Source: *The Straits Times,* pB1
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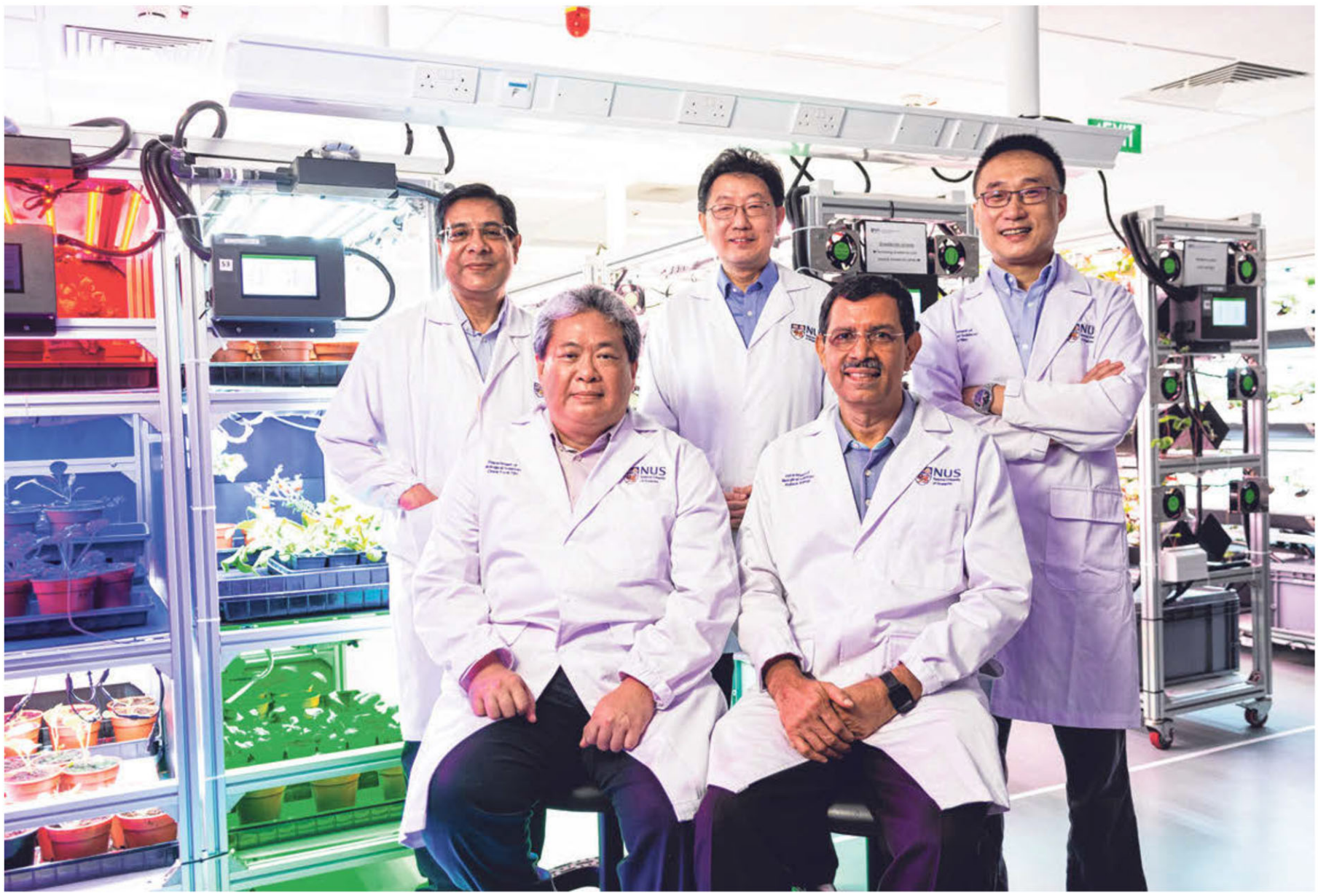

The National University of Singapore's (NUS) Research Centre on Sustainable Urban Farming, led by Professor Prakash Kumar (front row, right) from the Department of Biological Sciences, brings together scientists from across NUS. Its team includes (back row, from left) Associate Professor Sanjay Swarup from the Department of Biological Sciences; Professor Zhou Weibiao, head of the Department of Food Science and Technology; Professor Yu Hao, head of the Department of Biological Sciences; and (front row, left) Associate Professor Chew Fook Tim from the Department of Biological Sciences.
PHOTO: NUS

$10m research centre launched to solve urban farming challenges

Crop breeding strategies it will explore could boost S'pore's food security

Cheryl Tan

Work has begun on altering the genetics of important crops like leafy greens to boost their nutritional value and make them more suitable for indoor farming.

This is among the research projects that will be helmed by scientists at the National University of Singapore (NUS) at its new $10 million Research Centre on Sustainable Urban Farming (Surf).

The centre will also tackle some of the complex challenges associated with urban farming.

Launched last Friday, the facility will bring together scientists from across the university – including those in the fields of engineering and biological sciences – to develop novel and high-tech solutions for urban farming, said its director Prakash Kumar.

Singapore Food Agency chief executive Lim Kok Thai, who was a guest of honour at the launch, said such advanced breeding strategies could enhance the efficacy of urban farming and eventually the Republic's food security.

"With less than 1 per cent of our land available for food production, it is important that our farms adopt technology and innovation to grow food in a productive, climate resilient and resource-efficient way," he said.

NUS president Tan Eng Chye said at the launch that 10 projects have garnered about $11 million in external grants so far, with many professors linking up with other research institutes like the Agency for Science, Technology and Research and industrial players.

To ensure that the leafy greens are suitable for indoor farm environments, one project involves advanced breeding techniques like genome editing – modifying a plant's DNA to carry certain traits to improve yield and quality.

Other traits such as taste, shelf life and nutritional value can also be incorporated in the breeding of new plant varieties.

Associate Professor Chew Fook Tim from NUS' Department of Biological Sciences, who is co-leading the research project, said the team is looking to boost the yield of important crops like chye sim and kale for indoor growing.

He told The Straits Times that the team eventually hopes to develop a seed innovation hub that will carry the best versions of these key crops that can be distributed to urban farmers.

"This would allow them to produce nutrient-packed crops as well as improve yield to help Singapore meet its goal of producing 30 per cent of its nutritional needs by 2030," he said.

The team also hopes to breed new variations of fruits like strawberries and key crops for the production of alternative proteins like mung beans.

Another project, led by Associate Professor Sanjay Swarup from NUS' Department of Biological Sciences, will look into crop production and resilience, by harnessing the use of good microbes found in the natural environment.

To improve the food safety and shelf life of these vegetables, Assistant Professor Li Dan from the NUS Department of Food Science and Technology is working on a project involving light-emitting diode, or LED, light illumination.

The research centre started operations in June, with a new 200 sq m research facility set to be completed by early next year, said Prof Kumar.

It will boast state-of-the-art technology to facilitate research projects, such as plant growth rooms and a precision growth room where parameters such as the spectrum of light and temperature can be manipulated.

Professor William Chen, director of the Nanyang Technological University's food science and technology programme, said that while Surf addresses the bulk of challenges faced by urban farms here, the high cost of operations and the need for energy efficiency should also be taken into consideration.

Highlighting the importance of developing science and tech capabilities for local urban farms, he said: "Just like how NUS is integrating expertise from various disciplines into Surf, we should take a similar approach at the national level with complementary contribution from different institutes of higher learning, such that each can leverage their strength and provide a diversity of solutions."

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SEE SCIENCE • B8&9

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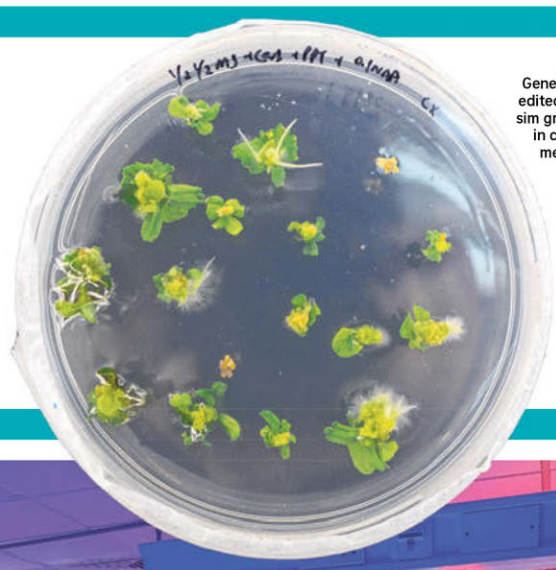
How chye sim is produced

As Singapore looks to boost its food security and produce 30 per cent of its nutritional needs by 2030, the National University of Singapore (NUS) has launched a new research centre to tackle challenges in urban farming and come up with high-tech solutions to make it sustainable in the long run. **The Straits Times** follows the journey of chye sim from seed to farm to table, and looks at how several research projects can help to improve its nutrition, quality and shelf life.

Stage 1 SEED

Project:
Breed suitable plant variety for indoor farming

- Through a process known as genome editing, the plant DNA can be modified to carry certain traits to make it better suited to an indoor environment.
- For example, certain genes could be selected to make the chye sim shorter with more branches to maximise farm space. Key nutrients like calcium, iron and natural anti-cancer ingredients could also be enhanced.



Genetically edited chye sim growing in culture medium.

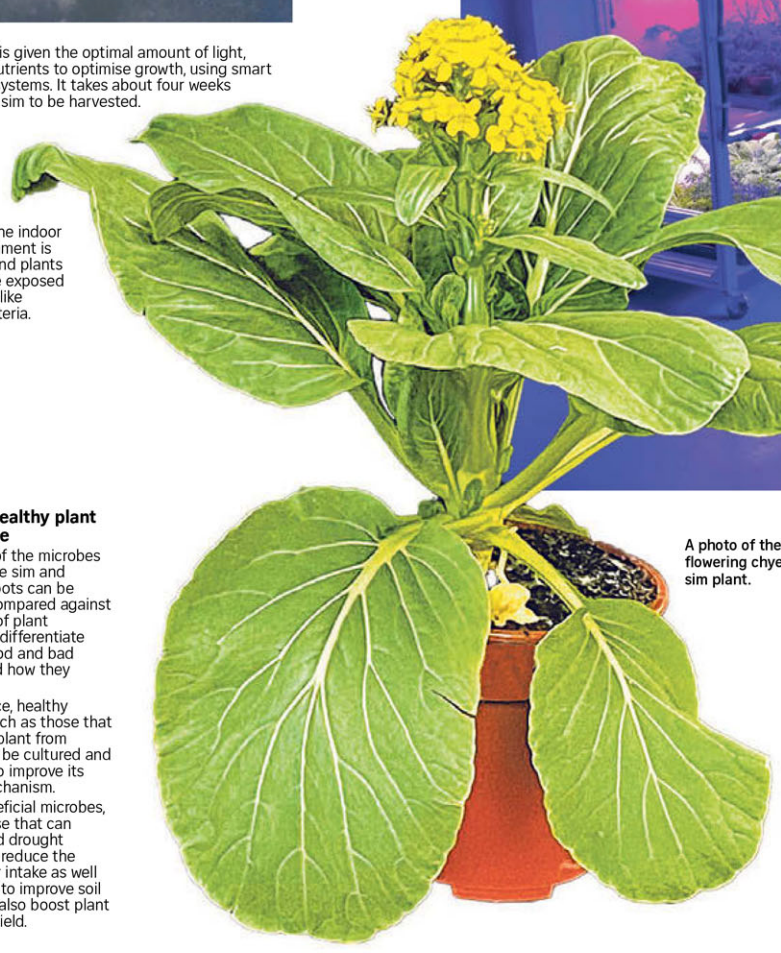
Stage 2 FARM

Once the seeds have been selected, they will then be propagated and grown in an indoor farm.

Root growth of a genome-edited chye sim shoot.The shoot will be transferred to soil once it has a few strong roots so that they can absorb water and minerals from soil. The size of the plant at that time would be roughly 1cm to 3cm.

- The shoot is given the optimal amount of light, water and nutrients to optimise growth, using smart monitoring systems. It takes about four weeks for the chye sim to be harvested.
- However, the indoor farm environment is not sterile, and plants could still be exposed to microbes like harmful bacteria.

Growth zone of NUS' indoor farm facility, which has different light wavelengths.



A photo of the flowering chye sim plant.

Project:
Ensure a healthy plant microbiome

- A sample of the microbes found in chye sim and around its roots can be taken and compared against a database of plant microbes to differentiate between good and bad bacteria, and how they function.
- For instance, healthy microbes, such as those that protect the plant from disease, can be cultured and harnessed to improve its defence mechanism.
- Other beneficial microbes, such as those that can provide good drought tolerance to reduce the plant's water intake as well as microbes to improve soil fertility, can also boost plant health and yield.

Project:
Wearable sensors for chye sim

- These "wearables" can track the chye sim's health and growth.
- Once attached to a leaf, the tiny chip contains sensors that detect plant signals to predict problems such as infection and damage from plant stress, which allows for early intervention.

Once the chye sim is harvested, it is packed and transported to supermarkets.

Plants being stored under LED light illumination to prolong their shelf life.

Project:
Prolong the chye sim's shelf life

- Scientists found that blue LED light can inhibit the growth of bacteria, thus helping to maintain the nutrition and quality of chye sim for a longer period.
- The special lights can be used when holding chye sim temporarily at the farm post-harvest, display shelves in the supermarkets, and in one's fridge.
- The team is now testing the use of blue LED light in simulated settings such as in supermarkets. They hope the lights could help double the shelf life of chye sim to around two weeks.

Stage 3 TABLE

Chye sim is cooked and consumed.

SOURCE: NATIONAL UNIVERSITY OF SINGAPORE
PHOTOS: DESMOND WEE, NUS, ISTOCKPHOTO
STRAITS TIMES GRAPHICS

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Researchers Yu Hao (left) and Chew Fook Tim with a kale cultivar tailored for indoor farming, part of their project on improving leafy greens for urban farms. PHOTO: NATIONAL UNIVERSITY OF SINGAPORE

SINGAPORE

$10m research centre launched to give boost to urban farming

The new $10 million Research Centre on Sustainable Urban Farming was launched last Friday, bringing together scientists from across the National University of Singapore to develop novel and high-tech solutions for urban farming. Projects include altering the genetics of important crops to boost their nutritional value and make them more suitable for indoor farming. **B1**