



# **Careers in agriculture**

An international career in wheat and grains **Humanities and Social Sciences, Science** 

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- ACHGK063 •
- ACHGK064
- ACHEK039
- ACSHE228
- ACSHE195







## An international career in wheat and grains

## Lesson overview

Grain is one of Australia's most important agricultural exports. Every winter, Western Australia has more land planted for grain crops than any other state. This means there are many jobs in wheat and grains research here in WA. The training, and experience you achieve in WA can set you up for a global career.

### Australian Curriculum:

Humanities and Social Sciences

Geography: Biomes and Food Security Year 9 - The challenges to food production, including land and water degradation, shortage of fresh water, competing land uses, and climate change, for Australia and other areas of the world (ACHGK063)

Geography: Biomes and Food Security Year 9 - examining the effects of anticipated future population growth on global food production and security, and its implications for agriculture and agricultural innovation (ACHGK064)

Economics and Business Knowledge Year 9 - Why and how participants in the global economy are dependent on each other (ACHEK039) (ACHEK039)

Science

Science as a Human Endeavour Year 9 - The values and needs of contemporary society can influence the focus of scientific research (ACSHE228)

Science as a Human Endeavour Year 10 - Advances in science and emerging sciences and technologies can significantly affect people's lives, including generating new career opportunities (ACSHE195)

#### Resources

- Case study on the career of Dan Mullan
- The Australian Bureau of Statistics provides insights on the agriculture industry, see: abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4102.0Main+Features10Dec+2012 (Accessed 25 June 2015)
- DAFWA 'Careers cards'

## **Tuning In**

Watch this video on Australian agriculture. It emphasises the role of research and innovation in farming. It was published in 2011 by Australia's Year of the Farmer.

youtube.com/watch?v=\_pb2fCoPmjw (Accessed 31 August 2015)

# Whole class introduction

Australian farmers are part of a global effort to feed the world. Scientists collaborate with farmers to develop the agriculture industry.

As the National Farmers Federation (NFF) of Australia states:

'The challenge for our farmers will be meeting the booming world need for food and fibre. This means we need to increase the amount of food and fibre we grow- with less land, less water, less impact on the environment, and with fewer people. This is why Australia spends \$1.5 billion a year on agricultural development and why we need to continue to spend more' (NFF presentation, 2012).

Agriculture offers an international career. Australian agricultural scientists are involved in many global collaborations to look at new and more efficient ways of producing food and fibre.

The vast Australian continent produces more food than our population can eat. Many farmers are focused on exporting their products. It is very important that farmers and agricultural scientists understand the markets available in other countries.

#### Did you know?

• 60% of Australian farm produce is exported, helping to feed 40 million people around the world each day (Australian Bureau of Statistics, 2012).

• In 2010-11, 14% of the total value of agricultural exports went to China. A further 13% went to Japan and 8% to Indonesia. Australian farmers also exported to countries beyond our immediate region such as those in the Middle East (10% of agricultural exports), the European Union (8%), and the United States (7%) (Australian Bureau of Statistics, 2012).



Agriculture is everywhere

# **Student activities**

Exercise 1: Why do other countries import food from Australia instead of sourcing all of their own food from their own land?


## Exercise 2: Look at the career case study for Dan Mullan.

Dan is based in Western Australia, but travels all over the world. Identify where Dan has travelled on the world map below.



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'The World Food Summit of 1996 defined food security as existing "when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life". Commonly, the concept of food security is defined as including both physical and economic access to food that meets people's dietary needs as well as their food preferences.' Source: who.int/trade/glossary/story028/en/ (Accessed 25 June 2015)

- 1. Read the case study on Dan Mullan's international career in wheat breeding.
- 2. One of the scientists who inspired Dan Mullan's career is the Nobel Prize-winning researcher Professor Norman Borlaug. Dan spent two years working at CIMMYT, a grains research centre based in Mexico, set up by Borlaug.

Borlaug was a wheat breeder who had excellent negotiating skills and an ability to communicate across cultures. He worked with governments in developing countries and encouraged them to embrace new breeds of wheat that could withstand drought and generate higher yields. Through this work, Professor Borlaug is credited with preventing hunger and starvation for millions of people across the world (Source: Dan Mullan, 2015).

### **Exercise 3:**

A university in Perth is starting a new grains research centre, named after Norman Borlaug. You are a rural journalist covering the story.

Write a short article on why the centre was named after Norman Borlaug and how Norman Borlaug is relevant to farming in the Western Australian environment.

Please include the following key words:

- Nobel prize
- Famine
- Green revolution
- Wheat breeding

## Reflection

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If we want to be able to feed the world, we need scientific information to ensure farmers can grow as much food as possible on the land that they have.

Create a list of careers in agriculture for people who like science.

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## Case study



## **Dan Mullan - Career in wheat breeding**

Being willing to leave his comfort zone, try new things and see new places has led Dan Mullan to build an international scientific career as a wheat breeder. He has worked in Mexico, Morocco, Turkey, and the USA and is proud of his profession because wheat breeders create new and effective ways to feed the world. Wheat breeders have addressed food shortages and found ways to overcome hunger and prevent conflict in poorer nations. Many plant scientists believe that to ensure a peaceful world, we need enough food to feed humanity.

### Choosing a pathway after school

Dan didn't know what direction his career would take when he started an agriculture degree at university. It was a very broad and wide-ranging course. After one year he tried to narrow down whether he wanted to focus on plants or animals. At this time he did an assignment on a wheat breeding program at the Department of Agriculture and Food, and it sparked his interest in plant genetics.

After finishing an undergraduate degree in agriculture, Dan moved to North Dakota in the USA, where he worked as a scientist for six months. He liked to go snowboarding in North Dakota, and while at work he researched the genetics of white wheat, investigating how to improve product quality.

When Dan returned to Perth, he decided that to launch the international career he wanted; he needed to complete a PhD. A PhD is a doctorate degree, taking 3-4 years to complete, and often involves delivering a 70 000 word assignment or research project. The subject for Dan's research was molecular genetics in wheat production.

After handing in this project, Dan decided to travel again, and he moved from Perth to Canberra, to take up a job with the CSIRO.

### Developing a wheat variety that requires less rain

The CSIRO job took Dan out of the science laboratory and back into the sunshine and open air of field work. He was testing new wheat varieties by planting small trial crops on farms and doing experiments in different environmental conditions. He liked this hands-on work, operating tractors, meeting lots of farmers and being outdoors.

At the CSIRO Dan's team investigated ways to breed a new variety of durum wheat (durum is Latin for hard, this strain has tough grains) that would still grow if it didn't rain much.

Dan moved to Mexico next to work in the CIMMYT laboratory, one of the most famous wheat research centres in the world. He spent two years here, continuing to research wheats that could survive drought. Dan learned Spanish and while he was in Mexico he went to many local festivals and celebrations.

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## Linking Western Australian farmers with opportunities in Japan

After two years, Dan felt like returning home to Perth. He accepted a job at Intergrain as a wheat breeder. Here he is researching wheat varieties grown to produce udon noodles. Western Australia is the world's biggest producer of udon noodle wheat. Udon noodles are hugely popular in Japan, where they are put in soups, with meat, vegetables or seafood. In the 1960s the Japanese noodle makers realised that the best wheat for udon noodles came from the dry climate of the Western Australian wheat belt. Scientist did not know why this was so. They did a lot of experiments to find out what qualities made up the best and most tasty udon noodles.

When they are eating udon noodles a Japanese person looks for:

- firm texture
- doesn't disintegrate when floating in a soup
- smooth
- elasticity and bounce
- a nice colour that is creamy, but not yellow, and definitely not white.

### A wheat breeder needs patience and a view to the future

Now Dan is trying to breed a variety of udon wheat that will produce more grains of wheat per plant. This has the potential to make more money for the farmer, as they can produce more wheat on less land.

It can take 10-20 years to develop a new breed of wheat, so a scientist like Dan needs a lot of patience.

Dan's inspiration for his career is Professor Norman Borlaug, a wheat breeder who won the Nobel Prize. Dan met Professor Borlaug when he was working in Mexico.



# **Supporting reading**



## Wheat, varieties, qualities and use

Wheat is a cereal plant of the genus *Triticum* of the family *Gramineae* (grass family). The wheat plant is an annual, probably derived from a perennial; the ancestry of and precise distinctions between species are no longer always clear.

In Australia wheat is sown in autumn and harvested, depending on seasonal conditions, in spring and summer. More than 80% of Australian wheat crops are grown in areas that receive less than 400mm rainfall.

Companies that make products like pasta, noodles, cake and bread look for different qualities in the flour produced from wheat. These companies are interested in the qualities of grain hardness, grain protein content and dough qualities.

Wheat breeders like Dan, develop new wheat varieties to meet these requirements and to be productive in different environments. Breeding programs are looking to develop wheat breeds that are less susceptible to frost, have reduced water needs (in a drying climate) and are productive when there are soil constraints like soil acidity or salinity.

Wheat genetics and the environment interact to influence flour qualities.

Hardness is measured by the ease with which outer layers of the grain can be removed by abraiding, by the amount of energy require or noise emitted in a grinding a sample, or by the amount of damage which occurs to starch granules during milling.

Wheat described as hard will have a vitreous (hard, transparent) endosperm and when milled will display greater damage to starch granules in the flour and is preferred for bread making.

Endosperm is the energy store that the embryo, in the seed or grain will use to grow a new plant.

Wheat described as soft will have an opaque and less compact endosperm compared to hard wheat. When milled soft wheat results in very small (or finer) flour particles and is considered more suitable for cakes and biscuits.

Protein content indicates the milled flours potential to absorb water, dough stability and extensibility. Extensibility is a measure of dough's capacity to stretch or increase in size. Greater protein content will increase extensibility. Extensibility and stability indicates how the dough will perform during the manufacture of food products.

Durum wheat is described as hard which this variety suitable for use in pasta products.

The Japanese-style white salted noodle or udon, requires soft-grained wheat with about 10.5% protein.

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### **Sources**

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