Including grains in your curriculum

LEAD AG TEACHER | SOUTH AUSTRALIA

SA SHEEP INDUSTRY FUND · agcommunicators. · ATASA

In South Australia, 4500 grain farms produce nearly 13 million tonnes of grain annually. Wheat has the largest market, contributing to domestic and international trade worth billions of dollars. (South Australian grains infographic (pir.sa.gov.au).

SPECIFIC LEARNING INTENTIONS

- broadacre crops include cereals, oilseeds and legumes
- crops are grown for grain, fodder including hay, silage and grazing, fibre like hemp and pharmaceuticals
- grains are an important industry in SA
- grain production in Australia is affected by many factors
- grains have been selectively bred over many generations to meet market expectations and increase productivity
- different varieties serve different purposes in different conditions
- Goyder's Line was developed to guide successful crop farming
- crops require specific management strategies to maintain quality, productivity and biosecurity
- crop rotations are an important part of crop management
- understanding differences between monocotyledons and dicotyledons helps with crop and weed management
- plant breeding is crucial to support the triple bottom line for farmers
- consumers can have a powerful influence on farming methods

AUSTRALIAN CURRICULUM VERSION 9 ACHIEVEMENT STANDARDS

Technologies Foundation

By the end of Foundation students identify familiar products, services and environments. They create a designed solution for a school-selected context. Students create, communicate and choose design ideas. They follow steps and use materials and equipment to safely make a designed solution.

Technologies Year 1-2

By the end of Year 2 students describe the purpose of familiar products, services and environments. For the prescribed technologies context *food and fibre production and food specialisations*, they describe the features and uses of technologies and create designed solutions. Students select design ideas based on their personal preferences. They communicate design ideas using models and drawings and follow sequenced steps to safely produce designed solutions.

Technologies Year 3-4

By the end of Year 4 students describe how people design products, services and environments to meet the needs of people, including sustainability. For the prescribed technologies context *food and fibre production and food specialisations*, they describe the features and uses of technologies and create designed solutions. Students select design ideas against design criteria. They communicate design ideas using models and drawings including annotations and symbols. Students plan and sequence steps and use technologies and techniques to safely produce designed solutions.

Technologies Year 5-6

By the end of Year 6 students explain how people design products, services and environments to meet the needs of communities, including sustainability. For the prescribed technologies context *food and fibre production and food specialisations*, they explain how the features of technologies impact on design decisions and they create designed solutions. Students select and justify design ideas and solutions against design criteria that include sustainability. They communicate design ideas to an audience using technical terms and graphical representation techniques. Students develop project plans, including production processes, and select technologies and techniques to safely produce designed solutions.

Technologies Year 7-8

By the end of Year 8 students explain how people design, innovate and produce products, services and environments for preferred futures. For the prescribed technologies context *food and fibre production*, they explain how the features of technologies impact on design decisions, and create designed solutions based on analysis of needs or opportunities. Students create and adapt design ideas, processes and solutions, and justify their decisions against developed design criteria that include sustainability. They communicate design ideas and solutions to audiences using technical terms and graphical representation techniques, including using digital tools. They independently and collaboratively document and manage production processes to safely produce designed solutions.

Technologies Year 9-10

By the end of Year 10 students explain how people consider factors that impact on design decisions and the technologies used to design and produce products, services and environments for sustainable living. They explain the contribution of innovation, enterprise skills and emerging technologies to global preferred futures. For the *food and fibre production* context, students explain the features of technologies and their appropriateness for purpose, and create designed solutions based on an analysis of needs or opportunities. Students create, adapt and refine design ideas, processes and solutions and justify their decisions against developed design criteria that include sustainability. They communicate design ideas, processes and solutions to a range of audiences, including using digital tools. Students independently and collaboratively develop and apply production and project management plans, adjusting processes when necessary. They select and use technologies skilfully and safely to produce designed solutions.

AUSTRALIAN CURRICULUM VERSION 9 CONTENT DESCRIPTORS

Strand: Technologies knowledge and understanding

Foundation: explore how familiar products, services and environments are designed by people AC9TDEFK01

Year 1-2: explore how plants and animals are grown for food, clothing and shelter AC9TDE2K03

Year 3-4: describe the ways of producing food and fibre AC9TDE4K03

Year 5-6: explain how and why food and fibre are produced in managed environments AC9TDE6K03

Year 7-8: analyse how food and fibre are produced in managed environments and how these can become sustainable AC9TDE8K04

Year 9-10: analyse and make judgements on the ethical, secure and sustainable production and marketing of food and fibre enterprises AC9TDE10K04

Strand: Technologies processes and production skills

Foundation: generate, communicate and evaluate design ideas, and use materials, equipment and steps to safely make a solution for a purpose AC9TDEFP01

Year 1-2: use materials, components, tools, equipment and techniques to safely make designed solutions AC9TDE2P02

Year 3-4: select and use materials, components, tools, equipment and techniques to safely make designed solutions AC9TDE4P03

Year 5-6: select and use suitable materials, components, tools, equipment and techniques to safely make designed solutions AC9TDE6P03

Year 7-8: select, justify and use suitable materials, components, tools, equipment, skills and processes to safely make designed solutions AC9TDE8P03

Year 9-10: select, justify, test and use suitable technologies, skills and processes, and apply safety procedures to safely make designed solutions AC9TDE10P03

A unit of work on grains can address a range of other ACARA achievement standards, from Technologies, Science and Humanities and Social Sciences. Refer to the Food and Fibre curriculum connection resources Food and fibre | V9 Australian Curriculum for further guidance (https://v9.australiancurriculum.edu.au/teacher-resources/understand-this-curriculum-connection/food-and-fibre/).

The South Australian Department for Education has produced two Technologies units of work with grains content. Both feature complete teaching sequences and all required resources:

Year 7 Plant Partnerships

Farm safety
To prepare them for working in a school farm environment, students learn about the safety risks that can be found on farms, especially for children, and also the solutions.

Plant partnerships with people
Students will learn plant structures, functions and their partnerships with people. They will explore different plant-based agricultural industries in Australia, the management strategies used in the past and how they relate to those that are employed today.

Plant partnerships with bees
Students will explore the partnership that plants have with bees. They will learn about the importance of bees for food and fibre production and conduct a survey of bees in their school grounds.

Plant partnerships with bees – generating and designing, producing and implementing
Students will apply their learning about bees and their importance to food and fibre production to explore ways that communities can support bees to thrive. They will design a bee support service following a set design brief.

Plant partnerships with the soil
Students will use an industry resource to manage their own learning around the partnerships that plants have with soils. They will monitor their own progress using a learning continuum.

Year 10 Top Crops

Cropping 101
Students will review cropping in Australia as well as compare the structural features of monocot and dicot plants and germination will be explored.

Decisions, decisions
Students will discuss the complex decisions required for successful cropping. Deconstruction of the topic of cereal crop management will lead students to a practical scientific investigation of an aspect of crop growth.

Plant engineers
Students will compare traditional plant breeding methods to emerging technologies while exploring the impact of plant breeding advances on society, with particular focus on the Green Revolution.

Designer crops
Students will build on the understanding of plant breeding and the challenges of managing crops, to design a new crop variety that addresses the triple bottom line. They will then design and create a fact sheet suitable for communicating the variety's key features to farmers.

These can be accessed on Plink:
Department for Education plink - Dashboard page

Each Grains topic is presented with increasing complexity, with content suitable for the Primary years presented first, followed by content suitable for Secondary years.

Grains industry topics	Resources	Capabilities and Cross Curriculum Priorities
Grains terminology • grain • seed • cereals • legumes • pulses • oilseeds • germination • seeding/sowing • harvest • emergence • fibrous roots • tap root • growth stage • tillage • monocotyledon • dicotyledon • coleoptile • precision agriculture	***When handling grain, ensure a risk assessment has been completed and students with allergy to gluten have been safeguarded*** GRDC Intro to grains, oilseeds and pulses **Introduction-To-Oilseeds-live.pdf (exactdn.com)** **Grain-facts-for-schools-wheat.pdf (grdc.com.au)** Order a seed kit: **Super Seed Kit | Australian Grains, Pulses and Oilseeds | Agriculture Lessons (primezone.edu.au)** Four lesson grains teaching sequence for Foundation to Year 2: **Winter Wheat and Summer Sunflowers | Agriculture Lessons (primezone.edu.au)**	Literacy Personal and social *Sustainability*
Crop types • investigating grain products • cereals – grass plants that produce edible grain eg wheat, barley, oats • legumes – plants that have their seeds in pods eg peas, beans, lentils, lupins • pulses – the edible seed from a legume plant • oilseeds – crops grown for oil eg canola, linseed • fibre crops – eg cotton, hemp • pharmaceutical crops – crops grown for medicinal purposes eg medicinal cannabis, poppies • fodder crops – crops grown for stock feed as hay & silage eg lucerne, oats; includes forage crops – crops grown for grazing eg pastures including natural grasslands • Australian and SA varieties • purposes & characteristics – matching to end uses, climate and topography	**2022-What-grain_seed-posters_FINAL.pdf (environment.sa.gov.au)** GRDC Paddock to Plate Year 3/4 **Grains Paddocktoplate-34 (exactdn.com)** GRDC Grains: Paddock to plate Years 5/6 **Grains Paddocktoplate-56 (exactdn.com)** **South Australian Crop Sowing Guide - GRDC** **The Science Behind Dough Quality | Agriculture Lessons (primezone.edu.au)**	Literacy Intercultural understanding *Sustainability*
Anatomy & physiology • parts of a plant • function of key structures – roots, stems, leaves, flowers, seeds • visual identification of key crop plants and grains • visual identification of key crop weeds • monocots versus dicots • photosynthesis and respiration • vascular transport	**Parts of a Plant Worksheets - Free Printable (sciencefacts.net)** **wheat-plant.pdf (agclassroom.org)** **Monocot vs Dicot - How to Tell the Difference (sciencenotes.org)** Monocots vs Dicots video: **https://youtu.be/7DqsZbSdbrk?si=qxesWA3ORGzJqEod** **GRDC | Growing Australian Grains – Years 7 to 10 | Agriculture Lessons (primezone.edu.au)** **The Science of Stems, Stomata and Sustainability | Agriculture Lessons (primezone.edu.au)**	Literacy *Sustainability*

Grains industry topics	Resources	Capabilities and Cross Curriculum Priorities
Crop reproduction and genetics • plant life cycle • flowers as reproductive structures • types of pollination • role of bees in food crops • crop growth stages • Zadoks growth scale • plant breeding • inheritable characteristics • genes & DNA • genetic diversity - ancient and native grains • genetic modification • Svalbard seed vault	Growth stages booklet: **Cereal growth stages - GRDC** **Printable Zadoks scale 12-518-DL-File-C-Documents-RELEASE.pdf (resources.qld.gov.au)** Canola growth stages: **69_GRDC_Canola_Guide_Canola_plant__and__how_it_grows.pdf (australianoilseeds.com)** **The Science of Genetics & Crossing Crops | Lesson Plan | Agriculture Lessons (primezone.edu.au)** Milestones in plant breeding infographic: **MILESTONES_FINAL.pdf (worldseed.org)** Documentary addressing crop genetics **Seed Hunter – 360 Degree Films** Virtual tour of Svalbard: **Svalbard Global Seed Vault Virtual Tour | Explore in 360°**	Literacy Numeracy Ethical understanding Intercultural understanding Critical and creative thinking *Sustainability* *Aboriginal and Torres Strait Islander Histories and Cultures*
Crop nutrition • plant requirements for nutrients • fertiliser types – inorganic and organic • granular v liquid fertiliser • micronutrients • macronutrients • deficiency • toxicity • soil and tissue tests • soil pH and nutrient availability • legume nodulation and nitrogen availability	GRDC Nutrition ute guides: **Ute Guides: Home** **Creating a Crop Nutrition Plan for Wheat: Everything You Need to Know | AgriTec Liquid Calcium Fertilizer (agritecint.com)** Assessing nodulation in pasture legumes: **how-do-i-better-manage.pdf (mla.com.au)**	Literacy Numeracy Critical and creative thinking *Sustainability*
Grain quality • linking grain qualities to end use • food safety • grain classification standards	Different classes of wheat: **Wheat Classes - Grains Australia** Grain receival standards: **Classification and receival standards (viterra.com.au)** Food safety: **Food safety requirements (viterra.com.au)**	Literacy Ethical understanding Critical and creative thinking *Sustainability*
Crop health and biosecurity • common pests in SA eg mice, snails, slugs, locusts, Russian wheat aphid, red-legged earth mite etc • diseases including fungal, bacterial and viral examples • common weeds eg grasses like ryegrass, wild oats and broadleafs like marshmellows, caltrop, fleabane • quarantine systems – farm, state and national level • crop rotations as a key strategy • integrated pest management strategies • managing resistance	**The Cost of Frost | Agriculture Lessons (primezone.edu.au)** **Landscape South Australia - Northern and Yorke | Pest plants (Weeds)** Weeds ute guide: **UTE_Guide_Weeds20_210X148_Dec21_screen-min.pdf (grdc.com.au)** Free-call 1800 11 00 44 or email: ground-cover-direct@canprint.com.au to order your free hardcopy and quote GRDC Order Code- GRDC1331 (a postage and handling charge applies). **Grains Farm Biosecurity Program (grainsbiosecurity.com.au)** Fact sheets: **Pests and Diseases - Grains Farm Biosecurity Program (grainsbiosecurity.com.au)**	Literacy Numeracy Personal and social Ethical understanding Critical and creative thinking *Sustainability* *Asia and Australia's Engagement with Asia*

Grains industry topics	Resources	Capabilities and Cross Curriculum Priorities
Sustainable grain production • soil health • reducing erosion risk • managing climate change • reducing emissions • fertiliser production as a key issue • different tillage systems • regenerative production principles • managing spray drift and off-target damage	The Importance of Soil for Growing Great Grain | Agriculture Lessons (primezone.edu.au) Bureau of Meteorology Agriculture Services: Water and the Land (bom.gov.au) What is Regenerative Agriculture? - Soils For Life Preventing off-target spray drift video: https://youtu.be/MnhvLTHyWcI	Literacy Numeracy Ethical understanding Critical and creative thinking *Sustainability*
Technology and innovation • weather stations • Goyder's Line • precision agriculture • yield mapping • variable rate tech • use of drones for crop monitoring and targeted spray programs • NDVI imaging • soil moisture probes • water use efficiency • inter-row seeding • controlled traffic • plant breeding for frost and drought tolerance, pest & disease resistance, yield, increased nutritional value	Make a rain gauge: Weather Science - How to Make a Rain Gauge (science-sparks.com) The Smart Technology Behind Smart Grain | Agriculture Lessons (primezone.edu.au) Landscape South Australia - Northern and Yorke | Goyder's Line:... Grains | Ag Week 2023 Digital Learning Kit | Agriculture Lessons (primezone.edu.au) Future of plant breeding: International Seed Federation (worldseed.org)	Literacy Numeracy Ethical understanding Critical and creative thinking Digital literacy *Sustainability*
Economics & business • consumer influence • Stock Journal market reviews • grain marketing – contracts and risk management • estimating yield potential – French Schultz; pod counts; tiller and head counts; biomass	Calculating yield potential: water-use-efficiency-southwest.pdf.pdf (grdc.com.au) A brief guide to estimating crop yields | General agronomy | Crop production | Grains, pulses and cereals | Crops and horticulture | Agriculture Victoria	Literacy Numeracy Critical and creative thinking *Sustainability*
Global significance • consumption data • exports • trade relationships • tariffs	Snapshot of Australian Agriculture 2024 - DAFF	Literacy Numeracy Intercultural understanding Critical and creative thinking *Sustainability* *Asia and Australia's Engagement with Asia*
Science as a Human Endeavour (S.H.E.) Key topics: • sustainability • technology • gluten • R & D priorities	R & D strategy: Grains (npirdef.org) Modernising Indigenous Native Grains Processing | AgriFutures Australia Grains, Gluten and Carbohydrates | Agriculture Lessons (primezone.edu.au)	Literacy Numeracy Personal and social Ethical understanding Critical and creative thinking Digital literacy *Sustainability*

Grains industry topics	Resources	Capabilities and Cross Curriculum Priorities
Science inquiry skills Using the scientific method to investigate: • germination conditions • crop types • crop varieties • soil type • fertiliser types & rates • seed age • sowing density • seeding systems • sowing depth • seed quality • seed treatments	**Working scientifically (nsw.gov.au)** **Science skills rubric (nsw.gov.au)** Some suitable dependent variables: • % grains germinated • % plants emerged • plants per square metre • plant biomass • number of heads per m^2 • number of tillers per m^2 • number of pods per m^2 • number of nodules per plant • yield • dry matter • weeds per m^2 Some suitable qualitative data (or observations) • leaf colour • pest damage • disease impact	Literacy Numeracy Ethical understanding Critical and creative thinking *Sustainability*
Practical skills • safe work practices • developing responsibility • safe operating procedures • risk assessments • identifying plants • milling grain to produce flour, then a consumable product like pancakes or muffins* • managing plants • seeding systems • soil testing • machinery & equipment • machinery operation • using a quadrat • recording and interpreting data • assessing crops for health, productivity, market specifications • yield estimations • nodulation assessment • practical application of genetics, biosecurity, marketing, grain quality	***When handling grain, ensure a risk assessment has been completed and students with allergy to gluten have been safeguarded*** Farm Safety (early years): **Farm Safety – George the Farmer** Farm safety for kids (year 5, 6 and 7): **Projects | Primary Producers SA (ppsa.org.au)** Farm Safety (year 7-10): **Future Farm Safety Resource Package (Years 7-10) | Teacher Guide | Agriculture Lessons (primezone.edu.au)** **Making and using a quadrat — Science Learning Hub** (for younger students, use a 1/10 m^2 quadrat rather than a $1m^2$ quadrat. Easier to manage the counting. $1/10m^2$ quadrats have cm sides) Grower guide to assessing legume nodulation: **fs4-se-sa-sw-vic.pdf (adelaide.edu.au)**	Literacy Numeracy Personal and social Ethical understanding *Sustainability*
Preparation of grain for showing • all the practical skills listed above • public speaking • communication with stakeholders (eg judges) • grain industry knowledge • meeting market specifications • Quality Assurance processes • required record keeping and documentation • career exposure	Showing grain and fodder: **National Grains & Fodder Competition | Royal Adelaide Show (theshow.com.au)** Contact Competition Coordinator Name: Chelsea Wilkinson Email: **CWilkinson@adelaideshowground.com.au** Phone: 08 8210 5251 RA&HS Reception: 08 8210 5211 Judging grains at the Show: **young-judges-schedule-finaldocx.pdf (theshow.com.au)** **Teaching Grains, Oilseeds and Pulses Young Judges – Teacher Handbook | Agricultural Shows Australia | Agriculture Lessons (primezone.edu.au)**	Literacy Numeracy Personal and social Critical and creative thinking *Sustainability*

Grains industry topics	Resources	Capabilities and Cross Curriculum Priorities
Careers Consider the range of skills students have – there will be a place for them all in the grains sector: • practical "hands on" • enterprise skills • data management • IT system development • mechanical • engineering • technical • research/scientific • marketing • communication	**Careers In Agriculture | Ag Careers | Australia - Career Harvest** – search prompts: grain • grain • plant breeding • agronomist • plant science **Careers in Grain | Agriculture Careers (careerharvest.com.au)** Cultivating Futures resources: **Engaging secondary students in agricultural careers | AgriFutures Australia** **Careers in Grains (frompaddocktoplate.com.au)** GRDC Futures in the Australian grains industry: **grdc-fact-sheet-fa.pdf** GRDC Grains Careers card game: **GRDC Grains Careers | PIEFA Food and Fibre Card Game | Agriculture Lessons (primezone.edu.au)**	Literacy Personal and social *Sustainability*

ASSESSMENT EXAMPLES USING THE ACARA ACHIEVEMENT STANDARDS

Technologies achievement standard	Example assessment activity **(When handling grain, ensure a risk assessment has been completed and students with allergy to gluten have been safeguarded)**	accomplished	competent	satisfactory	developing	limited
Technologies Foundation By the end of Foundation students identify familiar products, services and environments. They create a designed solution for a school-selected context. Students create, communicate and choose design ideas. They follow steps and use materials and equipment to safely make a designed solution.	Selecting from a range of materials provided, students design and create a wheat "mini-paddock" to germinate and grow ten wheat plants. They manage their own mini-paddock over several weeks, observe the wheat growth, record observations and evaluate if the mini-paddock was successful.					
Technologies Year 1-2 By the end of Year 2 students describe the purpose of familiar products, services and environments. For the prescribed technologies context *food and fibre production and food specialisations*, they describe the features and uses of technologies and create designed solutions. Students select design ideas based on their personal preferences. They communicate design ideas using models and drawings and follow sequenced steps to safely produce designed solutions.	Students investigate the characteristics of wheat and the products created from it. From a display of wheat grain, wheat flour and end-products like bread and pasta, they describe and compare the qualities of wheat at each stage. They suggest the range of ways that the wheat has been transformed such as texture, colour and taste.					
Technologies Year 3-4 By the end of Year 4 students describe how people design products, services and environments to meet the needs of people, including sustainability. For the prescribed technologies context *food and fibre production and food specialisations*, they describe the features and uses of technologies and create designed solutions. Students select design ideas against design criteria. They communicate design ideas using models and drawings including annotations and symbols. Students plan and sequence steps and use technologies and techniques to safely produce designed solutions.	Students create a visual flow chart showing the steps required for a grain like wheat, lentils or canola to be grown then transformed into an edible product. They use images, diagrams or models to depict each step from paddock to plate.					

Technologies achievement standard	Example assessment activity (When handling grain, ensure a risk assessment has been completed and students with allergy to gluten have been safeguarded)	accomplished	competent	satisfactory	developing	limited
Technologies Year 5-6 By the end of Year 6 students explain how people design products, services and environments to meet the needs of communities, including sustainability. For the prescribed technologies context *food and fibre production and food specialisations*, they explain how the features of technologies impact on design decisions and they create designed solutions. Students select and justify design ideas and solutions against design criteria that include sustainability. They communicate design ideas to an audience using technical terms and graphical representation techniques. Students develop project plans, including production processes, and select technologies and techniques to safely produce designed solutions.	Students explore the different crop types and varieties being grown in Australia and the challenges farmers face in producing adequate quantities of good quality grain while protecting the environment. They use this background information and blue-sky thinking to design a new type of crop that solves key sustainability challenges. They use their chosen format to "pitch" the unique characteristics and benefits of their new crop type to an audience that could include industry representatives or primary producers.					
Technologies Year 7-8 By the end of Year 8 students explain how people design, innovate and produce products, services and environments for preferred futures. For the prescribed technologies context *food and fibre production*, they explain how the features of technologies impact on design decisions, and create designed solutions based on analysis of needs or opportunities. Students create and adapt design ideas, processes and solutions, and justify their decisions against developed design criteria that include sustainability. They communicate design ideas and solutions to audiences using technical terms and graphical representation techniques, including using digital tools. They independently and collaboratively document and manage production processes to safely produce designed solutions.	Students visit a primary production business or machinery dealership and work collaboratively to conduct an audit of seeding or harvest equipment. They record features that address identified priorities which could include: • worker health and safety • emissions • grain quality Students then suggest modifications that would improve the sustainability of the machinery, addressing the triple bottom line of *people, profit and planet*.					
Technologies Year 9-10 By the end of Year 10 students explain how people consider factors that impact on design decisions and the technologies used to design and produce products, services and environments for sustainable living. They explain the contribution of innovation, enterprise skills and emerging technologies to global preferred futures. For the *food and fibre production* context, students explain the features of technologies and their appropriateness for purpose, and create designed solutions based on an analysis of needs or opportunities. Students create, adapt and refine design ideas, processes and solutions and justify their decisions against developed design criteria that include sustainability. They communicate design ideas, processes and solutions to a range of audiences, including using digital tools. Students independently and collaboratively develop and apply production and project management plans, adjusting processes when necessary. They select and use technologies skilfully and safely to produce designed solutions.	Students imagine their district is facing a new biosecurity threat to grain production from a microscopic insect pest. They design a biosecurity plan to protect the school farm or a site of their choice. They consider key stakeholders and recommend a range of strategies to reduce the risk and manage the threat. They are encouraged to include innovative or novel tactics and technologies.					

Disclaimer: *This curriculum resource is designed to support schools in delivering quality food and fibre content to students. It has been developed by Lead Ag Teacher Sue Pratt, AgCommunicators – a registered teacher with more than 30 years' experience in teaching agriculture and science. Prior to using this resource, teachers should conduct a risk assessment in line with their site's curriculum and safety guidelines and check all links are appropriate to the school's online policies. The risk assessment may include provision of specialised Personal Protective Equipment and review of the school's policies and procedures on chemical use.*