The Farm Tech Challenge

Contents

Increasing agricultural productivity to feed a growing world population whilst protecting biodiversity, soils, and the health and safety of people on the farm is one of the biggest challenges facing humanity. Syngenta has established **The Good Growth Plan** to work together with partners to address this challenge. It is clear that the application of science and technology will have an important role to play.

The Farm Tech Challenge

Today's students will be crucial to the development of new solutions. Syngenta has joined with partners from universities, engineering institutes and farming to launch The Farm Tech Challenge to encourage the next generation to not only think about the issues facing the world, but also to foster the skills and innovative thinking that will help meet these challenges in the future.

The Challenge is for students aged from 11 to 14 to come up with a project utilising digital technology to address one of the themes of The Good Growth Plan:

- Make crops more efficient: producing more food in a sustainable way.
- Rescue more farmland: protecting soil and reducing erosion.
- Help biodiversity flourish: looking after all wildlife in a farmed environment.
- Empower smallholders: finding solutions that work on a small scale in rural communities.
- Help people stay safe: improving the health and safety of all people on the farm.

To align with the curriculum, the project will need to demonstrate an input-processing-output approach, with students utilising technology and combining data with an element of programming to deliver a solution that will fit with the themes of the Challenge.

Why have we launched The Farm Tech Challenge?

- To show that agriculture is a modern, technically advanced industry.
- To encourage the next generation to not only think about the challenges facing the world, but also foster the skills and innovative thinking needed for a career in the industry.
- To provide students with the opportunity to experience real-life applications of technology that will help meet these challenges in the future.

Why should students get involved in The Farm Tech Challenge?

Students who participate in this Challenge will develop skills and experience which directly relates to a range of STEM subjects and careers; this could include project management, logical analysis, problem-solving and quantifying aspects of an activity.

Society needs people who are skilled in these areas; it is these people who provide us with clean water, eradicate diseases, design and build homes and provide communication systems. These skills are essential for those at the front line of research to tackle climate change, provide cheap clean energy and feed a growing population. It could well be that involvement in activities like the Challenge, first sparks an interest or acts as a catalyst, leading to a lifelong involvement in STEM subjects.

Challenge Timeline: Key Dates

5th September 2016	Farm Tech Challenge Launch
September 2016 to March 2017	Window' for Students to Work on Project*: • Form Team • Research • Planning • Programming/Making • Testing, Evaluating * We have given a wide window to allow flexibility as to when teams are able to work on the Challenge. For example, there would be no disadvantage to a team if they did not start the project until January.
29th March 2017	Submission deadline: • Written Submission • 3 Minute Video Pitch • Registration Form
April 2017	Judging Finalists Notified
Early June 2017	Farm Tech Experience – Finals • Winners Announced • Prizes for Schools and Students

The Good Growth Plan

The Good Growth Plan is Syngenta's commitment to make a measurable contribution to the planet by 2020. It sets six specific targets related to improving resource efficiency, rejuvenating ecosystems and revitalising rural communities.

Make crops more efficient

To feed its growing population, the world will have to grow more food in the next 50 years than it has produced in the past 10,000. This huge increase in production needs to be achieved while using resources far more efficiently. The challenge will be even greater if climate change continues to disrupt temperature and weather patterns.

Rescue more farmland

Every second the world loses an area of farmland the size of a football field to soil erosion, desertification and urban expansion. Poor farming practices expose soil to wind and rain erosion, leaving millions of hectares infertile each year; an area large enough to feed Europe is too depleted to produce food.

Help biodiversity flourish

The sustainability of agriculture depends on biodiversity; more than a third of the world's agricultural crops depend on pollination, but pollinator populations are falling. Changing agricultural practices have altered rural landscapes and natural habitats. Expanding the use of land for crops can reduce forests, meadows and hedgerows that provide food and shelter for flora and fauna that make a sustainable agricultural landscape.

Empower smallholders

Over 2.5 billion people depend on agriculture for their livelihoods. Smallholder farmers are critical to the world's food security, yet they often face high financial risks and low returns. Every day 180,000 people leave rural communities to live in cities. Ensuring that farming is a viable and attractive occupation will help to create vibrant, productive rural communities.

Help people stay safe

Agriculture is the world's second largest source of employment, often involving long hours and heavy work in challenging climates and harsh conditions. We have a responsibility to help improve occupational safety and health in agriculture.

Look after every worker

We recognise a responsibility to ensure that our supply chain meets internationally acceptable standards, especially in developing countries. If the agricultural sector does not offer fair and attractive conditions for its workers, population drift from rural communities to cities will steadily undermine efforts to increase agricultural production.

More information can be found at: **www.goodgrowthplan.com**

The Technology

The choice of the technology used by students in the Challenge is obviously critical and will be influenced by a number of considerations, including:

- the nature of the project
- the experience of the students
- the equipment available

One approach could be to use a device such as Raspberry Pi, Arduino or BBC Micro:Bit. These offer a number of advantages such as being relatively cheap, low power, portable and input/output devices can be easily connected. Alternatively, a PC or Mac could be used as the basis for a solution; or the programme used could be configured as an app.

It is important that whatever device or system is used is one that:

- is fit for purpose
- enables students to effectively design an **'input-process-output'** system
- incorporates an element of programming
- allows students to demonstrate their proficiency in developing and testing the system.

Examples of different types of input-process-output approaches are listed in the Students Toolkit.

Valid and invalid system designs

If the input was weather data directly from a weather station, sensor or data source (e.g. Met Office data extracted by postcode) and the output was turning on an irrigation system, this would be a valid approach as there is a clear interaction between the systems. However it would not be valid to enter a project in which the programme asked the farmer to input when it last rained and what the temperature is, did a calculation and then told them when to turn on irrigation, because there is no direct interaction between the systems.

Use of apps

To be valid, an app would have to interact with external systems for inputs and outputs. An example would be the 'Hive' app for thermostatic heating control (an example of the emergence of the 'internet of things'). It would be unlikely that in the context of the competition a working app would be created; rather, there should be some level of prototyping with the inputs and outputs as well as an understanding of how the programming would sit in the middle.

Coding / programming

This is not a coding competition and we are not asking for a submission of the code. However, evidence of the application of logic and the use of programming should be clear in the submission (this could be a direct demonstration or through a block diagram/flow chart in either the video pitch or written submission).

Some example projects are listed in the Students Guide to help stimulate ideas.

The Submissions Process

To be eligible to make an entry, students should be between the ages of 11 and 14 (as at 1st September 2016)

Entries can be made by groups of up to five students:

- Entries are admissible from individual students; these will be judged alongside entries from groups.
- Entries may have had the involvement of a larger group; however up to five students need to be named as leading and co-ordinating the project.

Each submission should consist of:

1. **A registration form:** A registration form completed by the teacher/ tutor is required to accompany each entry submitted. This can be downloaded from www.farmtechchallenge.co.uk.

2. **Written submission:** Each team is required to provide a written submission of no more than 1500 words. The submission form can be downloaded from www.farmtechchallenge.co.uk.

3. **Video pitch:** A video pitch lasting no more than three minutes.

The submission should provide the judges with evidence against all the criteria. The Students' Toolkit includes prompt questions and Hints and Tips which may be useful.

How to Submit Entries

Completed registration and submission forms, together with video files (as an MP4) should be emailed to **learningzone.uk@syngenta.com.**
This can be done using a FREE online file transferring platform such as **WETRANSFER.com** or **HIGHTAIL.com**.

Deadline date for submissions is 23.59 hours on **Wednesday 29th March 2017.**

Note

- Please ensure files are clearly and consistently labelled with the name of the team and your school for easy cross-referencing.
- All entries should be submitted electronically. We are unable to accept postal entries.

The Judging Criteria

Entries will be judged by a panel of experts drawn from the spheres of agricultural science, digital technology and education.

The judges will consider both the written submission and the video when judging and each of the criteria will have equal weighting:

1. The project should be based on a need that is relevant to the aims of the Challenge and priorities of Syngenta's Good Growth Plan. It should address one or more of the areas of productivity, biodiversity, soils and safety. ***(20 marks)***
2. The project should demonstrate originality and creativity in the development of a solution. ***(20 marks)***
    - How has the project developed from its inception to the finished product?
    - How is the project better than current solutions on the market?
3. The solution should be developed in a logical and rigorous way, including the selection of hardware, use of software, role of programming and testing of the product. ***(20 marks)***
    - Does the entry have well thought out reasons behind the technology chosen for the project?
    - How is the technology better/more appropriate than other tech available?
4. Both the process and the outcome should be clearly and thoroughly evaluated. ***(20 marks)***
    - How effectively does the solution address the problem?
    - Have the team considered how easily the solution could be used on a real farm?
5. Key features of both the process and the outcome should be clearly and effectively communicated. ***(20 marks)***
    - The video and entry form should be where the teams 'show their working'; are their ideas effectively communicated?

Judging Process and Prizes

Judging will be in two stages. The first round will create a shortlist of finalists from which a winner will be selected. The judges' decision will be final.

All finalists will be invited to a 'Farm Tech Experience'. This will be at a Syngenta site, a university department or industry partner where students will be able to see science and computing in action and present their idea to a panel of experts from agriculture, education and industry.

All shortlisted entries will be provided with written feedback on the quality of the submission, indicating the views of the judges on strengths and areas for development. No feedback can be provided on other entries.

Using Social Media

You can spread the news of your participation in The Farm Tech Challenge using your school's communication channels. This could include communications that go out to parents, governors, teachers and the local community.

The Farm Tech Challenge team will be posting regular updates, useful links and videos, through our Twitter, Facebook and YouTube accounts.

You can follow us and join the conversation at…

- Farm Tech Challenge UK
- @FarmTechUK
- Farm Tech Challenge UK

If you regularly update your Twitter account through the duration of the Challenge, don't forget to include #FarmTechUK so we can see your tweets too.

We've provided a handy Schools' Media Pack with suggestions and tips for engaging your local press, radio and TV with news of your Farm Tech Challenge activities.

Useful Links

The Students' Guide aims to prompt team members into thinking about how they might approach the Challenge. There are a number of areas of wider reading and research that are relevant and some links are provided here for interest and convenience.

Syngenta has a range of materials available, some of which are aimed specifically at students and others with a broader perspective on meeting future challenges:

- The Good Growth Plan: www.goodgrowthplan.com
- Syngenta Learning Zone: www.syngenta.co.uk/learningzone

Hardware and software:

It may be useful to consider options in terms of the hardware and software used; these need to be appropriate for the skills and experience of the students involved as well as being fit for purpose for the project. Kit may already be available that is an obvious choice, but there may be a role for a wider consideration of options. It would be unfair to guide participants towards certain products but making prudent decisions at this stage will have an impact on the quality of the work and the entry. Two organisations that can provide quality guidance are referred to here; their advice will also help to place the students' activities in the wider context of their overall education.

- A really useful and comprehensive guide has been prepared by Computing at School (CAS) and NAACE called "Computing in the National Curriculum: a guide for secondary teachers". Included in this is a section on Resources (pp 20-21), which includes information about programming languages, hardware and software. It can be downloaded from www.naace.co.uk/publications/cas-computer-guide-for-secondary-teachers/

Both CAS (www.computingatschool.org.uk) and NAACE (www.naace.co.uk) are useful organisations. CAS offer a daily bulletin on CPD events, discussions and resources; and NAACE provide various types of support which group leaders are likely to find useful.

Software to support the development of apps:

If the decision is made to develop a solution that involves the use of apps, these sites may provide relevant information about designing and testing.

- Apps in education blog: http://appsineducation.blogspot.co.uk/2011/10/app-building-tools-for-teachers-and.html
- POP: https://popapp.in/

Examples of software and systems designed to help farmers:

Some farmers already make use of information processing systems to improve the quality of their products. Although these are fully developed commercial systems, their approach is directly relevant to this Challenge in that they are gathering inputs, processing data and providing outputs.

SmartVineyard™: http://smartvineyard.com/

Semios Orchard Management: http://semios.com/

OnFarm Decision Farming: http://www.onfarm.com/

More examples can be found at the Farm Tech Challenge Facebook (Farm Tech Challenge UK) and Twitter (@FarmTechUK) pages

Research on strategies to maximise plant yield and minimise resource use:

There is a lot of research around improving the efficiency and effectiveness of agriculture. These sites provide some ideas and may prompt thinking about how a system might provide support:

- Alternate wetting and drying: www.knowledgebank.irri.org/training/fact-sheets/water-management/saving-water-alternate-wetting-drying-awd
- Precision farming:
  - www.harper-adams.ac.uk/initiatives/national-centre-precision-farming/precision-farming.cfm
  - www.ipf-uk.com/precision-farming
  - www.ursula-agriculture.com
- Electronics in agriculture: www.eee.manchester.ac.uk/our-research/research-themes/e-agri
- MySoil app: www.bgs.ac.uk/mysoil

UK Strategy on Agricultural Technologies:

The UK Government's Agri-Tech Strategy outlines the steps needed for the UK to become a world leader in agricultural technology, innovation and sustainability. This fits very nicely with the Farm Tech Challenge and this document explains how new technologies, products and services can lead to productivity gains in the UK and also contribute to international development:

- https://www.gov.uk/government/collections/agricultural-technologies-agri-tech-strategy

Curriculum Links

Computing

KS3

- design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems
- understand several key algorithms that reflect computational thinking [for example, ones for sorting and searching]; use logical reasoning to compare the utility of alternative algorithms for the same problem
- use two or more programming languages, at least one of which is textual, to solve a variety of computational problems; make appropriate use of data structures [for example, lists, tables or arrays]; design and develop modular programs that use procedures or functions
- understand simple Boolean logic [for example, AND, OR and NOT] and some of its uses in circuits and programming; understand how numbers can be represented in binary, and be able to carry out simple operations on binary numbers [for example, binary addition, and conversion between binary and decimal]
- understand the hardware and software components that make up computer systems, and how they communicate with one another and with other systems
- understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits
- undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users create, re-use, revise and re-purpose digital artefacts for a given audience, with attention to trustworthiness, design and usability
- understand a range of ways to use technology safely, respectfully, responsibly and securely, including protecting their online identity and privacy; recognise inappropriate content, contact and conduct and know how to report concerns.

Science

KS3

Photosynthesis

- the reactants in, and products of, photosynthesis, and a word summary for photosynthesis
- the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere

Relationships in an ecosystem

- the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops
- the importance of plant reproduction through insect pollination in human food security
- how organisms affect, and are affected by, their environment, including the accumulation of toxic materials.

National Curriculum Programme of Study for Science at KS3, 2013

Design Technology

KS3

Design

- use research and exploration, such as the study of different cultures, to identify and understand user needs
- identify and solve their own design problems and understand how to reformulate problems given to them
- develop specifications to inform the design of innovative, functional, appealing products that respond to needs in a variety of situations
- use a variety of approaches [for example, biomimicry and user-centred design], to generate creative ideas and avoid stereotypical responses
- develop and communicate design ideas using annotated sketches, detailed plans, 3-D and mathematical modelling, oral and digital presentations and computer-based tools

Evaluate

- analyse the work of past and present professionals and others to develop and broaden their understanding
- investigate new and emerging technologies
- test, evaluate and refine their ideas and products against a specification, taking into account the views of intended users and other interested groups
- understand developments in design and technology, its impact on individuals, society and the environment, and the responsibilities of designers, engineers and technologists

Technical knowledge

- understand how more advanced electrical and electronic systems can be powered and used in their products [for example, circuits with heat, light, sound and movement as inputs and outputs]
- apply computing and use electronics to embed intelligence in products that respond to inputs [for example, sensors], and control outputs [for example, actuators], using programmable components [for example, microcontrollers].

National Curriculum Programme of Study for Design Technology at KS3, 2013

The Farm Tech Challenge Partners

Syngenta is a leading agricultural company helping to improve global food security by enabling millions of farmers to make better use of available resources. Through world class science and innovative crop solutions, our 28,000 people in over 90 countries are working to transform how crops are grown. We are committed to rescuing land from degradation, enhancing biodiversity and revitalising rural communities. To learn more visit www.syngenta.com and www.googgrowthplan.com.

Working in partnership is one of the important underlying principles of The Good Growth Plan. It is only through working together that we will be successful in meeting these global challenges.

The Farm Tech Challenge partners are:

Institute of Agricultural Engineers (IAgrE) www.iagre.org
The IAgrE is the professional body for engineers, scientists, technologists and managers in agricultural and allied land based industries, including forestry, food engineering and technology, amenity, renewable energy, horticulture and the environment. We are a registered charity working for the public benefit through bringing together academics, practitioners and industry to share knowledge and promote professionalism in the advance and application of technology in the land based sector.

University of Manchester www.eee.manchester.ac.uk
As one of the largest electrical and electronic engineering schools in the UK, we are known for our theoretical and applied research. We have been educating engineers for over a century and our courses are informed by the needs of industry, influenced by the latest research and taught by knowledgeable, enthusiastic experts. Integrating sensors, electronics, control, power systems and ICT engineering into agriculture is a key enabler for delivering improved food supply and sustainable energy production.

Harper Adams University www.harper-adams.ac.uk
With a reputation for excellence and innovation, Harper Adam's campus offers state-of-the-art facilities and rewarding courses for undergraduate, postgraduate and lifelong learners in agriculture, agribusiness, animal, engineering, food, rural and land-based studies. The National Centre for Precision Farming is based at the Agricultural Engineering Innovation Centre at the University and helps farmers and other stakeholders understand and apply precision farming methods.

Farming and Countryside Education (FACE)
www.face-online.org.uk
Farming and Countryside Education is the leading charity helping primary and secondary schools to engage with food, farming and the countryside. We equip teachers to create engaging experiences for their pupils that address such issues as health, the environment and food security, while gaining first-hand knowledge of the science and business of farming.

Bright Crop www.brightcrop.org.uk
Organisations from across the industry, including food manufacturers, machinery engineers and scientific researchers have come together to introduce young people to the uniquely diverse and rewarding careers on offer. Bright Crop lets you explore a wide range of job roles, see what the jobs are really like, get tips from the experts, and start to plan your route to a career in farming and food supply. The Agri-Food industry needs talented individuals with the ideas and the know-how to meet current and future challenges
Our Ambassador network is made up of professionals from within the Agri- Food supply industry who volunteer their time to inspire students in schools about agricultural careers.

Linking Environment And Farming (LEAF) www.leafuk.org
LEAF is the leading organisation promoting sustainable agriculture, food and farming. We help farmers produce good food, with care and to high environmental standards, identified in-store by the LEAF Marque logo. We build public understanding of food and farming in a number of ways. These include Open Farm Sunday and year round farm visits to our national network of LEAF Demonstration Farms.

Farm Business www.farmbusiness.cc
Farm Business is targeted at large scale farming operators in the UK with content for dairy, beef, arable, sheep, pigs, poultry, vegetable and fruit producers. The aim of Farm Business is to engage with all levels of the food chain from primary production through to retail, in a thought provoking and informative style. Editorial aims are to offer positive and progressive articles on technical, business and marketing aspects that enable UK farmers to operate more efficiently, competitively and profitably.

Zinc Media www.zincmedia.com
An award-winning communications company specialising in creating programmes and initiatives to support teaching and health professionals to educate, inform, and drive positive behaviour change amongst children, young people and their families for clients such as BMW, Syngenta, Siemens, Nationwide Building Society, Transport for London, Sanofi Pasteur MSD and AstraZenca.