# Grains Research and Plant Breeding

## TEACHER GUIDE

**LESSON 2**

**YEAR 7–10**

This resource has been developed by:

Primary Industries Education Foundation Australia

www.primezone.edu.au
primezone
The place for all your food and fibre resources

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

LESSON 2

# Grains Research and Plant Breeding

## LEARNING AREA

Design and Technologies (Year 7–10)

## AUSTRALIAN CURRICULUM CONTENT

Analyse how people in design and technologies occupations consider ethical and sustainability factors to design and produce products, services and environments **(AC9TDE8K01)**

Analyse how food and fibre are produced in managed environments and how these can become sustainable **(AC9TDE8K04)**

Analyse how people in design and technologies occupations consider ethical, security and sustainability factors to innovate and improve products, services and environments **(AC9TDE10K01)**

Analyse and make judgements on the ethical, secure and sustainable production and marketing of food and fibre enterprises **(AC9TDE10K04)**



*Cover image courtesy: GRDC*

**This resource has been developed by:**

Primary Industries Education Foundation Australia | www.primezone.edu.au primezone The place for all your food and fibre resources

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

# Contents



## LESSON OBJECTIVE

Students will learn about the role of the Grains and Research Development Corporation and the aims of plant breeding. They will work collaboratively to think about the issues facing Australian grain producers and have the opportunity to design their own imaginary crop variety.

## LESSON OVERVIEW

**Activity 2.1 – Who Invests in Grains Research?** (15 minutes)

**Activity 2.2 – Plant Breeding** (30 minutes)

**Activity 2.3 – Breeding a New Plant Variety** (25 minutes)

This resource has been developed by:

Primary Industries Education Foundation Australia | www.primezone.edu.au primezone The place for all your food and fibre resources



GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

# Resources and Equipment

## ACTIVITY 2.1 – Who Invests in Grains Research?

1. **Worksheet 2.1a – Who Invests in Grains Research?** (Media activity)
2. Welcome to GRDC (1:59)

## ACTIVITY 2.2 – Plant Breeding

1. Access to computer/digital device
2. **Worksheet 2.2a – Plant Breeding** (Stimulus activity)
3. How seed breeding works (1:56)
4. From single seed to pure breed (2:55)
5. 'Speed Breeding' in Australia Boosts Future Crop Possibilities (1:42)
6. **Worksheet 2.2b – Australian Grain Production** (Brainstorming activity)

## ACTIVITY 2.3 – Breeding a New Plant Variety

1. **Worksheet 2.3a – Breeding a New Plant Variety** (Creative thinking activity)

# Lesson Guide

## ACTIVITY 2.1 – Who Invests in Grains Research?

Students will learn about the role of the Grains and Research Development Corporation.

1. Facilitate a discussion prompted by the following questions and record student responses in a central area:
   - What are some of the end products of grains?
   - What are some of the end products of oilseeds?
   - What are some of the end products of pulses?
   - What organisations are responsible for improving crop production in Australia?
   - Where does the funding come from to research and improve crop production in Australia?

   **Answers**
2. Distribute **Worksheet 2.1a – Who Invests in Grains Research?** (Media activity) to students, and as a class, read the information and watch the video Welcome to GRDC (1:59) which focuses on the work of the Grains and Research Development Corporation.
3. Allow students time to record their responses on the worksheet.

   **Answers**

## ACTIVITY 2.2 – Plant Breeding

Students will engage in a brief introduction to plant breeding and learn about the aim and significance of this profession to the grain industry.

1. Display **Worksheet 2.2a – Plant Breeding** (Stimulus activity) or distribute copies to students. Students observe the range of images provided and complete the sentence: *The role of a plant breeder in the grain industry is to...*

   **Answers**

*(Activity 2.2 continued following page...)*

2. Ask students to contribute their sentences to the class and record some of their ideas in a central area.
3. As a class, view How seed breeding works (1:56), From single seed to pure breed (2:55), and Speed Breeding' in Australia Boosts Future Crop Possibilities (1:42). Discuss how innovation and technology have decreased the time needed to create new varieties of plants, and have them ready and available for producers. Also, discuss why this technology is essential to future progress in cropping.
4. Provide students with **Worksheet 2.2b – Australian Grain Production** (Brainstorming activity), allocate them into pairs and encourage students to collaborate and consider a range of abiotic and biotic factors that can impact crop production in Australia. Students record four factors that can decrease productivity within the industry and a genetic trait that would be needed to combat/control these factors. Alternatively, a circle of concern strategy could facilitate this activity.

   **Answers**

## ACTIVITY 2.3 – Breeding a New Plant Variety

Students imagine creating a new plant variety of significance that seeks to combat one or more challenges of the Australian environment (abiotic and/or biotic).

1. Distribute **Worksheet 2.3a – Breeding a New Plant Variety** (Creative thinking activity). Working individually or in pairs, ask students to design a new/imaginary plant variety to combat one or more identified factors from the previous activity. Students record imaginary traits about their new plant, including:
   - name
   - plant description (genetic characteristics)
   - plant dimensions
   - growth distribution (map)
   - end uses of the plant.
3. Ask students to present their designer plants to the class if time allows.

# Answers

## ACTIVITY 2.1 – Who Invests in Grains Research?

**1.** A variety of responses and examples could be provided. Examples include:

- **Grains**
  Flour, noodles, pasta, bread, couscous, biscuits, cakes, pastries, confectionary, soups, stews, beer, malt for distilled beverages, malt vinegar, breakfast cereals, health products, and livestock feed.
- **Oilseeds**
  Oils, spreads, dyes, cosmetics, food colouring, and can also be roasted.
  Non-oil varieties are used for animal feed, and the leaves are used for fodder.
- **Pulses**
  Can be consumed when fresh or dried. They are used in hummus, salads, soups, stews, dips, for flour in cakes, as a green manure crop, and for livestock feed.
- **Organisations**
  GRDC, AGT, Australian Government, State Governments, State Departments of Primary Industries, private stakeholders.
- **Funding**
  GRDC is predominantly funded by levies (a percentage of profits is collected from the sale of grain). The Australian Government matches the levy contributions (up to a limit). GRDC also is funded through other funding sources, including interest, royalties, and grants, contribute a smaller proportion to GRDC's income.

### WORKSHEET 2.1a – Who Invests in Grains Research? (Media activity)

Answers will vary depending on individual student responses, but may include:

- Research, development and extension
- Produce videos to support producer's education
- Agronomy
- Grower case studies
- Pests
- Weeds
- Farming systems
- Disease
- Soil
- Nutrition
- Crop variety development
- Best practice management
- Workshops and events.

# Answers (continued)

## ACTIVITY 2.2 – Plant Breeding

### WORKSHEET 2.2a – Plant Breeding (Stimulus activity)

The role of a plant breeder in the grain industry is to... develop new varieties of plants that offer an advantage or solution to those who will use it.

### WORKSHEET 2.2b – Australian Grain Production (Brainstorming activity)

Answers will vary depending on individual student responses, but may include:

- heat tolerance
- resistance to pest and disease
- drought tolerance
- frost tolerance
- tolerance to low nutrient levels (specific genes for specific elements), etc.

## ACTIVITY 2.3 – Breeding a New Plant Variety

### WORKSHEET 2.3a – Breeding a New Plant Variety (Creative thinking activity)

Answers will vary depending on individual student responses.

# References

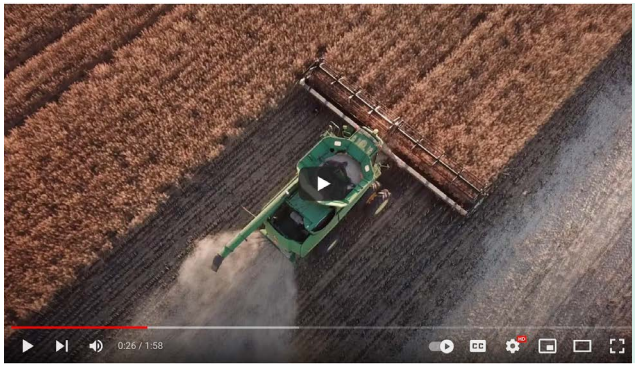

- Australian Grain Technologies. (2019). *The Science of Plant Breeding | Australian Grain Technologies*. Agtbreeding.com.au. https://www.agtbreeding.com.au/about/the-science-of-breeding
- Grains Research and Development Corporation. (2021, October 15). *Welcome to GRDC*. www.youtube.com. https://www.youtube.com/watch?v=IUvII7WzUZg&t
- The Oregonian. (2016). *How seed breeding works*. In YouTube. https://www.youtube.com/watch?v=q02g_OKTByM
- The University of Western Australia. (2020, February 19). *From single seed to pure breed*. www.youtube.com. https://www.youtube.com/watch?v=ZX_CgYmqjrE
- Voice of America. (2018, February 23). *"Speed Breeding" in Australia Boosts Future Crop Possibilities*. www.youtube.com. https://www.youtube.com/watch?v=N51URONgyA0

# Who Invests in Grains Research?

GRDC is the Grains and Research Development Corporation. They are responsible for planning, investing, and overseeing research, development and extension for 25 different crops such as wheat, canola, chickpeas and lentils.

The primary purpose of the GRDC is to drive discovery, development, and innovation that enhances the productivity, profitability and sustainability of Australian grain growers and benefit the industry and wider community. GRDC is predominately funded by grain growers and the Australian Government.

**Scan the QR code or click on the link to view the video focused on the role of the Grains Research and Development Corporation.**




**Welcome to GRDC** (1:59)
https://www.youtube.com/watch?v=IUvII7WzUZg

**Record three lasting images from the video about the role of GRDC, the technologies they use and the key areas they target.**

1. _____

_____

2. _____

_____

3. _____

_____

This resource has been developed by:

Primary Industries Education Foundation Australia | primezone www.primezone.edu.au The place for all your food and fibre resources

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

# Plant Breeding

**View the images below carefully and formulate a sentence that could be used to describe the role of a plant breeder/researcher in the grain industry.**


This resource has been developed by:

Primary Industries Education Foundation Australia

www.primezone.edu.au
primezone
The place for all your food and fibre resources

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

# Australian Grain Production

Plant breeding is the development of a new variety of plant that offers an advantage to those using it. The advantage may be increased quality of produce; increased yield (the quantity of a product); tolerance to an environmental factor, e.g. heat; resistance to a pest or disease; or even an enjoyable alternative product for consumers, e.g. a new coloured fruit.

**Brainstorm and identify at least four factors that can impact the growth and productivity of crops (abiotic or biotic) and a genetic trait that plant breeders would want to use to combat this factor. Record your ideas inside the map of Australia. An example has been provided.**

**1.**

**Abiotic Factor:**
Saline soils (salinity)

**Genetic trait:**
Salt tolerant gene

**2.**

**Abiotic Factor:**

_____

_____

**Genetic trait:**

_____

_____

**3.**

**Abiotic Factor:**

_____

_____

**Genetic trait:**

_____

_____

**4.**

**Abiotic Factor:**

_____

_____

**Genetic trait:**

_____

_____

**5.**

**Abiotic Factor:**

_____

_____

**Genetic trait:**

_____

_____

This resource has been developed by:

Primary Industries Education Foundation Australia | www.primezone.edu.au primezone The place for all your food and fibre resources

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

# Breeding a New Plant Variety

**Design a new plant variety that combats one or more abiotic or biotic issue/s. Your plant should deliver a practical solution to a known or imaginary problem.**

## Plant name:

_____

## Genus name:

_____

## Dimensions of plant (mm):

Length: _____ Width: _____

## Plant description:

_____

_____

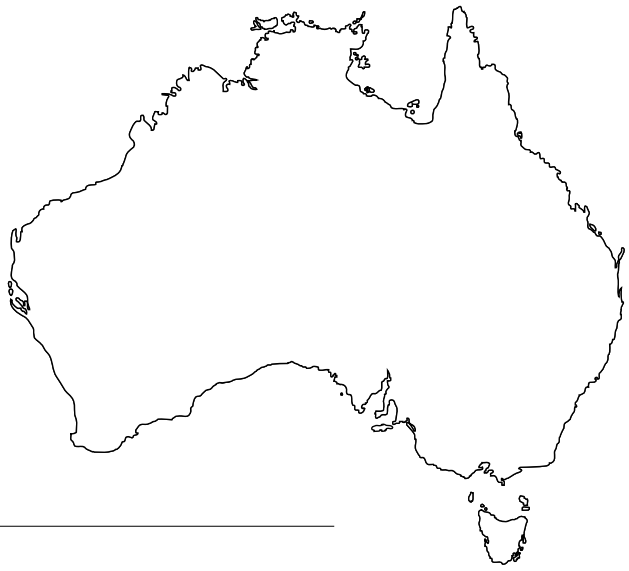
_____

_____

_____

## Sketch of plant:

## Australian growing areas:



## Two end products:

1. _____

2. _____

## Features of genetic improvement:

_____

_____

_____

This resource has been developed by:

Primary Industries Education Foundation Australia | www.primezone.edu.au primezone The place for all your food and fibre resources

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION