merchants. Work will be undertaken without supervision. Responsibility for and organisation of the work of others involved in the program may be required.

### ELEMENT

*Elements describe the essential outcomes of a unit of competency.*

### PERFORMANCE CRITERIA

*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*

#### 1. Analyse relevant regional and site characteristics

- 1.1 Production, economic output and environmental goals for assessment and development of a nutrition program are defined following a review of enterprise production plan and in consultation with land manager
- 1.2 Relevant climate data, environmental context information and site data are accessed and reviewed
- 1.3 Appropriate **soil, plant and water tests** are determined according to plant species, climatic conditions, industry best practice and enterprise guidelines
- 1.4 Soil, plant and water testing program is developed that defines sampling, field testing, off-site analysis activities, task responsibilities, involvement of contractors, scheduling and desired information outcomes
- 1.5 Testing tasks are implemented and monitored, liaison procedures with outside testing agencies are supervised, and remedial action is undertaken where necessary

- 1.6 Characteristics, condition and nutritional status of soils and **plant species** under production are determined by analysing collected data and comparing to accepted standards
2. Determine nutrient requirements for plant production systems
- 2.1 Different nutritional requirements of the plant during **growing cycle** and a **range of conditions** are identified according to published data on species, historical records, current site data, own experience and enterprise guidelines
- 2.2 Program is developed to achieve appropriate soil conditions and nutrient availability for plant production according to enterprise production plan
- 2.3 Capital and maintenance nutrient applications are calculated using **nutrient planning tools**
- 2.4 Seasonal variations and requirements are determined from published data on species, historical records, own experience, industry best practice and enterprise guidelines
3. Design a nutrient management plan
- 3.1 Criteria determining choice and sources of **fertiliser** and **soil amendment products** are identified
- 3.2 Application rates are calculated based on soil, plant and water test results, plant requirements, growth stage, enterprise production plan and manufacturer's specifications
- 3.3 **Application methods** and timing are selected to ensure they are effective, efficient and appropriate to product formulation and to minimise loss
- 3.4 **Resources, tools, equipment and machinery** required for program are determined, costed and availability is confirmed with suppliers, contractors and appropriate personnel
- 3.5 Cost-effective soil management, soil amendment, and provision of plant nutrients is determined through the calculation of unit costs, total costs and estimated returns
- 3.6 **OHS/WHS hazards** associated with program are identified, risks are assessed and **controls** are developed and documented
- 3.7 **Environmental impact** of poor nutrient management practices and potential **benefits** of a program aligned to production goals are identified and documented
- 3.8 Compliance requirements with appropriate federal, state and local government legislation are identified

**4. Monitor production and evaluate the program**

- 4.1 Program implementation and results are monitored by testing soil, plants and/or produce according to industry practice to ensure requirements of enterprise production plan are achieved
- 4.2 Program is reviewed and refined to ensure it is responsive to changing conditions
- 4.3 Non-compliance with documented objectives and specifications is identified and remedial actions are implemented to alleviate or overcome identified shortcomings in program
- 4.4 **Remedial action** to improve plant nutrition is taken, documented and reported to staff, managers, contractors, consultant and customers according to enterprise plan
- 4.5 Agreed changes are incorporated into a detailed plan

**REQUIRED SKILLS AND KNOWLEDGE**

This describes the essential skills and knowledge and their level, required for this unit.

### Required Skills

- documenting plans, specifications and work procedures
- calculating cost and spatial and logistical requirements of components of plant nutrition program
- communicating and negotiating orally and in writing with staff, managers, contractors, consultants and customers
- complying with legislative requirements and codes of practice
- conducting literature and consultative research, and collating and analysing findings on plant structure, biology and nutritional requirements, nutrients available from fertilisers, soils and soil amendments, and environmental implications of program
- recording all relevant information according to enterprise and industry standards
- writing reports for staff, managers, contractors and customers

### Required Knowledge

- characteristics of soil and uses of soil amendments and additives to enhance available nutrition for specific crops
- characteristics of plants at various growth stages
- identification of pastures, crops and weeds
- main simple and compound fertiliser products available to enterprises, including analysis, solubility, salt index, application rates and costs
- plant structure and physiology including basic biochemical pathways
- methods of nutrient uptake by plants and favourable conditions for effective uptake to occur
- nutrients and water required by plants grown within enterprise and effects of nutrient deficiency and toxicity on individual plant species and varieties, including visual symptoms
- OHS/WHS hazards associated with implementing a plant nutrition program and controls necessary to remove or minimise associated risks
- organic matter, pests and disease, and nutrient interactions in soil and nutrient cycling
- practical relevance of the concepts to specific plants and soils used in the enterprise
- practical understanding of environmental issues associated with selecting nutritional materials, implementing a plant nutrition program, needing to comply with legislation and ensuring minimal impact on environment
- processes and techniques for preparing, costing and documenting a plant nutrition program
- relationship between soil and growth media characteristics
- relationship between soil and growth media characteristics and availability and mobility of nutrients, including macro and micro elements, to plants
- site evaluation techniques, including methods of sampling and analysing soils and other growth media
- soil amendments commonly required to treat soil problems experienced by enterprise

### RANGE STATEMENT

*The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. **Bold italicised** wording in the performance criteria is detailed below.*

**Soil, plant and water tests** conducted as part of a plant nutrition program may include:

- analysis of chemical characteristics such as:
  - acidity or alkalinity (pH)
  - cation exchange capacity
  - nutrient levels
  - carbon content
  - toxicity levels e.g. aluminium, sodium
  - trace elements
- on-site testing and off-site analysis of soil to determine physical characteristics such as:
  - soil consistency
  - structure and texture
  - topsoil depth
  - soil smell
  - presence of carbonates
  - quality of seedbed tilth
  - resistance to emerging seedlings
  - soil compaction
  - depth of root growth, root health and colour
  - water holding capacity and water infiltration
  - soil biota population and diversity
  - degree of dispersability
- testing nutrient status of plants through:
  - establishing likely effects on soil chemical and physical characteristics
  - plant tissue testing
  - testing water for suitability for plant growth

**Plant species** may include:

- fruit and vegetables
- herbs
- indigenous and exotic species and varieties
- nuts
- oil crops
- pasture, broad-acre cropping plants and turf species
- tree, shrub and ornamental plant species
- tubers
- vines and canes
- wild harvest

**Growing cycle** may include:

- seeds
- germination
- establishment
- stages of growth (e.g. Zadocks scale in cereals)
- flowering
- senescence

**Range of conditions** that affect crop nutrition may include:

- crop load
- crop quality requirements
- cropping and fertiliser history
- grazing intensity
- growth media characteristics
- water (soil moisture, water logging, deficit)
- irrigation methods and scheduling
- seasonal influences
- soil management practices
- spraying program
- weather
- disease

**Nutrient planning tools** may include:

- soil test results
- calculations using computer programs
- nutrient application
- fertiliser analysis
- application machinery

**Fertilisers** may include:

- organic
- inorganic
- solids, liquids, gases
- straight, compound and blended products
- high and low analysis products

**Soil amendment products** may include:

- animal manures
- composts
- cover crops
- gypsum
- lime
- materials to modify soil pH
- mulches
- soil amendments to improve chemical, physical and/or biological properties of soil to meet requirements of plant production

**Application methods** may include:

- foliar sprays
- soil applications
- surface and sub-surface placements
- fertigation
- broadcast
- incorporated
- basal/split application
- liquid furrow injection



**Resources, tools, equipment and machinery** may include:

- aerial photographs, charts and tables of soil characteristics and plant soil parameters
- GIS and GPS technology
- sensors eg NDVI
- application equipment and machinery such as:
  - air blowers
  - spray equipment
  - irrigation systems set up for fertigation
  - pumps and pump fittings
  - rippers
  - seeders
  - tractors and trailers or three-point linkage spreaders
- backhoe
- charts and illustrations of symptoms of plant nutrient deficiencies and toxicities
- hand-held salinity or electrical conductivity meter
- hand or powered auger
- nutrient application methods, including placement
- methods such as:
  - banding
  - broadcasting
  - ripping
  - spraying and fertigation on or below soil surface
- pH test kit or electronic pH testing device
- plastic overlays
- sample bags
- tape measure

**OHS/WHS hazards** may include:

- air-wind speed/temperature
- chemicals and hazardous substances
- confined spaces
- disturbance or interruption of services
- dust
- fire
- incorrect manual handling
- machinery and machinery parts
- moving vehicles
- noise
- sharp hand tools and equipment
- slippery and uneven surfaces
- soil and water-borne micro-organisms
- solar radiation
- venomous/toxic living organisms

**Controls** should include enterprise OHS/WHS policies and procedures for:

- appropriate use of safety equipment, including signage and protective barriers
- assessing and reporting risks
- basic first aid available on site
- cleaning, maintaining and storing tools, equipment and machinery
- correct manual handling
- identifying hazards
- maintaining personal hygiene
- reporting problems to land manager
- safe handling, use and storage of chemicals and hazardous substances
- safe operation of tools, equipment and machinery
- appropriate use of personal protective equipment, including sun protection

**Environmental impacts** may include:

- nutrient run-off in soil and surrounding environment
- raised levels of greenhouse gas emissions
- negative or unintended side effects in water
- destruction of habitat
- salinisation
- erosion
- water logging
- raised water table
- disruption of ecosystem

**Benefits** may include:

- improved application techniques
- optimised application rates
- improved assessment of nutrient requirements
- improved targeting of nutrient application
- reduction in toxic side-effects of nutrients
- reversal of environmental degradation

**Remedial action** may include:

- adjustments to soil amendments
- changes to fertiliser application and soil management practices
- irrigation scheduling
- nutrient application rates and methods
- use of foliar sprays

## EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the curriculum.*

**Critical aspects for assessment and evidence required to assess competency in this unit**

The critical requirements for this unit of competency as a whole are listed below. Assessment must include evidence of the ability to:

- access and analyse information on regional and site factors
- select suitable management practices, soil amendments and fertilisers
- determine appropriate analytical application techniques
- determine resources and equipment for application of nutritional materials
- prepare implementation plans, specifications and associated documents
- apply knowledge of plant growth and physiology

**Context of and specific resources for assessment**

Assessment for this unit of competency is to be largely practical in nature and will most appropriately be assessed in the workplace or in normal work conditions.

For valid assessment, learners must have opportunities to participate in exercises, case studies and other real and simulated practical and knowledge assessments that demonstrate the skills and knowledge required to develop a soil health and plant nutrition program.

The candidate must also have access to the following resources:

- soil, plant and water interpretation criteria
- plant identification keys and booklets
- analytical results
- site and operational information
- soil amendment product specifications and performance data
- fertiliser labels, product cards and material safety data sheets (MSDS)
- reference books.

**Method of assessment**

For valid and reliable assessment of this unit, evidence should be gathered through a range of methods to indicate consistent performance. Evidence should be gathered as part of the learning process, where appropriate.

Assessment methods may include more than one of the following:

- practical application and demonstration of skills
- oral presentations
- written assignments or tests
- work-based activities
- simulations

**Guidance information for assessment**

To ensure consistency, competency should be demonstrated on more than one occasion over a period of time in order to cover a variety of circumstances, cases and responsibilities, and where possible, over a number of assessment activities.

The skills and knowledge required to develop a soil health and plant nutrition program must be transferable to a range of work environments and contexts, including the ability to deal with unplanned events. For example, this could include work with new crop or pasture species not usually produced in the local area, crops for which there are little or no local interpretative criteria, or new fertiliser products.

## VU21626

## Manage soils to enhance sustainability

### Unit Descriptor

This competency standard covers the process of assessing soil characteristics, developing and implementing a plan to improve the productivity of soils, and monitoring and reviewing the results.

Soil chemistry, physical chemistry and biology are used in the analysis of soil tests and the importance of soil biota in soil structure and plant nutrition is considered. Strategies to maximise production through improved soil biota is considered, and the opportunity to increase biodiversity by strategic use of unproductive land is covered.

The principles of developing productive soils involve improving soil structure, increasing soil macronutrients and micronutrients to optimum levels, balancing exchangeable cations, achieving optimum pH, eliminating toxic nutrient levels and enhancing activity of soil biota.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Employability skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. Refer to the employability skills summary to identify employability skill requirements.

### Application of the Unit

This unit is applicable to persons who have a role in managing a land based production business. This unit is likely to require consultation with external experts, such as pasture and cropping consultants, fertiliser representatives, contractors, extension officers from State Agricultural Departments, agronomists and producer groups.

### ELEMENT

*Elements describe the essential outcomes of a unit of competency.*

### PERFORMANCE CRITERIA

*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold/italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*

#### 1. Identify characteristics of Australian soils to assess their current health

- 1.1 Identify the **common characteristics** of **Australian soils** and their limitations
- 1.2 Refer to a paddock assessment to establish **soil characteristics**
- 1.3 Research soil biota and its relationship to soil fertility
- 1.4 Evaluate current production practices in terms of their possible contribution to **land degradation and soil problems**
- 1.5 Evaluate current production practices in terms of the possible contribution to land improvement and soil solutions

- 1.6 Identify and select appropriate **land preparation** methods matched to **machinery and equipment** to maintain and improve soil productivity and structure
2. Develop a plan to improve and maintain the sustainability and productivity of soils
- 2.1 Identify the impact of weather and climate on operational activities on soil structure and fertility and develop contingency plans to account for climatic or other events.
- 2.2 Evaluate a range of soil sampling techniques
- 2.3 Interpret **soil test analysis** and compare with historical data in the development of a plan
- 2.4 Select required nutrient balance levels to optimise **soil fertility** for effective use and uptake of plants.
- 2.5 Evaluate **alternative strategies** or products to improve soil fertility
- 2.6 Develop a **soil amendment strategy** including **soil ameliorating activities** and **soil ameliorant products** to enhance **sustainability** of soil productivity
- 2.7 Select production crops suitable for soil type and climate for a **land use rotation** plan to improve and/or maintain soil productivity.
- 2.8 Determine soil conservation strategies to minimise soil erosion and increase soil capacity, productivity and sustainability
- 2.9 Assess the **environmental implications** of chemical use, consider and document alternative strategies
- 2.10 Incorporate **monitoring** and recording of information on soil sustainability and productivity into the plan
- 2.11 Communicate the plan to **stakeholders**
3. Implement a plan for improvement and maintenance of a healthy soil
- 3.1 Implement a schedule for soil improvement taking into account **seasonal, geographical and resource factors** and stock/crop rotation
- 3.2 Implement strategies to integrate the most suitable methods of soil improvement operations with the proposed land use rotation plan
- 3.3 Determine key responsibilities for specific implementation processes
- 3.4 Modify plan to meet all contingencies and communicate with appropriate stakeholders
- 3.5 Record and retain soil management activities and retain outcomes in an appropriate manner

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|--|---|
| 4. Review plan, implementation strategy and the outcomes and determine necessary modifications | 4.1 Analyse effectiveness of the soil improvement management plan, through evaluation at <b>key points</b> , making adjustments as necessary                          |
|  | 4.2 Prepare recommendations for future strategies, based on the analysis of paddock observations and production data to further enhance soil ecosystem and production |

## REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

### Required Skills

- assess soil type, texture and structure in the paddock
- Research information
- diagnose areas with soil problems or potential soil problems
- diagnose and interpret soil sample test results and determine priorities for improving soil health
- consider and select alternatives including organic products and methods for improving soil health
- calculate amounts of nutrients required and prepare a fertiliser program which reflects needs and priorities
- record and store information
- develop, implement and evaluate a plan to achieve productive soils
- use the principles of soil science to monitor soil productivity
- communicate with stakeholders orally and in writing

### Required Knowledge

- physical, chemical and biological properties of soils
- soil sampling strategies
- soil biota - types, role in cycling nutrients and improving soil structure
- basic chemistry concepts related to interpreting soil test analysis: symbols, elements and compounds; valency, anions, cations; reactions; EC (electrical conductivity), CEC (Cation Exchange Capacity); organic matter; pH and its importance in the availability of nutrients; role of macronutrients and micronutrients in plant nutrition. Concept of limiting factors for production
- basic biology: the chemical basis of plants and animals; basic plant structure and function; plant nutrition; water, proteins, sugar, nitrate, lignin content; extent and nature of soil micro organisms
- the natural cycling of nutrients: carbon, nitrogen, phosphorous and the role of soil biota in the cycles
- factors affecting soil biota: moisture, temperature, aeration, nutrient supply, pH, and organic matter
- possibility of problems with the use of conventional chemical fertilisers including acidification contamination of soil and associated water contamination and harm to soil biota
- alternative methods to improve soil fertility, including products and use of machinery for aeration and mulching
- appropriate timing for fertiliser applications
- strategic use of pesticides for optimal effect
- soil conservation strategies and sustainable production techniques
- underground water movement
- data collection and record keeping

## RANGE STATEMENT

*The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. **Bold italicised** wording in the performance criteria is detailed below.*

**Common characteristics** of Australian soils may include:

- low fertility levels
- low organic matter
- low cation exchange capacity in some soil types
- shallow depth of topsoil
- salinity

**Australian soils** may include:

- Anthrosols
- Organosols
- Podosols
- Vertosols
- Hydrosols
- Kurosols
- Sodosols
- Chromosols
- Calcarosols
- Ferrosols
- Dermosols
- Kandosols
- Rudosols
- Tenosols

Physical **soil characteristics** may include:

- soil consistency, structure (including slaking and dispersion) and texture
- topsoil depth
- soil smell
- presence of carbonates
- quality of the seedbed tilth to maximise seed germination
- resistance to emerging seedling through poor seed bed preparation
- soil compaction
- depth of root growth, root health and colour
- water holding capacity and water infiltration
- living organism diversity
- earthworm numbers- as a general indicator of soil health
- subsoil constraints (ie Boron)



**Land degradation and soil problems** may include:

- dry-land and irrigation salinity
- sodicity
- wind and water erosion
- poor pasture species
- poor production
- weeds
- soil compaction
- water-logging and poor water quality
- nutrient deficiencies
- Factors that lead to soil problems could include:
  - land clearing, bare areas
  - insecticides and herbicides
  - acidifying fertilisers
  - inappropriate tillage practices, including selection of machinery, inappropriate machinery use or timing of operations
- over grazing and poor grazing management
- burning
- mechanical fallow
- machinery tillage methods (no-till and direct seeding methods, conventional seedbed preparation)
- prickle churning to assist in stubble break down
- spray grazing and spray topping of pastures
- grazing strategies
- retention of crop residues

**Land preparation** methods used to improve soil fertility may include:

- zero and minimum tillage equipment using narrow points
- boom spray
- GIS and GPS technology
- sod, slot, and disc seeder to minimise soil disturbance
- contour banking equipment
- aerators
- mulchers

**Machinery and equipment** used to help improve soil fertility may include:

**Soil test analysis** may include:

- soil pH
- Cation Exchange Capacity and the balance of cations
- toxicity levels eg aluminium, sodium
- carbon content/organic matter
- approximate nutrient levels in soil
- suggested optimum levels of nutrients
- trace elements
- appropriate action may include:
  - selection of most suitable fertiliser types
  - calculation of application rates
  - timing of applications
  - liming or gypsum applications

**Soil fertility** may be influenced by:

- ability of soil to hold plant nutrients and nutrient availability to plants
- soil water availability to the plant root system
- percentage of organic matter found in soil
- carbon to nitrogen ratio
- nitrogen fixing bacteria
- organic and non-organic fertilisers
- soil temperature
- cation exchange capacity and soil pH

**Soil amendment strategies** may include:

- use of green manure crops; increasing calcium levels; adding organic matter and aeration of soils to improve soil biota activity and utilising nutrients that are locked up
- organic matter may include mulched pasture/plant tissue, organic nutrients, crop residues, worm castings, grass clippings, composted paper and cardboard, sawdust and seaweed
- use of parasitic controls that are dung beetle friendly and strategic use of herbicides to minimise frequency of use and concentration
- use of biological controls.
- use of animal manures, guano, reactive rock phosphate
- use of potassium sulphate instead of potassium chloride
- selection of the fertiliser which is least acidifying
- use of compost, fishmeal and kelp products (i.e. Biochar)
- alleviating soil compaction by using aerator

**Ameliorating activities and practices** may include:

- balancing the calcium/magnesium ratio
- modifications to soil drainage or moisture holding capacity
- practices that increase levels of organic matter
- grazing strategies to maximise retention of groundcover
- controlled traffic farming
- pH modifying agents such as lime
- structure modifying agents such as gypsum and artificial structure additives

**Soil ameliorant products** may include:

- organic matter
- animal organic products
- flocculating agents
- texture modifications
- wetting and water retention agents
- increasing productivity and profit from the production system
- improving water use efficiency in the production system
- protecting the on farm natural resources
- creating more opportunities for biodiversity
- reducing off-site impacts from the production system
- job satisfaction for farmers

**Sustainability** objectives may include:

**Land use rotation** types may include:

- broad acre continuous cropping
- ley farming systems
- pastures in a grazing system including cell grazing
- green manuring or sacrifice crop
- break crops bred for disease resistance
- vegetable production
- production horticultural crops including stone fruits, herbs, grapevines and olives

**Environmental implications** from chemicals and other products may include:

- mass movement of phosphates, nitrates and in-ground water
- effects of chemical residue on living biology of soil and grazing animals
- algal bloom cause by run off of fertilisers and nitrates

Techniques used to **monitor** soil productivity may include:

- regular soil tests
- annual soil biota tests
- plant tissue and grain tests
- annual visual assessment of soil structure and health
- annual earthworm counts
- sampling to be undertaken at the same time of year, and in the same place each year
- agronomists
- consultants/technical specialists

**Stakeholders** may include:

- fertiliser representatives
- farming partners and staff

**Seasonal, geographical and resource factors** may include:

- forecast of heavy rain events when application of fertiliser is scheduled
- late seasonal break
- lack of rain in growing season
- summer rainfall where weed germination may occur
- flood
- long term drought conditions
- use of contractors to complete operations in a timely manner
- staffing

**Key points** for evaluation of the program may include:

- collation and analysis of production data, paddock observations and review of the soil improvement plan
- Improvement in productivity - change in production level will be measured, e.g. crop production, pasture growth rates, improvement in species composition of pastures, milk production, kg of meat produced per hectare.
- improvement in soil fertility - measured by comparison of soil tests
- improved profitability
- increase in biodiversity of the soil
- improved water quality from reduced fertiliser and chemical run-off into waterways and dams
- improved stock health
- improved farmer job satisfaction

## EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the accreditation submission.*

### **Critical aspects for assessment and evidence required to assess competency in this unit**

The learner must be able to:

- critically analyse current soil status and identify essential elements of healthy soils
- develop a plan to improve and maintain a healthy soil
- implement plan for improvement and maintenance of healthy soil
- review the plan in terms of the intended outcomes of achieving healthy soils and make modifications

### **Context of and specific resources for assessment**

This unit can be assessed as a stand-alone unit of competency, integrated assessment tasks with another unit of competency or through a combination of both. Evidence should be gathered as part of the learning process where appropriate.

Specific resources required for assessment of this unit include:

- access to a land based business or case study
- farm/property and district map
- soil test analysis
- soil biota analysis
- land based business historical production records and financial analysis
- historical land use program records.

**Method of assessment**

Evidence should be gained through a range of methods to ensure valid and reliable assessment and consistency in performance.

Evidence should be gathered as part of the learning process where appropriate and could be from assessment of the unit of competency alone, through an integrated assessment activity or through a combination of both.

Assessment methods could include:

- practical exercises, for example assessing the current status of the soil health and structure, and evaluating operational activities
- written and/or oral questioning to assess knowledge and understanding of soil physical, chemical and biological properties, diagnosing and interpreting soil test results and plant nutrition through soil management
- completion of learning materials, including analysis of learners' own properties and circumstances, case studies and management plans
- development of a product or plan to improve the health and fertility of soil
- third party report to support the evidence gathered
- consideration of case studies which may be from a different geographical area and rainfall zone to assess learners ability to transfer skills and knowledge and problem solving abilities

## VU21629

## Select and use agricultural technology

### Unit Descriptor

This unit of competency covers the selection and application of modern agricultural technology in production systems. Applications include the recording and reporting of farm activities, mapping, farm and production planning, data collection and analysis and variable rate technology. This unit assists land managers to make informed decisions specific to production systems and applications.

Applications in agricultural science range from spatial information tools to the precision application of production inputs and growth models for the improvement of production.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Employability skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. Refer to the employability skills summary to identify employability skill requirements.

### Application of the Unit

This unit is applicable to persons who have a role in managing or operating a land based production business or provide expert advice such as consultants, industry specialists and extension officers.

### ELEMENT

*Elements describe the essential outcomes of a unit of competency.*

### PERFORMANCE CRITERIA

*Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.*

#### 1. Evaluate the need for agricultural technology

- 1.1 Organisational tasks and processes that could be supported by **technology applications** are identified and **evaluated**
- 1.2 Opportunities and limitations for operational improvements that may result from adopting specific technology applications are assessed
- 1.3 **Equipment, tool and resource** requirements and options are evaluated
- 1.4 The cost-benefit of using technology is evaluated
- 1.5 Independent technical advice and sources of information are sought as required
- 1.6 A plan to incorporate the use of technology to **improve operational** efficiency, productivity and sustainability is developed
- 2.1 Technology is used to record, analyse and manage production data

- |  |     |   |
|--|-----|---|
| 2. Implement technology to manage production | 2.2 | Technology is used to develop treatment strategies or input requirements  |
|  | 2.3 | Technology is used to collect, store and analyse data across the <b>land based business</b>                                   |
|  | 2.4 | Technology is used both as an information resource and for reporting and communication purposes                               |
|  | 2.5 | Technology use is integrated to improve operational efficiency, production, profitability and sustainability                  |
| 3. Evaluate the use of technology            | 3.1 | Strategies are developed and reviewed to ensure the use of technology is cost effective and consistent with operational goals |
|  | 3.2 | The need for additional training and/or support is assessed   |
|  | 3.3 | Strategies are developed to address <b>barriers</b> to the effective use of technology when necessary                         |
|  | 3.4 | The impact of technology use on production levels, input costs and the cash flow budget is evaluated                          |
|  | 3.5 | Strategies for monitoring, evaluating and incorporating future developments in technology are considered                      |

## REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

### Required Skills

- identify a range of technologies and how to apply them in an agricultural system
- obtain and process data and information using technology
- assess and review production information for application into farm management
- identify appropriate training and support for staff
- identify and manage issues that may arise in the use of the technology
- complete a cost and benefits analysis
- analytical skills to evaluate opportunities

### Required Knowledge

- basic principles of technology used for agricultural applications
- basic principles of cost-benefit analysis
- equipment, tool and resource requirements
- context in which particular organisations operate and how this may impact on the selection and use of technology
- potential barriers to learning, and strategies to address these
- range of technology options available to support organisational activities
- strategies that can be used to evaluate technology use
- training and technical support options available to the organisation to develop skills in the use of technology
- sources of information related to agricultural technology
- trends and developments in technology relevant to agriculture

## RANGE STATEMENT

*The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. **Bold italicised** wording in the performance criteria is detailed below.*

**Technology applications**

may include:

- spatial information mapping
- data management and processing
- production management
- environmental management
- social networking
- variable rate application inputs
- more timely or efficient management
- source information

**Evaluation** may include:

- relevance to user
- cost effectiveness
- operational impacts
- human impacts
- environmental impacts
- training requirements
- reliability

**Equipment, tools and resources** may include:

- computer (e.g. desktop or mobile device)
- operator free machinery
- specialist software for managing and processing data
- geo-referenced data (e.g. farm, yield and soil maps; satellite or aerial imagery)
- real time sensors (e.g. multispectral cameras, soil moisture probes, weather stations, milk monitors)
- proximal or remotely sensed data collection tools
- precision and/or variable rate applicators or feeds
- livestock identification systems
- auto steer
- rate controllers

**Operational improvements** may include:

- optimised crop/pasture inputs
- accuracy of seed and nutrient levels and placement to increase productivity and reduce wastage
- time and labour savings
- reduction in yield variations
- crop or production system integration
- data storage and analysis
- improved pest, weed and disease control
- increased efficiency, sustainability and profitability

**Land based businesses** may include:

- broad acre cropping
- animal production including intensive grazing systems
- production horticulture
- consultancy



**Barriers** may include:

- overall cost
- justification of costs
- staff skills and attitudes
- internet access
- data allowance
- device capability and reliability
- access to training
- access to support services
- incompatible system components or data formats
- access to data and accurate GPS signals
- perceived versus the real need to incorporate technology applications (technology addiction)

## EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the curriculum.*

**Critical aspects for assessment and evidence required to assess competency in this unit**

The learner must be able to:

- choose appropriate technology to support a production system
- implement technology applications to support decision making
- develop strategies to ensure technology is used effectively
- use production data to plan for and improve productivity, sustainability and profitability.

**Context of and specific resources for assessment**

This unit can be assessed as a stand-alone unit of competency, integrated assessment tasks with another unit of competency or through a combination of both. Evidence should be gathered as part of the learning process where appropriate.

Specific resources required include:

- access to a land based business or case study
- land based business historical production data and financial analysis.
- pasture and/or cropping production programs
- appropriate equipment, tools and resources

**Method of assessment**

Evidence should be gained through a range of methods to ensure valid and reliable assessment and consistence in performance.

Evidence should be gathered as part of the learning process where appropriate and could be from assessment of the unit of competency alone, through an integrated assessment activity or through a combination of both.

Assessment methods could include:

- practical exercises, for example assessing the current production practices and budgets, use of the technology and conducting a review of improvement gains through the use of current technology
- written and/or oral questioning to assess knowledge and understanding of incorporating technology to improve efficiency, profitability and sustainability
- completion of learning materials, including analysis of learners own properties and circumstances or case studies and management plans
- project to plan the incorporation of technology into the land based business
- written and/or oral questioning to assess learners ability to transfer skills and knowledge and problem solving abilities based on case studies from different geographical areas and rainfall zones.

## VU21628

## Manage application technology

## Unit Descriptor

This unit of competency specifies the outcomes required to provide information or manage application technology in crops or pastures. The technology applies to the application of chemicals such as herbicides, fungicides, insecticide and fertilisers as well as biological and organic agents.

The unit involves the application of a broad knowledge base to identify and apply solutions to a range of problems. This includes plant morphology and physiology, plant protection and nutrition requirements, environmental impacts, occupational health and safety hazards and the use of information technology.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Employability Skills

The required outcomes described in this unit of competency contain applicable facets of employability skills. The qualification's Employability Skills Summary in which this unit is included will assist in identifying employability skill requirements.

## Application of the Unit

This unit of competency applies to work in a range of agricultural or support enterprises, such as agronomists and rural merchants. Work will be undertaken without supervision. Responsibility for and organisation of the work of others involved in the program may be required.

**ELEMENT**

*Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.*

**1. Analyse application requirements****PERFORMANCE CRITERIA**

*Performance criteria describe the required performance needed to demonstrate achievement of the element. Terms requiring explanation or further definition should be bolded and italicised and detail provided in the range statement. Assessment of performance is to be consistent with the evidence guide.*

- 1.1 Goals for application of **agents** are determined following a review of enterprise production plans and in consultation with land manager
- 1.2 Records of previous nutrition, pest, weed and disease management including the application of any agents are accessed and reviewed
- 1.3 Relevant **climate, environmental and geographic data** from available information systems and sources is accessed and reviewed
- 1.4 Yield monitoring data including yield variability is accessed and reviewed
- 1.5 Relevant **soil, plant and water** information from tests and/or records is accessed and reviewed

**2. Develop an application plan**

- 2.1 Performance targets and indicators are identified in the plan
- 2.2 Appropriate agent/s, including adjuvants, **method of application** and **equipment** are selected based on site analysis, recommendations, production requirements, environmental conditions and **manufacturer's specifications**

- 2.3 Spray nozzles are selected to achieve the optimum droplet size with minimal variation and deliver the appropriate liquid flow rate for the selected agent in the desired spray distribution pattern
  - 2.4 Measures to control **factors** influencing the level of spray drift are specified and monitored
  - 2.5 Procedures are specified to ensure compliance with the range of appropriate federal, state and local government legislation and/or regulations
  - 2.6 **OHS/WHS hazards** are identified and appropriate **controls** are implemented
  - 2.7 **Environmental impact** of application is specified and clean up strategies are appropriate to the area
  - 2.8 **Scheduling** for applications is determined taking the range of seasonal, geographic and resourcing factors into consideration
  - 2.9 The type, format, frequency and detail of **record keeping** required by legislation and undertaken by manager(s) and operators are specified
3. Monitor and evaluate the effectiveness of the application plan
- 3.1 The effectiveness of the application is evaluated at key points and adjustments made as necessary
  - 3.2 Environmental impacts and OHS/WHS hazards relating to application strategies are monitored and assessed throughout the implementation process
  - 3.3 Modifications are made to the plan as and when necessary for environmental, OHS/WHS, resourcing or effectiveness reasons
  - 3.4 Data, observations and documentation from the implementation of the application plan are analysed against the plan according to enterprise guidelines
  - 3.5 Recommendations for future strategies are prepared based on the analysis of the data
  - 3.6 Documentation of the implementation includes information on any difficulties or issues faced, technical details, environmental and OHS/WHS impacts; recommendation for future action, results, costs and any available data analysis

## REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit. Knowledge and skills listed here must be assessed in the unit.

### Required skills

- interpret, analyse and extract information from a range of sources
- establish processes, strategies, procedures and controls for the application of chemical and biological agents
- prepare written plans and procedures for implementation by others
- explain and deliver instructions about the plans and scheduling of operations
- identify and react appropriately to environmental implications and OHS/WHS hazards
- identify and assess weeds, pests, diseases and nutritional and other deficiencies
- formulate efficient, cost effective control programs
- read and interpret manufacturer's instructions and agent labels
- record recommendations and applications

### Required knowledge

- characteristics of pest, weed and disease species including their life cycles and reproduction capability
- principles of integrated pest and weed management
- range and classes of fertilisers, herbicides, insecticides and fungicides available and their basic chemistry
- growth stages of weeds and plant morphology
- the effects on crops of weeds, pests, diseases and/or lack of soil fertility
- mode of action of chemical or biological control agents and long term effects of these agents with respect to plant back periods and resistance
- range and effect of different nozzles, pressures, spray patterns, droplet sizes and basic physics of droplets and fluids
- OHS/WHS hazards and controls and environmental impacts
- best management practices and processes to minimise the impact of agents
- federal, state and local government legislation and/or regulations

### RANGE STATEMENT

*The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. **Bold italicised** wording in the performance criteria is detailed below.*

**Agents** may include the following and may vary in formulation:

- fertiliser
- insecticide
- herbicide
- fungicide
- organic agents
- adjuvants

**Climate, environmental and geographic data** may include:

- inversions and thermal activity
- wind direction and wind speed
- temperature range
- frost
- Delta T
- local topographic features
- property boundaries
- waterways and water holding areas
- location of non-target crops
- human and animal habitation

**Soil, plant and water** information may include:

Soil

- pH
- salinity
- nutrient and carbonate content
- nutrient availability
- structure
- depth
- colour
- texture
- compaction
- depth of watertable
- depth of root zone
- organic matter
- plant available water

Plant

- type of crop
- stage of growth
- nutrient
- condition of plant

Water

- salinity
- pH
- chemical content
- turbidity
- biological activity

**Methods of application** may include:

- spray
- injection
- wick wiping
- mist
- fertigation
- fixed or variable rate application

**Equipment** may include:

- boom spray
- injector
- mister
- nozzles
- wick wiper
- monitors
- GPS

**Manufacturer's specifications**

may include:

- timing
- rates
- placement
- legal uses
- drift control additives
- surfactants and other enhancing adjuvants
- hazards
- protective equipment requirements
- mixing instructions
- wind speed and temperature limitations
- first aid procedures
- compatibility

**Factors** that influence the level of drift may include:

- droplet size
- wind speed
- humidity
- formulation
- height of emission
- size of area treated
- temperature inversion

**OHS/WHS hazards** may include:

- air-wind speed/temperature
- chemicals and hazardous substances
- dust
- incorrect manual handling
- machinery and machinery parts
- moving vehicles
- noise
- solar radiation

**Controls** may include:

- assessing and reporting risks
- basic first aid available on site
- cleaning, maintaining and storing tools, equipment and machinery
- correct manual handling
- identifying hazards
- maintaining personal hygiene
- reporting problems to land manager
- safe handling, use and storage of chemicals and hazardous substances
- safe disposal of containers and waste chemical
- safe operation of tools, equipment and machinery
- access to current material safety data sheets (MSDS)
- appropriate use of personal protective equipment, including sun protection

**Environmental impact** may include:

- minimisation of run-off and toxic side effects in soil and surrounding environment achieved by:
  - improved application techniques and rates
  - improved assessment and targeting
  - reduction of toxic side effects of applied nutrients in crop plants
- negative impact of over-spraying or run-off into external environment
- effect on non-target species
- resistance in target species
- excess noise
- excess dust
- incorrect use and disposal of debris, containers, chemicals or hazardous substances that could contaminate soil or water, produce odours or attract pests
- use of non-renewable energy
- greenhouse gas emissions

**Scheduling** may include:

- timing of applications to suit seasonal influences, weather and weather forecasts
- production stages and resource availability

**Record keeping** may include:

- operator and evidence of training
- land owner
- location of application areas
- dates and times of application
- product detail
- target crop
- application equipment
- amount of product used
- weather conditions
- notification of neighbours

## EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the Curriculum.*

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

The participant must be able to:

- identify, locate and assess appropriate information sources and then apply them
- determine the appropriate equipment, method of application and chemical or agent for the target species
- take account of the local conditions to ensure efficacy of application and minimise the effect on non-target species and resistance
- ensure the appropriate rates are used taking into account issues such as water quality, target species and crop stage of growth
- ensure appropriate OHS/WHS practices are followed
- ensure appropriate records are kept
- comply with applicable legislation/regulations



**Context of and specific resources for assessment**

Assessment for this unit of competency is to be largely practical in nature and will most appropriately be assessed in the workplace or simulated normal work conditions.

The candidate must also have access to the following resources:

- relevant information sources, which may be industry personnel, appropriate internet sites, equipment and chemical company information and industry and/or research publications
- spray equipment and manuals
- relevant weather information
- site and operational information
- chemical and other product specifications and performance data
- material safety data sheets (MSDS)
- regulations pertaining to the chemicals and mode of application
- GPS

**Method of assessment**

For valid and reliable assessment of this unit, evidence should be gathered through a range of methods to indicate consistent performance.

Evidence should be gathered as part of the learning process, where appropriate.

For valid assessment, learners must have opportunities to participate in a range of exercises and other real and simulated practical and knowledge assessments that demonstrate the skills and knowledge to manage application technology.

Assessment should be appropriate to the elements being assessed and could include:

- demonstration
- oral explanations and tests
- written test
- development of plans and case studies.

**Guidance information for assessment**

To ensure consistency in learners performance, competency should be demonstrated on more than one occasion over a period of time in order to cover a variety of circumstances, cases and responsibilities, and where possible, over a number of assessment activities.

The skills and knowledge required to develop an application technology program must be transferable to a range of work environments and contexts, including the ability to deal with unplanned events. For example, this could include work with new chemicals, agents or mixes not usually used in the local area, new or experimental application methods and changes in regulations.

## VU21630

## Apply plant biology to agronomic practices

### Unit Descriptor

This unit covers the application of introductory plant biology (plant taxonomy, plant morphology and plant physiology) to a wide range of agronomic practices including crop/pasture establishment, fertiliser use, irrigation, Integrated Pest Management (IPM), crop harvesting, grazing management and the provision of specialist agronomic advice.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The qualification's Employability Skills Summary in which this unit is included will assist in identifying employability skills requirements.

### Application of the Unit

This unit applies to work as an agronomist. Work is normally undertaken without supervision.

## ELEMENT

*Elements describe the essential outcomes of a unit of competency. Elements describe actions or outcomes that are demonstrable and assessable.*

1. Apply plant taxonomy to agronomic practices

2. Identify plant functions and their impact on growth

## PERFORMANCE CRITERIA

*Performance criteria describe the required performance needed to demonstrate achievement of the elements. Terms requiring explanation or further definition should be bolded and italicised and detail provided in the range statement.*

*Assessment of performance is consistent with the evidence guide.*

- 1.1 Identify botanical terminology of ***plant taxonomy (plant kingdom divisions, major plant families*** and genera) for plant classification
- 1.2 Apply the rules of ***plant nomenclature*** when naming plants
- 1.3 Describe the ***external features of plants – leaves, stems, flowers and fruits*** using botanical terminology
- 1.4 Identify a range of plants used in agronomy to species level, using ***plant keys*** and/or other references where required
- 1.5 Use correct botanical terminology to discuss plant taxonomy in agronomic practices
- 2.1 Investigate and identify ***plant cell structures***, their functions and the organisation of cells into ***primary tissues***
- 2.2 Research the structure and ***functions*** of leaves, stems, root and flowers in relation to agronomic practices
- 2.3 Describe the processes and outcomes of photosynthesis, respiration and transpiration

3. Apply plant morphology to agronomic practices
- 3.1 Research, analyse and document **specialist botanical knowledge** of plant morphology (leaf, root, stem, flower and seed characteristics from development to maturity) for crop and pasture management
- 3.2 Use correct botanical terminology when discussing plant morphology and identifying growth stages of plants
- 3.3 Identify **critical growth stages** for crop/pasture monitoring, nutrient assessment and spray applications

## REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit.

### Required Knowledge

- Plant morphology
- Plant taxonomy
- Plant physiology
- Plant nomenclature according to the rules and recommendations of the International Code of Botanical Nomenclature (ICBN) and the International Code of Nomenclature for Cultivated Plants (ICNCP)
- A broad knowledge of agronomic practices

### Required skills includes the ability to:

- Use appropriate authoritative references and resources for plant classification
- Apply scientific concepts of plant biology to agronomic practices
- Identify plants according to accepted taxonomic classifications

## RANGE STATEMENT

*The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording in the Performance Criteria is detailed below.*

**Plant taxonomy** may include:

The classification of plants into different categories, as cited in the ICBN and include:

- class
- subclass
- order
- family, sub family
- tribe, sub-tribe
- genus
- species
- variety, form, cultivar and subspecies

**Plant kingdom divisions** may include:

- bryophytes
- pterophytes
- gymnosperms
- angiosperms
- monocotyledons
- dicotyledons

**Major plant families** may include:

- Poaceae, Fabaceae, Brassicaceae and Asteraceae

What is **plant nomenclature**?

- The formal method of naming plant species according to the rules and recommendations of the ICBN and ICNCP.

Descriptions of **external features of plants** may include:

- leaves: leaf surfaces, shapes and margins, attachments and arrangements
- stems
- flowers: flower structures, shapes, inflorescences presentation and arrangements
- fruits

**Plant keys** may include:

- Written and electronic tools for the classification and identification of plants utilising visible plant morphological characteristics. Accurate identification using plant keys can be limited by morphological limitations of the plant specimen and reliability of diagnostic features.

**Plant cell structures** may include:

- cell wall
- cell membrane
- nucleus
- vacuole
- cytoplasm
- mitochondrion
- chloroplasts and other organelles

**Primary tissues** may include:

- cellulose
- meristem
- xylem
- phloem
- cuticle
- epidermis
- cortex
- vascular cambium and vascular rays
- stomata
- parenchyma
- sieve tubes

Information about **plant function** may include:

- plant cell structures and primary tissues,
- leaves, stems, roots and flowers
- processes of photosynthesis, respiration and transpiration

**Specialist botanical knowledge** of plant morphology may include:

- specialisations and modifications to leaves, stems, roots and flowers.

Tools to identify **critical growth stages** for crop/pasture monitoring, nutrient assessment and spray applications may include:

- Zadoks Decimal Code

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment section in Section B of the curriculum.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

The candidate must be able to:

- Demonstrate knowledge of plant functions and physiological processes
- Use correct botanical terminology
- Identify vegetative and reproductive growth stages of crop and pasture species.
- Apply the science of plant taxonomy to a range of plants
- Classify a range of plants according to plant kingdom divisions and apply this to agronomic practices
- Identify a range of plants using plant keys, if required
- Apply binomial nomenclature when naming plants
- Evidence must include a wide range of plants and assessment must include plants grown *in situ*.

**Context of and specific resources for assessment**

The context for the assessment of this unit may be in a real or simulated workplace where agronomic practices would be undertaken.

- Specific resources required for the assessment of this unit include a real or simulated workplace environment, access to a wide range of plants growing *in situ*, microscopes, computers, taxonomic keys and botanical references and publications.

**Method of assessment**

Evidence should be gained through a range of methods to ensure valid and reliable assessment and consistency in performance. Evidence should be gathered as part of the learning process, where appropriate, and could be from an integrated assessment activity from another unit.

Assessment methods may include:

- Assignment/s related to plant taxonomy
- Practical demonstration to assess skills in using plant keys for plant identification
- Oral and/or written questioning to assess understanding of botanical taxonomy
- Third party report on the evidence gathered.