

SPECIAL REPORT

Looking to what the future holds for Scottish farming

4 hrs ago

FARMING SEVEN DAYS FARMING SCOTLAND



Farmer William Rose predicts a growing role for autonomous vehicles (Image: Sally Jubb Photography)

By Kerstin Rodgers

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IN Scotland, farming is looking to the future. Farmer William Rose, from Mid Coul Farms, Inverness, is a third-generation farmer; he is one of two major Scottish producers of organic carrots, the other being the Doric-speaking Mitchell brothers at

Brexit also made the cost of farm labour difficult to access. “We chartered planes and buses from Poland,” he recalls. But Eastern **Europe** is booming, and William thinks the Polish soon won’t be content to be agricultural workers.

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What must farmers address to prepare for the future? “Our unique issue is hand weeding: we desperately need to automate that process,” he says.

Replacing humans

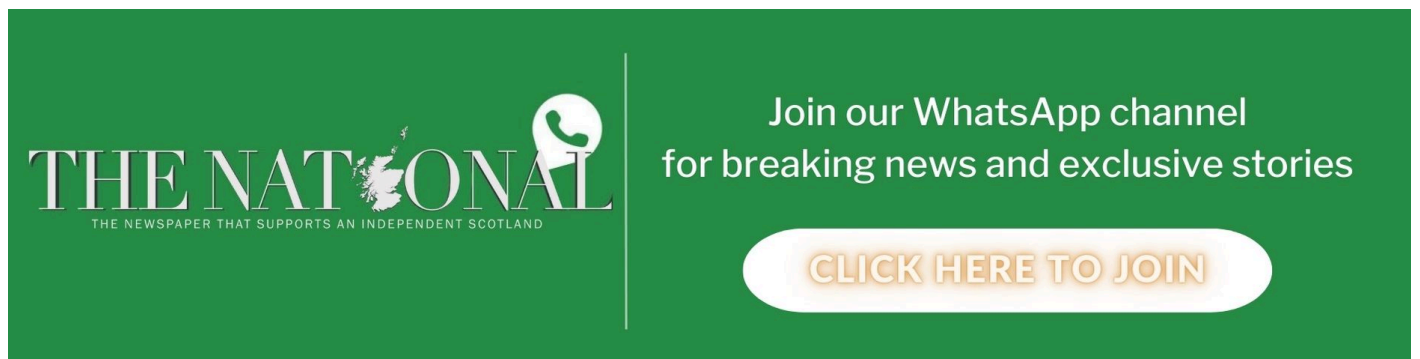
The answer is robotics. The latest innovations from the United States are spearheaded by companies such as Carbon Robotics. Their laser-weeding machines, which sound like something out of Star Trek, are currently extremely expensive (\$1.3 million).

In the States, this is affordable as farming is on a much bigger scale. “They have the climate to grow all year round.” William said. “Here we are planting for 10 days every year. We’re weeding for six to seven weeks of the year. But in America, they’re weeding every day for the whole year.”

William is looking to invest in similar German technology from Escarda which is more reasonably priced: “Today, some kit arrived from Germany, which we’re going to fit into one of our tractors. It will allow us to video the growth every couple of days of a carrot bed, so that they can feed that into their AI algorithms.

“You train it to recognise this is a three-day-old carrot, this is a six-day-old carrot, this is a nine-day-old carrot. So everything which is not any of the above, they can kill it with a laser.”

So this is precision farming, like keyhole surgery? “It’s like 5000 strikes every minute,” Williams explains. “If you’re looking at it at night, wearing protective goggles, you’d see thousands of beams coming out and killing weeds.”



There are other options: “Blasting hot **oil** onto the weed or maybe using hot water. There’s a number of ideas out there on how you kill weeds. Obviously, the ones that don’t use chemicals are going to be the best ones long-term.”

In the future, William says, they will farm “per plant”. “We will treat each plant individually – bear in mind that there would be millions of plants per hectare – according to what our system is telling us is a problem. Say there’s an aphid on a particular plant, but none on the others. Today, as we are worried about aphids bringing in disease, we will spray the whole crop. In the new world, we just spray that one aphid. That’s already possible today – but in a lab, not in a field.”

Soil-free farming

In 2015 film *The Martian*, Matt Damon plays an astronaut who is accidentally left behind on the planet Mars. Struggling to survive, we see him running out of food. He uses his knowledge as an agronomist to create an interior allotment with Martian soil, crew waste products and water created from rocket fuel. Eventually, he manages to grow a crop of potatoes.

This is what I’m reminded of during a visit to tomato farm Lapietra in Monopoli, Puglia. A large greenhouse glows with what can only be described as pink neon disco lights. There are rows and rows of tomatoes on the vine, sometimes growing to 15 metres in length, strung back and forth. The plants are suspended over what looks like space-age grow bags, but there is no soil. The stems grow from rock wool cubes called “rootmaxX”.

Farmers as “horny-handed sons of the soil” are now in the past. Instead, we have hydroponic farming for the 21st century, and

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I’m not allowed in, and can only peer through the transparent plastic. Clothes and bodies might contain bugs. This is a sterile

Why farm this way, rather than the traditional method? “We avoid a lot of disease and can increase production [more easily]. We aren’t dependent on the weather,” says Simona. This is also a more sustainable method of farming – they don’t waste water, and their workers move around the farm on bicycles instead of petrol vehicles.

But isn’t all this dependent on electricity? “Yes,” confirms Simone. “No electricity, no crop. We have expensive sensors everywhere and our energy bills are huge – €300 per square metre rather than the traditional €70. But we do use solar energy to offset the cost, and we use generators.” All the delivery vehicles are electric.

Bari is the main city in Puglia, and Simona studied agricultural science there. Agriculture is still the main industry in the region, and this means she can work near where she was brought up.

I see large bins full of delicious tomatoes and wonder why they were thrown away. She laughs: “These are just the rubbish. We give the green tomatoes to the monkeys at the local zoo.”

But William doesn’t see us entirely converting to soil-less farming on Earth. “I can never see a world in which everything we eat is grown in a controlled environment. I don’t believe that that would ever a) be economic and b) be good for the population because you would lose all the nutrition that you get from soil,” he says.

“I’m not sure it’s wise to rely on hydroponic farming compared to soil growing, for the main reason that hydroponic growing only uses 17 different elements, by which I mean NPK [nitrogen, phosphorus, potassium], calcium, zinc, molybdenum. In normal soil, there are 20 billion elements.”

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There are many questions farmers looking to the future don’t currently have answers for, such as the extent to which the elements in soil not present in hydroponics are important. According to a paper for the National Library of Medicine in the US, there is evidence that soil biodiversity is interrelated with the gut microbiome. Put simply, the microbiome of soil may be significant for human health.

Feeding the animals

In Phytovally in Switzerland, the plant equivalent of Silicon Valley in California, I attend a conference held by Nutreco, manufacturers of feed for both land and aquatic animals.

There has been much talk about the gut microbiome in humans, diversifying our diet. Nutreco holds the same ambition, making ‘smart mixes’ for animals.

The thinking goes that if animals are healthier, while it’s good for them even in terms of their short lives, it will have a knock-on beneficial effect for humans. Happier cattle make better-tasting meat and produce more milk, for instance.

To “empower the gut”, Nutreco is working on phytogetic solutions.

Can plants solve animal problems, I ask Dr David Bravo, chief science officer for Nutreco: “We still have a pre-Copernican attitude towards plants. We believe they revolve around us animals. But the opposite is true – animals are not the centre of the universe, plants are. You can solve animal problems with plants.

“Infectious diseases have not disappeared in humans, they’ve morphed into modern diseases, often based on the gut, such as Diabetes 2, MS and Crohn’s.

“Animals are suffering from similar diseases – even wild animals now have diabetes.

“On a Darwinian level, plants are the most successful life forms on the planet. They have evolved to such an extent that they are immobile and can source energy from the sun. “They are masters of biochemistry, turning solar energy into chemical energy. There are 390,000 species of plants, they are 90% of life, the biomass, on planet Earth. The other 10% is animals, land or aquatic and insects. A landscape without plants is lunar.”

Farming by app

In Puglia, I visit a grape farm, Difesa del Canneto in Casamassima. In one corner, improbably pink crimson grapes hang

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as fashionable sartorially, but he stands in the field farming, arm aloft, with an iPhone. I peer closely. With an app, he controls

These Puglian table grapes are particularly sweet, something that is assessed by measuring the Brix level – indicating sweetness – these grapes have a Brix of 18 to 20, rather than the standard 15. Today Brix can be measured by apps.

The farmers I meet are all slaves to the weather, using multiple weather apps to fine-tune the predictions. A bad summer or a hail storm can wipe out a crop, leading to bankruptcy.

New crops and superfoods

Israelis have famously turned deserts into fertile fields. I recently attended a food tech event at the Israel embassy in London. To enter, I pass through a phalanx of security, skirting the 24-hour picket stationed on the corner of the private road in Kensington. Inside there are half a dozen companies.

GreenOnyx, trumpeting “the dawn of a fresh era”, sells a new kind of crop – duckweed, a pond weed rebranded as “water lentils”. The trade name is “wanna greens”, resembling caviar but bright green; a protein-rich food sold in a tub, lasting six weeks in the fridge.

I taste a sweet mini tomato from Supree that self-dries on the vine, thanks to tiny wrinkles on the fruit. These are marketed as a dried snack, which is lighter to **transport** and distribute. Anina transforms “ugly” vegetables, which would otherwise be food waste, into a freeze-dried “bowl” made of courgettes, with a nutrient-rich grain salad inside that you rehydrate in water and microwave. “Airlines are very interested,” says the owner.

Melt & Jet make a freeze-dried mango or coffee “pill” that melts on your tongue and somehow improves your skin, gives you energy and alleviates stress. It looks like the space food that I was given as a child when my parents visited the National Air and Space Museum in Washington DC.

I suck on a product called Jo-Mo – “the joy of missing out sugar” (a play on FOMO, fear of missing out) – a sugar-free, dairy-free chocolate designed for vegans and diabetics.

Food tech today emphasises new ingredients, alternatives to meat, and sustainable foods.

Old and new ways

Back in Scotland, I speak to Ross Mitchell, one of the Mitchell brothers’ sons. He’s recently joined the family firm, after working in an alternative energy start-up in Aberdeen making underwater lithium-ion batteries. Today’s farmers are a far cry from the stereotype of a slightly backward rural guy in a straw hat. Ross has a degree in mechanical engineering.

The farming Mitchell brothers (below) combine ancient and modern – organic farming and high-tech machinery; getting their hands dirty working in the fields while juggling huge financial deals.



(Image: Supplied)

The family are close-knit, living within a five-minute drive from each other, near Turriff. They speak Doric at home, which is an 18th-century dialect. “It’s the third most popular language in Scotland, after English and Scots,” explains Ross.

Alternative energy

Ross thinks the future of green energy in Scotland, due to the particular climate, lies probably in offshore wind rather than onshore.

Eventually, he’d like the farm to use electric vehicles, but he says: “I don’t think an electric harvester is ever going to be possible with the existing technology because it’s just too heavy. Even our diesel engines get stuck because of the challenging conditions.”

GPS

There are so many satellites – around 8000, mostly each the size of a shoe box – circling Earth that they are now a form of “space junk”.

Satellites used for Global Positioning Systems are essential in modern farming, to optimise the routes that tractors take to till the fields. It’s a big step up from the robotic lawn mower I got for Christmas, which presently can’t handle bumps or bare patches.

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Ross Mitchell explains: “I was talking with John Deere (which makes agricultural equipment) last month and they were saying by 2030 there’ll be driverless tractors out in the fields”

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The future of farming

William Rose concludes: "What will happen in farming is that, in my lifetime, most of the operations we do in our fields will mostly be done using autonomous vehicles. "Our staff will be mostly based in the office. We'll have an engineering workshop, where there'll be two guys who react to patrol the field when they go out, having been called out by the system to repair, say, a broken tie-in.

"We'll probably employ fewer people, but there will be much higher-quality jobs that will pay them more. Our crops will be inspected regularly with some kind of system mounted on a drone or mounted on a robot, which will look at each plant."

"Old Macdonald had a farm" picture books that we read to children haven't been representative of farming for some decades, but now things are changing even further and faster, for better or worse.

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