APP CLEARING THE AIR OVER DEFORESTATION ALLEGATIONS B14



## Food of the future

Dr Wieger Wamelink with samples of plants grown in Mars and Moon soil simulants. The botanist and ecologist is eyeing the potential of developing a "small but sustainable ecosystem" in space.

# Getting ready to grow greens on the Red Planet

**With the world's food supply under growing stress, scientists are coming up with innovative ways to improve food production. Samantha Boh looks at some of these technologies in Wageningen University and Research in the Netherlands and Nanyang Technological University.**


Radishes grown in (from left) simulated Moon soil from an Arizona desert; simulated Mars soil from a Hawaii volcano; and Earth soil. PHOTOS: WAGENINGEN UNIVERSITY AND RESEARCH

The prospect of a Mars colony is a step closer to reality, with Dutch scientists having harvested more than a dozen crops grown in simulated Mars soil, right here on Earth.

Now the scientists are asking if plant growth can be sustained there.

Dr Wieger Wamelink, who led the team from Wageningen University and Research in successfully growing the crops, is on a mission to find out whether bacteria – which is essential in turning dead plant parts into nutrients for plant growth – can survive on the Red Planet.

"With this next step, we are moving from just growing crops to building a small but sustainable ecosystem," said Dr Wamelink, who is both a botanist and an ecologist.

He is teaming up with Dr Maaike van Agtmaal from Imperial College London, who will start the experiments this month.

Sterilised Mars and Moon soil simulants will be inoculated with bacteria from different agriculture soils and placed under controlled conditions. The bacteria's activity will then be monitored.

"My aim is to study the process of terraforming of soils, the process of making soil habitable. We will therefore also compare the results from the simulants with Sahara sand and Arctic soil," Dr van Agtmaal said.

The experiment will last a month, with samples taken every week.

Last year, Dr Wamelink got the scientific community excited after he revealed that his team had harvested tomatoes, rye, spinach, cress, peas, radishes, garden rocket, chives and leeks grown in Mars and Moon soil simulants. The Mars soil simulant came from a volcano in Hawaii, while the Moon soil simulant came from an Arizona desert.

The crops were cultivated in a regular greenhouse and post-harvest tests found that they were safe to eat, with no dangerous levels of heavy metals – such as copper, arsenic and lead – detected.

Seeds from the crops were replanted last year and successfully germinated. "So we now know the cycle is complete," said Dr Wamelink.

Preliminary findings have revealed no differences between crops grown in Earth soil and in Mars and Moon simulants, including in vitamin and protein content.

But Dr Wamelink said the harvests of crops grown in Mars and Moon soil simulants were still poorer than those grown in Earth soil. Cress, for example, produced seeds of a smaller mass, which had poorer germination.

"This could be due to lower bacterial activity," he said.

Dutch company Mars One, which is tentatively aiming to set up human colonies on the Red Planet, said it is interested in the latest project.

"It could mean an important step towards producing food more efficiently on Mars, which means less time or space would be needed to grow a healthy diet for future Mars settlers," said chief executive and co-founder Bas Lansdorp.

Dr Wamelink will embark on a study of Mars' cosmic radiation and its potentially harmful effects on plants later this year.

The researchers have been crowdfunding (https://crowdfunding.wur.nl/project/planten-kweken-op-mars) to keep the research going and have raised 60 per cent of the €25,000 (S$37,300) target.

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## Turning soya bean waste into packaging

Once dismissed as food waste doomed for the landfills, soya bean residue has now been harnessed by local researchers and turned into a raw material to create biodegradable packaging.

A team led by Professor William Chen, director of the Food Science and Technology Programme at the Nanyang Technological University, has found a new way to extract cellulose from soya bean residue, also known as okara.

The method, which was developed over a year, involves adding a compound found commonly in detergent to okara.

The compound removes the lipids and proteins present in the residue, leaving behind just cellulose which can then be used to create materials for packaging, like biodegradable cling wrap – a thin plastic film commonly used to wrap food products.

Laboratory experiments found that the proportion of cellulose in okara samples increased from 50 per cent to around 90 per cent after they were treated with the compound.

Prof Chen explained that lipids and proteins had to be removed as they would hamper the process of turning cellulose into packaging materials in the later part of the development process.

This new method could provide a more cost-effective alternative to the more common method of using alkali and enzymes to remove lipids and proteins respectively from okara.

Enzymes are more costly and have to be used under specific conditions. Prof Chen said the cost of using enzymes to treat okara can be as high as $27,000 per kilogram of okara. His detergent treatment technology costs $120 per kilogram of okara.

"Moving forward, we will try to purify the cellulose further, and reduce the concentration of the compound used to minimise the impact on the environment," said Prof Chen.

"Now the solution comprises mostly water and about 2 per cent of the compound, which we are confident can be reduced further."

Each day, 30,000kg of okara – left over from soya milk and tofu production, for example – are discarded in Singapore and researchers have been developing ways to give this waste a new lease of life.

So far, okara has been used by researchers here to create a medium to grow yeast – a project also led by Prof Chen.

Other researchers have turned okara into mock meat products.

**Samantha Boh**

# Mock meat made to feel like the real deal

WHY PLANT PROTEINS ARE SAFER

**It is difficult to be poisoned by plant proteins because if something turns bad, there is more spoilage material so you can see the changes.**

**PROFESSOR ATZE JAN VAN DER GOOT**, lead researcher of the team that developed the mock meat made of plant proteins.

Imagine a thick juicy beef steak made completely out of plant proteins but feels just like the real thing.

That has been made possible by Dutch food technologists who have developed a unique manufacturing process that gives plant products the same texture that muscle grants meat.

The process involves putting a mixture of soya protein, wheat gluten and water into a cylinder, where it is placed under mild pressure and smashed together using rotating plates.

Gluten and soya are like oil and water and do not mix, but the strands of soya and gluten are forced to wrap around each other, which creates a firm fibrous structure with the texture of meat.

Once out of the machine, the 3cm-thick plant-based meat has a texture like that of steak.

With a growing global population in need of more protein to survive but faced with a pressing need to reduce the environmental impact of meat consumption, this technology could be invaluable in reducing the reliance on meat, said Wageningen University and Research (WUR)'s Professor Atze Jan van der Goot, the lead researcher behind the project.

According to the Food and Agriculture Organisation of the United Nations, over a billion animals are slaughtered for food each week.

Sustaining the growth of animal farms will drive up greenhouse-gas emissions, water pollution, deforestation and biodiversity loss, as well as cause health complications for people who eat too much meat, said Prof van der Goot, who is from the department of agrotechnology and food sciences.

He noted that plant proteins are also much safer than animal proteins. "It is difficult to be poisoned by plant proteins because if something turns bad, there is more spoilage material so you can see the changes," he said.

The WUR team has formed a consortium with eight companies, including a flavour house, ingredient producers and a machine manufacturer, and the group will be developing the plant-based meat further over the next few years. This includes getting it to taste like authentic meat.

The consortium, which started work in January, has already received millions of dollars in funding.

**Samantha Boh**

The production process involves getting the strands of soya and gluten to wrap around each other to create a firm fibrous structure with the texture of meat. PHOTO: COURTESY OF WAGENINGEN UNIVERSITY AND RESEARCH