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Tobacco-powered aeroplane to be tested 'within months'

Researchers are getting ready to test a tobacco-powered aeroplane thanks to a new bio jet fuel made from the seeds of nicotine-free plants, and the result could be a 75 % reduction in carbon emissions compared to fossil fuels.

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It's one of a number of projects that are working to convert crops such as tobacco into sustainable energy and materials.

The Issue

The aviation industry is one of the fastest-growing sources of emissions and is responsible for around 3 % of the EU's greenhouse gases.

Using bio-based fuels instead of fossil fuels is one way of reducing the environmental impact of flying.

The EU has set out sustainability criteria for biofuels and bioliquids to ensure real carbon savings and protection of biodiversity.

Dr Sergio Tommasini has a dream: fields of tobacco as far as the eye can see, thousands of hectares of green stretching across South Africa, Brazil and Europe.

But he is not some latter-day pedlar of a cancer-causing weed. In fact, if you smoke one of his leaves you'll likely spit it out in disgust, says Dr Tommasini, managing director of Sunchem Holding, an Italian research and development company.

For this tobacco has no nicotine. It is grown for its seeds, which are rich in oil that can be used to make bio jet fuel.

And a tobacco-powered Boeing plane will be roaring along the Cape Town-Johannesburg corridor conducting tests within months, if things go to plan.

‘It’s going to be the greenest flight ever,’ said Dr Tommasini.

Launched in December 2014, Project Solaris is a collaboration between his company, the sustainable jet fuel supplier SkyNRG, and some private investors, supported by South African Airways and the aerospace company Boeing. The EU has part-funded their feasibility study to test the viability of the process before it is scaled up.

The hybrid tobacco, Solaris, for which Sunchem holds the international patent, currently grows on 50 hectares of land in Limpopo province, in the northeast of South Africa. Some two to three tonnes of crude oil can be pressed from its seeds per hectare per year, says Dr Tommasini.

Solaris has been bred to have leaves much smaller than the flappy ones of a normal tobacco plant, and to have oily seeds. The scientists believe it can overcome the notorious troubles that arose around first-generation biofuels such as sugar cane and maize, accused of competing with food production.

In South Africa, at least, it won’t be food-versus-fuel, but fuel-versus-smokes – and Solaris could also be used in rotation on the 70 000 hectares of cotton plantations in the country, says Dr Tommasini.

Elsewhere, such as in Europe, it could be rotated with food crops, which would enhance the soil and break disease cycles. Meanwhile, the leftovers from seed-pressing yield a rich animal feed.

‘It’s not toxic, so it is feeding into the nutrition cycle,’ he added.

Aviation

So, is tobacco the answer to the dreams of the aviation industry?

In 2015 Solaris became certified by the Roundtable on Sustainable Biomaterials (RSB), a global scheme supported by the World Wide Fund for Nature (WWF), supporting the sustainable production of biofuels and other biomaterials.

Over the lifecycle of the fuel, it will lead to a cut of 75 % in carbon emissions compared with its fossil fuel counterparts, says Dr Tommasini — much better than the threshold of a 50 % reduction set by the RSB.

But Dr Jeremy Woods from the Centre for Environmental Policy at Imperial College London, UK, who is not involved in the project, says that, however hard they try, such lifecycle calculations can’t fully take into account the carbon cost that comes with the clearing of virgin land for cultivation — which can happen indirectly because the original crop has been displaced to some other, previously unplanted terrain.

He recently calculated that four million hectares of land would need to be deployed to biofuel crops in order to supply the aviation industry.

‘On the one hand it’s very unlikely that biofuels could service today’s and the future aviation industry,’ said Dr Woods. But a more nuanced goal, in which biofuels are a partial and intermediate solution, looks more feasible.

‘If you see biofuels as a share of a transition programme, then it suddenly doesn’t look impossible,’ he said.

> The airline industry has committed itself to stop CO2 emissions increasing from their level in 2020. The biggest fact
> The airline industry has committed itself to stop CO2 emissions increasing from their level in 2020. The biggest factor that will enable them to reach this goal will be sustainable alternative fuel. Source: data from the International Civil Aviation Organization

Tree tobacco

Head north-east from South Africa and you'll hit the island of Madagascar, where scientists are growing a single hectare of the toxic, invasive tobacco tree, *Nicotiana glauca* — known for its love of the driest, hottest, most inhospitable patches of our crowded planet - which they want to turn into a source of sustainable energy and materials.

Tree tobacco is a mostly unwelcome addition to a nation's flora. It is indigenous to South America, and is smoked by some Native Americans, but it is tenacious and invasive in many parts of the world. Victims of its poisonous leaves include some people who have mistaken it for spinach, and a number of ostriches.

But lately scientists have grown excited about its extraordinary ability to do without groundwater and its apparently low demand for other essentials such as the nitrogen required for photosynthesis.

'It's an incredibly hardy species and the growth is really quite astounding,' said Dr Alisdair Fernie, of the Max Planck Institute of Molecular Plant Physiology in Potsdam, Germany, who coordinates the MultiBioPro project, an industry-academic partnership funded by the EU.

This is a plant that does not need pampering with micro-irrigation, a common technique when farming in very dry soil. Instead it appears to absorb moisture from the air through its pores.

'As a potential biofuel this is essentially gold dust,' says Dr Fernie. 'It grows not even on marginal land but land that is completely bankrupt for agricultural use.'

Work on *N. glauca* is less advanced than on Solaris. Field trials have been done in the United Arab Emirates, and the hectare under cultivation in Madagascar will soon be harvested and the seeds taken to Germany for an attempt at biorefining for jet fuel, or as an additive to other fuels to reduce their emission of particulates and carbon monoxide.

As with Solaris, finding multiple uses for every part of the plant is thought to be key to its success, so MultiBioPro is also considering how the tree's biomass can be processed into other products.

Within the toxic leaves lurks Vitamin D — a product increasingly in demand as a supplement — and these also contain solanesol, widely used in the pharmaceutical industry. Another strand of research in the programme is looking at other chemicals it might produce.

More info

Project Solaris

MultiBioPro