The Guardian



Virtual fences, robot workers, stacked crops: farming in 2040

Population growth and climate change mean we need hi-tech to boost crops, says a new report

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Sun 17 Feb 2019 07.00 GMT

It is 2040 and Britain's green and pleasant countryside is populated by robots. We have vertical farms of leafy salads, fruit and vegetables, and livestock is protected by virtual fencing. Changing diets have seen a decline in meat consumption while new biotech production techniques not only help preserve crops but also make them more nutritious.

This is the picture painted in a report from the National Farmers Union which attempts to sketch out what British food and farming will look like in 20 years' time.

"The *Future of Food 2040* report is a catalyst to encourage us all to start the debate about our food and our future so we can plan ahead," said Andrea Graham, NFU's head of policy services and author of the report, who interviewed 50 experts across Britain's food chain to gauge their views. "It is also a reminder for government, at a critical time in British history, to make domestic food production a strategic priority in all policy making."

While some of the predictions may seem a long way off, others are already in their infancy. "Even now, there are technologies being developed that can care for crops on a plant-by-plant Virtual fences, robot workers, stacked crops: farming in 2040 | Environment | The Guardian



Andrea Graham, the report's author. Photograph: Toby Lea

basis or control the grazing of cattle without physical fences, and by 2040 this technology will be commonplace in farming," Graham said.

The British farming sector will need to be more efficient if it is to meet a key NFU goal of producing net zero greenhouse gas emissions by 2040. "Over the next 20 years we will face potentially seismic changes in all aspects of society," Graham added. "An increase in the global population and the need to mitigate climate change will provide opportunities for British food and farming to increase productivity and reduce its impact on the environment."

The introduction of vertical stacking and recent advances in LED technology will expand the range of crops that can be grown using hydroponics, aquaponics and other controlled environment systems. Worldwide predictions suggest that the vertical farming industry will grow to be worth billions of pounds over the next few years. Leafy salads,

and some vegetables and fruits will be widely grown using the technology. However, its high energy consumption will need to have been overcome, and certain crops will remain difficult to grow, the report acknowledges.

Another key trend will be 3D-printed food, which will produce "intricate sculptures out of everyday foodstuffs that will look good and will also be used to improve the convenience and the nutritional value of meals". This will enable more food to be produced on demand, reducing wastage.



A robotic strawberry picker, designed by the University of Essex. Photograph: NFU

With the UK on course to be the most obese nation in Europe by 2030, a greater focus on healthy food will emerge. The popularity of flexitarian diets, which are predominantly vegetarian with only occasional meat and fish consumption, is likely to continue to increase. Already 41% of meat-eaters currently classify themselves as flexitarian, and the percentage of meat-free evening meals is on the rise in Britain, according to research from Kantar Worldpanel. In-vitro meat, cultivated from animal cells rather than from slaughtered animals, and insect protein "may well grow in popularity depending on advances in making these protein sources more palatable, and the ability for them to be produced cost-effectively at scale", the report says.

On farms, technology will play an increasingly pivotal role. Nano-sensors will be able to collect an array of information, such as soil data and moisture levels, reducing the need to perform daily routine jobs such as checking fuel levels and temperatures.

The use of unmanned aerial vehicles (UAVs), or drones, for sensing and mapping will become widespread, while robots will perform labour-intensive tasks such as fruit picking, milking, livestock feeding and even slaughter.

A growing premium for antibiotic-free meat will see the use of biotechnology in food production become ubiquitous. New breeding technologies, such as genome editing to produce plants and animals with enhanced immune systems and disease resistance, will also become commonplace.

"There's some great technology out there," Graham said. "The problem is that much of it is still just prototypes, and small-scale. "The challenge is: can we scale up? How do we go from a few scientists working with just one farmer to a much wider uptake?"

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