



Harper Adams  
University

# Crops Matter

A degree that matters



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# How to use this pack

## What is included?

This pack includes:

- 3 x research stories about projects that are taking or have taken place at Harper Adams University
- 6 x activities to be completed

Through this pack you'll learn about the vast range of agricultural careers, where our food comes from and cutting-edge research that could change what we eat.

Some sections of this pack will require you to have the internet to access online games and resources.

To complete this pack, you will need some paper, a pen and you may also wish to print some of the pages.



## Curriculum Links:

The following pack has been put together with the national curriculum in mind. The following activities and elements of this pack are linked to the national subjects of English, biology, and geography.

# An introduction to crops

## What are crops?

A crop is a plant grown and harvested on a large scale for profit or food.

Crops fall into six categories:

- Food crops (for humans)
- Feed crops (for livestock; for example cows)
- Fibre crops (for textiles)
- Oil crops (these can be for cooking or industrial uses)
- Ornamental crops (for example for landscape gardening)
- Industrial and secondary crops (these are for personal and industrial uses, for example rubber)

In this pack, we're going to be mostly focusing on crops that are grown for human and animal consumption.

In the UK, the most popular crop is wheat. It can be milled into a flour and be used in bread, biscuits and cakes. It can also be used in animal feed and to make bioethanol which is an alternative to petrol.

Here at Harper Adams University we do a wide range of research around crops and we would like to share some of this with you.

Take a read and immerse yourself in some of the research that is going on at Harper Adams on the following pages. Then as you progress through the pack use your task sheets to help your knowledge grow.



# Growing salad all year round

*Researchers grow salad in shipping containers with LED lights*



Baby leaf greens are a fundamental part of many people's salads. These leaves are harvested from green, leafy plants, such as spinach and kale, around three to four weeks after being planted.

G's is a salad producer which supplies all the major UK, and many European, retailers with a vast range of fresh produce. They grow their winter baby leaf in Italy and Spain and only grow in the UK during the warmer summer months.

Harper Adams University is part of a collaborative project to see if the company can grow baby leaf greens in the UK all year long.

Winter Grow, being trialed at G's facility in East Anglia, centres on indoor growing of baby leaf under LED lights, which can be controlled to include varying levels of light from across the colour spectrum.

Ben Barnes, the University's project lead said: "The work will explore two big questions: can we increase the efficiency of the **propagation** facility in terms of getting a more **homogenous** crop? And is it feasible to produce baby leaf crops during the winter at an affordable price point? One element of this is the development of 'lighting recipes' to enhance plant growth characteristics."

The work is taking place in a shipping container. It aims to create optimum growing conditions, factoring in variables like the heat created by having the LEDs on full power all of the time, and the humidity generated from the plants.

Success in the trial would likely have an impact for G's but also in the industry at large. The company is already collaborating with the London-based indoor farm Growing Underground, which grows salads using **hydroponic** techniques.

Vertical farming, where crops are either grown in stacked layers or on vertical structures, is set to play a big role in the future of agriculture. But there are still some issues to be ironed out before it becomes a mainstream production option.

Barnes explains: "One of the biggest problems with the vertical farming concept is this interaction between moisture and temperature. You've got the two factors constantly fighting against each other and that ends up sucking huge amounts of energy if you're not careful."

A second element to the project with G's, called Smart Prop, which is supported by Innovate UK, aims to improve growth and plant strength in propagating seedlings for later planting in fields.

## Further thinking

What do you think **propagation** means? \_\_\_\_\_

What do you think **homogenous** means? \_\_\_\_\_

What is **hydroponics**? \_\_\_\_\_

Use a search engine to check your answers.

# Waterproofing crops

## Helping crops lose less water during drought

Harper Adams University has been looking at waterproofing a number of crops over the past 24 years.

Waterproofing a crop means adding a layer to reduce the amount of water lost through transpiration. This is important for crops in areas that can suffer with droughts. It's hoped that by waterproofing a crop the yield losses won't be so great. The researchers are hoping to find natural waterproofing solutions which could be cheaper and more practical than irrigating crops during times of drought.

PhD student Michele Faralli carried out research to determine the effects of waterproofing oilseed rape with a spray derived from conifer plants.

Oilseed rape has become an increasingly-valuable crop, with greater amounts being grown due to its usefulness as a cooking oil and biofuel. But the crop is highly susceptible to drought.

Michele said: "I have been using a natural waterproofing spray, derived from conifer plants, on oilseed rape samples in both greenhouse and field environments. I hoped to see if it led to plants retaining more water during drought.

"The field experiment results showed a 50 per cent increase in yield when a droughted crop was sprayed, compared to the crop not being sprayed. This built on my previous greenhouse research which found a yield increase of 30 per cent."

Researcher Kelly Racette conducted an experiment to see if a wax, derived from cauliflower leaves, which is a waste product, can help peanuts retain water in drought situations.

Peanut is generally considered a drought-tolerant species, in comparison to other crops, so is frequently grown in places where there's a lack of rain. The hardiness of the crop and its popularity as a staple food due to its calories and protein have meant that there's been an increased population of farmers growing peanut in marginal and semi-arid to arid lands in the United States of America. However, these environments often experience unpredictable rainfall patterns, which are becoming even more erratic due to global climate change.

To test the effectiveness of the leaf wax, Kelly tested three applications on two different types of peanut. The three applications were: water, the leaf wax and Vapor Gard, which is a commercial product that reduces water transpiration, **cold desiccation**, heat stress and drought stress. She also looked at plant water use, leaf temperature, the rate water vapour passes through the stomata, **chlorophyll fluorescence** and leaf area to see how the leaf wax compares to the other two applications.

Kelly said: "The benefits of leaf wax over the commercial product, if it works well, are it could be cheaper, more environmentally-friendly and sustainable due to being created from a waste product.

"Potentially, I could take what I learn from this experiment back home with me, to help local farmers. The area that I come from in America has a number of peanut farmers, and they are starting to find it more difficult to grow their crops because of the unpredictability of the weather."

## Further thinking

What do you think **cold desiccation** means? \_\_\_\_\_

What is **chlorophyll fluorescence**? \_\_\_\_\_

Use a search engine to check your answers.



# Historic crop holds key to health benefits

*“There is evidence that the beta glucan in naked barley can help with type 2 diabetes.”*

A research project at Harper Adams University, looking at increasing the yields of a special type of barley, is producing promising results.

Naked barley was an important crop in the Bronze Age, but since then has almost been forgotten in the UK. The varieties of naked barley adapted to the British climate have long since been lost, and those from further afield perform poorly in wetter, cooler summers, but its health benefits are so great that a research project is underway to produce a variety that is more versatile.

Dr Edward Dickin, lecturer and project lead, said: “There is evidence that the beta-glucan in naked barley can help with type 2 diabetes as it aids **blood glucose metabolism**. **Type 2 diabetes** currently accounts for just over 8 per cent of the annual NHS budget. It also supports controlling cholesterol levels.

“These health benefits are hard to ignore, and this is why a number of undergraduate students and I have been looking at producing a barley crop better adapted to the UK climate.”

Due to the naked barley’s structure, the whole grain is able to be used

without processing. Oats contain beta-glucan as well, but it needs specialist milling equipment and heat treatment.

Ed added: “Naked barley hasn’t been a common crop here since the Bronze Age because the yield quantity is lower than covered barley, making it an unviable crop for farmers. We hope to change that.

“I’ve been crossing naked barley varieties from around the world to try and find a variety of the crop which is suitably adapted to the UK climate and produces higher yields.

“From the current generation we’re working on, we’re getting a good yield, but further testing needs to be done.

“Several food companies are interested in the crop and the first product made from UK-grown naked barley, tasty barley flakes for porridge and baking, went on the market in 2016.

“When most people think of barley they will probably think of beer. Beer uses a different variety of barley that has actually been bred to reduce beta-glucan because it reduces alcohol yield.”



## Further thinking

What do you think **beta-glucan** is? \_\_\_\_\_

What do you think **blood glucose metabolism**? \_\_\_\_\_

What is **type 2 diabetes**? \_\_\_\_\_

Use a search engine to check your answers.

# Activity 1

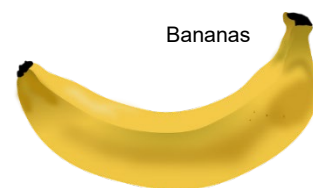
## Where does our food come from?

Write as many countries as you can think of where each food product on the right comes from. There are some clues on the map to start.

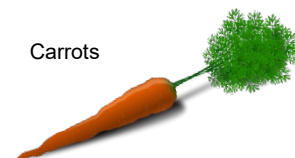


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Now research other products and create a match-up exercise for someone else to answer. This [picture](#) might help you



Bananas



Carrots



Peanuts



Rice



Cocoa beans

## Activity



### Activity 2

## Match the Grain

Open the 'Match the Grain' PowerPoint.

View the PowerPoint in presentation mode and navigate using the arrows and the pictures for your answers.

Work your way through Level 2.

Level 1 is aimed at primary school pupils, but it'll provide some good clues to the answers for Level 2 if you struggle!

## Activity

### Activity 3

## Grain Chain

Work your way through the resources below. They are from [Grain Chain](#), a website with a wealth of resources about farming and the baking industry.



Wheat farming



Wheat milling



Industrial bread making



Grain Chain presentation



Grain Chain worksheet



Interactive quiz





## Activity 4

### Reproducing with cones

Many tree species rely on pollinators to reproduce. Hazel, crab apple and rowan are all examples of flowering trees that are pollinated by bees and other insects.

Conifer species produce cones rather than flowers and rely on wind pollination. Male cones generate pollen, which is carried by the wind to the female cones, which then use it to develop seeds. The hard scales of the cone protect the new seeds as they grow.

In some conifers, male cones sit higher in the tree than female cones, allowing the pollen to be carried further by the wind.

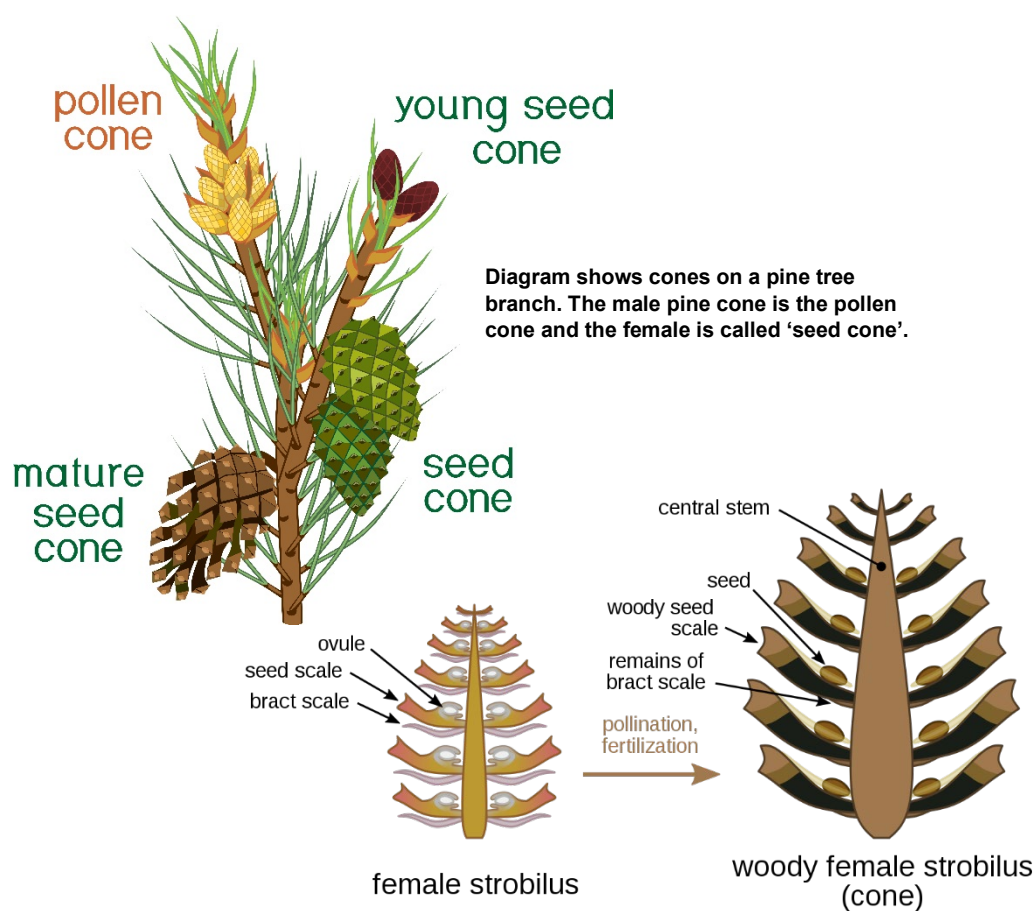


Diagram shows an unfertilised female cone and a fertilised female cone. Image: Nefronus

The seeds of a conifer are winged seeds. When they are released by the cone, they will float on the wind until they reach the ground where they will germinate and grow.

The Ducksters website looks at a number of ways non-flowering plants reproduce. Have a read through the summaries and then answer the quiz at the bottom.



Record your score here

Choose another plant (maybe one covered on the Ducksters website) that you haven't studied before.

Find out more about how it reproduces and create a presentation, video or document to show someone else the process involved.





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### **Responsibilities include:**

- Study plants and soil to develop better techniques to improve crop yield
- Research and promote farming practices or products that lessen the effects of changes in soil, climate, and weather or prevent damage from pests
- Visit fields to collect seed, plant, and soil samples and testing samples for nutritional deficiencies, diseases, or other changes
- Assisting with plant selection and the development of planting and irrigation schedules, budgets, and timelines

### **Requirements include:**

- Degree in agronomy, agriculture, or related field
- Driving license and willingness to travel
- Willingness to work outside
- Proficiency with computers
- Exceptional active listening and verbal and written communication skills

## **Agronomist**

An agronomist is like a doctor for plants. They visit farmers' fields and advise on treatments for the crops to try and gain the highest yield possible.



## Farm Manager

The farm manager oversees the farm. They make business decisions about the farm's activities, along with looking after the finances and marketing of the farm's products.



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### Responsibilities include:

- Manage farm finances and production
- Practical activities, such as tractor driving, operating machinery or spraying fields
- Market farm's products
- Buy supplies, such as fertiliser and seeds
- Understand the implications of the weather
- Ensure products are ready for deadlines
- Maintain knowledge of pests and diseases
- Protect the environment and maintain biodiversity

### Requirements include:

- Previous hands-on farming experience is as important as academic qualifications
- A degree is greatly valued, most farm managers have at least a degree or foundation degree in agriculture or a related subject
- Willingness to be outside
- A range of skills including an understanding of machinery, marketing, finances and negotiations



# Food Buyer

A food buyer is responsible for planning, selecting and purchasing quantities of goods and merchandise that are sold in supermarkets. They source new and review existing goods to ensure their products remain competitive.



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## **Responsibilities include:**

- Analyse consumer buying patterns and predict future trends
- Liaising with existing suppliers and negotiating contracts
- Sourcing and building relations with new suppliers
- Sourcing and selecting new products
- Monitoring market changes, competitor prices and products
- Keep up to date with market trends and react to changes in demand and logistics

## **Requirements include:**

- A degree in agriculture, agri-business or food could be advantageous. A degree in retail or business could equip you with greater commercial awareness
- Able to work under pressure
- The majority of your time will be spent in an office, although there may be travel off-site or even internationally
- Good communications and negotiation skills



## Plant Breeder

Plant breeders/geneticists aim to develop useful traits in plants, such as disease resistance and drought tolerance.



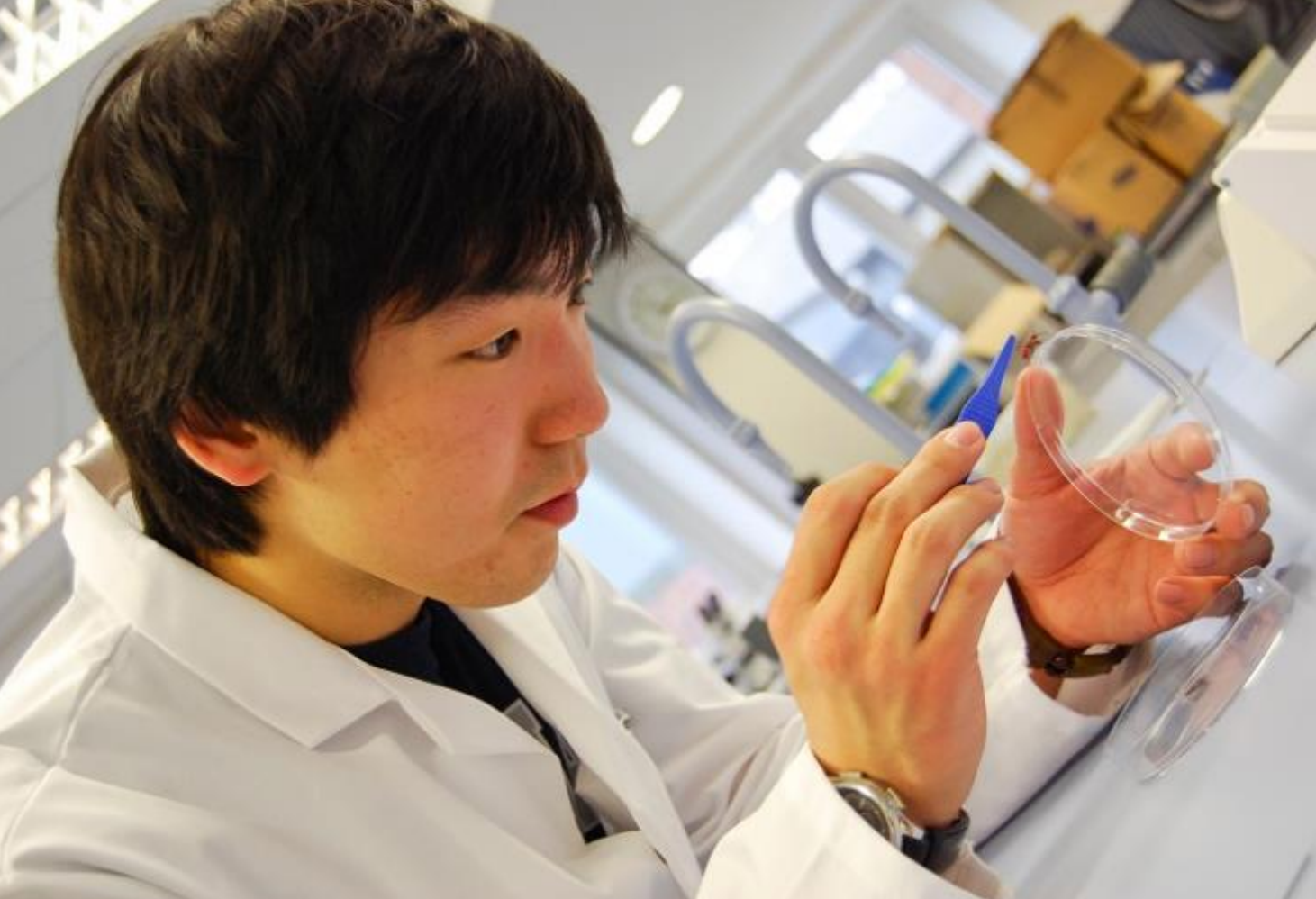
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### **Responsibilities include:**

- Research methods and techniques for improving plant breeding
- Produce research aims and objectives, and predict the cost of the work
- Identify and select plants exhibiting desirable traits, based on natural genetic variation
- Cross plants to produce new breeding material for field and glasshouse trials

### **Requirements include:**

- A good honours degree. Relevant subjects include life and medical sciences and agricultural and horticultural sciences
- Good problem-solving skills
- Strong communication skills
- Strong team-working skills
- An analytical and investigative mind
- Computer literacy



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**Responsibilities include:**

- Collect and manage field specimens
- Conduct air, water, and soil samples for data collection about habitat and ecology
- Provide guidance to stakeholders in order to solve complex and widespread pest control problems
- Work with a holistic ecological mindset to develop and troubleshoot robust solutions and pest management plans
- Review current literature on an ongoing basis

**Requirements include:**

- Some entry-level positions are open to candidates with bachelor's degrees in entomology or related scientific fields, such as biology
- Comfortable with insects
- Strong observation skills
- Good communication skills
- Critical thinking skills

# Agricultural Entomologist

An agricultural entomologist studies how to protect crops from pests, without harming beneficial insect species like bees.



## Drones Operator

Data on crop performance is now being collected by drone and moving forward it's likely that more farming operations will be carried out by drones



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### Responsibilities include:

- Plan flight paths
- Test flight equipment
- Carry out aerial surveys
- Gather digital images and data
- Produce maps based on flight data
- Work with other professionals to interpret data

### Requirements include:

- Permission for Commercial Operations (PfCO)
- Other qualifications may be required depending on the work being undertaken
- Pay attention to detail
- Flexible and open to change
- Work well under pressure



## Activity 6

### Crops project

Hopefully you've read through all of the information in this pack, on the linked websites and had a go at a few of the games.

As a final activity write a short piece (at least 350 words, although it can be as long as you want) about your experience of using the pack.

You might want to discuss:

- What you knew about agriculture and crops before this pack and highlights of what you've now learnt
- A fact that you didn't know before that you found interesting
- Anything that you found challenging
- What you enjoyed doing the most
- Something you'd like to learn more about or another area you'd like to explore

Once you've written your piece, why not send it to:

[schoolsliasion@harper-adams.ac.uk](mailto:schoolsliasion@harper-adams.ac.uk) so we can see what you thought about the experience. We love hearing from you.

## Further Thinking

Now you've worked your way through the pack that we've created and reflected on your experience, is there another activity or area that you think we should include? Or something that you think would be fun for primary school children to engage with that relates to crops?

Have a go at creating your own activity on your chosen topic, be that a worksheet, presentation or other form of delivery.

When your activity is ready, why not send it to us? You never know, we might use it in future school activities! [schoolsliasion@harper-adams.ac.uk](mailto:schoolsliasion@harper-adams.ac.uk)



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**Thank you for completing your activities  
around crops. We hope you enjoyed  
learning more and getting creative.**

**If you would like to have a look at more of  
our education packs, please visit our  
website for more information.**

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