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Research push to create high-quality seeds and ease costs plaguing vertical farms

Indoor vertical farming solutions on display at Arianetech's booth at the Agri-Food Tech Expo Asia event on Nov 5. Globally, high-tech vertical farms have not been faring well due to high energy costs, a downturn in funding and tight profit margins, among other reasons. ST PHOTO: GAVIN FOO

To find a solution for the high production costs plaguing vertical farms in Singapore, a research initiative led by the National University of Singapore (NUS) is going back to the basics of plant science to create high-quality seeds.

The Seed Innovation Hub hosted at NUS received a $22 million boost from the authorities on Nov 5 to advance crop breeding and develop superior seeds with traits such as faster growth, better taste and stronger nutritional value, specifically tailored for indoor environments.

This grant is part of an over $80 million funding push in local food research that the Singapore Food Agency (SFA) announced on Nov 4 and 5 at the Singapore International Agri-Food Week (SIAW).

The other grants under the second phase of the Singapore Food Story R&D Programme are for aquaculture, alternative proteins and new ways to determine the safety of novel foods without animal testing.

The Seed Innovation Hub started around 2022, and the $22 million injection allows it to enter the second phase of research.

"Most (farmers) have been getting seeds from the outside, and most of them are meant to be grown outside, not really indoors," said Associate Professor Chew Fook Tim, who is from the NUS department of biological sciences and leading the project.

"One of the things we needed to do was to actually target the plant itself, the vegetable itself so that we can improve the productivity of indoor farms," he added.

To that end, Prof Chew and his team gathered thousands of varieties of crops from across the world over the past few years and have started to closely profile each crop's traits – down to the leaf structure and ideal shade of green.

This will be followed by mapping the DNA of each plant to identify the ideal genes. The next step would be to breed the promising varieties to produce faster-growing or more nutritious progenies. Conventionally, one breeding cycle can take a year, but Prof Chew's team will be employing "speed breeding".

Speed breeding refers to techniques used to produce crops much faster than normal by manipulating environmental conditions such as light, temperature and humidity indoors.

This allows multiple generations of crops to be grown in a single year, so that the scientists can hasten the pace of getting the winning seeds for local farmers.

Prof Chew added: "The bottom line to address the issue of cost is the turnaround (of growth) and, at the end of the day, that depends on the productivity of the plant itself. Of course, there are other factors like how you maintain your farm, optimise lighting.

"But I think we've left behind the most important component, which is the plant itself."

In the first phase of the Seed Innovation Hub, Prof Chew's team has developed newer chye sim and kale varieties that have achieved 20 per cent higher yields than ordinary varieties.

This was more of a pilot, and in the second phase – with the $22 million funding – the project will expand to include a broader range of crops, including Asian vegetables, fruited crops like capsicum, brinjal and cucumber, and specialty greens like arugula and amaranth.

In a couple of years, the hub will have a new home in NUS' upcoming centre dedicated to innovation in agriculture, aquaculture and food science.

The project also involves other local institutes as well as players in the industry such as agri-tech start-up Singrow and global seed company Syngenta.

Globally, high-tech vertical farms have not been faring well due to high energy costs, a downturn in funding and tight profit margins, among other reasons.

The Seed Innovation Hub, led by NUS Associate Professor Chew Fook Tim (right, pictured with NUS Professor Yu Hao), received a $22 million boost from the authorities on Nov 5 to advance crop breeding and develop superior seeds specifically tailored for indoor environments. PHOTO: NUS

In 2023, US-based Aerofarms and AppHarvest filed for bankruptcy. In 2025, another US-based start-up, Plenty Unlimited, filed for a type of bankruptcy not long after raising almost US$1 billion (S$1.3 billion) in funding.

The Singapore agri-tech sector has also been affected by a series of closures and delays. For example, Growy Singapore is winding up and in liquidation less than a year after its official opening.

Keeping in mind the headwinds for the sector, Singapore announced on Nov 4 that it will be replacing its "30 by 30" local farming target.

Revised targets have been set, one of which is for the Republic to produce 20 per cent of the country's consumed fibre by 2035.

But Singapore is pumping more resources into its strength in deep research to help overcome setbacks in the local farming and alternative protein sectors.

The $22 million for the Seed Innovation Hub is part of the $40.5 million that SFA on Nov 5 awarded to the second phase of the Singapore Food Story R&D Programme.

The other $18.5 million was awarded to an existing aquaculture programme called AquaPolis, and the funds will be channelled to a project that aims to produce better-quality Asian sea bass.

The aim is to work with local farms to produce parasite-resistant juvenile sea bass through selective breeding.

Announcing the $40.5 million funding at the SIAW Global Agri-Food Scientific Symposium on Nov 5, Senior Minister of State for Sustainability and the Environment Zaqy Mohamad said the second phase of the research and development programme focuses on "improving productivity and reducing costs for local production, which are the two critical factors that will determine the long-term viability of Singapore's food production capabilities".

On Nov 4, $42 million in funds was announced for 11 projects covering future, novel foods and food safety.

Mr Zaqy added that efforts will continue to drive scalable and cost-efficient cell-based meat and precision fermentation products.

In precision fermentation, microbes are used as "cell factories" to produce a range of food ingredients such as fungi-based proteins.

To ensure such novel foods are safe, new testing methods tailored for the Asian genetic profile will be created. These methods will not rely on animal testing, which can be unethical.

"This ensures Singapore is well prepared to seize opportunities when the future foods industry accelerates globally, while advancing safety assessment methods that better protect our consumers," Mr Zaqy said.

Shabana Begum