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How does your market garden grow?

Urban agriculture, such as roof-top farms and vertical planting, is a viable option for S'pore to maintain its food security

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SINGAPORE is famous for its luscious greenery, yet almost none of it is edible. Indeed, only about 5 per cent of the vegetables consumed in Singapore are grown here.



Edible greenery: Aero-Green Technology, an off-shoot of a Taiwanese company, operates a farm in Lim Chu Kang using Prof Lee's aeroponic system

This is something that strikes Elise Harris as ironic, because food security, or the lack of it, poses a real threat to any country that is dependent on imports for food.

Thus far, Singapore's lack of food security has only manifested itself in minor irritations - for instance when food prices increase because supplies from a particular country are cut, for whatever reason. But what would happen if our ports of entry were sealed?

In a worse case scenario, such as when the Soviet Union fell in 1989, Cuba was literally starved of all support overnight, leaving its people on the brink of starvation.

The solution? Urban agriculture, says Ms Harris, a food systems planning consultant from Australia. Urban agriculture is usually simply defined as agriculture which takes place within the city limits and may include roof-top farms, community gardens and vertical planting integrated into the design of buildings.

When the people of Cuba faced starvation, radical policies to convert state land into farms managed largely by the community saved them. In Havana, a city of two million people, almost 90 per cent of the vegetables consumed are grown within the city limits, says Ms Harris. She believes that Singapore can achieve the same level of food security, if it wanted to. 'We cannot afford to wait until food becomes too expensive to start working on this,' she added.

Ms Harris was in Singapore recently to study the potential of urban agriculture under a planning fellowship offered by the Singapore Institute of Planners (SIP) and Surbana, a township development company. She began by meeting with government agencies and people involved in food production, green roofs and community gardens. She then presented SIP with a set of policy recommendations.

Some of her recommendations require technology that has not been thoroughly developed or tested yet - for instance, incorporating systems of food production into buildings. However, she noted that with the current emphasis and support for roof-top and vertical greening of buildings by planning authorities (although only for aesthetic purposes so far), such food production is quite conceivable.

Other recommendations simply require allocating space for community gardens. Interestingly, one of her recommendations involves a concept and an application of technology that was developed in Singapore over 10 years ago.

Aeroponics is a soil-less system for growing plants. In 1997, Lee Sing Kong of the National Institute of Education conceived a model of urban agriculture that integrated his own patented aeroponic system with HDB flats which he called 'aero-bridges'.

Explaining his inspiration for aero-bridges, he says: 'When you look at a Housing Board estate like Punggol 21, it's just point blocks. But I thought that if you can connect the air space between the blocks, you can turn this into productive space. You only need one cubic metre of nutrient solution to grow 120 6 x 1.2 m troughs of vegetables.'

Prof Lee's system of aeroponics is already in use here. Aero-Green Technology, an off-shoot of a Taiwanese company, operates a farm in Lim Chu Kang using Prof Lee's system. Prof Lee believes that per square metre, his system can produce 3.5 kg to 4 kg of leafy vegetables per month.

Recent interest

The aero-bridges concept, however, had been sitting on the backburner until recently, when it was ranked among the top three solutions chosen in the Discovery Channel's Ecopolis series, which explores environmentally friendly ways to sustain an overcrowded, polluted world in 2050. Prof Lee says that the planning authorities here have since expressed interest in his concept, as has an eco-development in China.

Why has it taken so long to gain any momentum? Prof Lee himself started research into aeroponics in 1992. 'In the last 10 years, there have been no danger signs,' he says, alluding to the more recent concerns about global warming and other environmental sustainability issues.

There is no time to lose, he says. 'You cannot wait for a crisis before you start planning. It's important to work on a prototype (for aero-bridges) now so we can learn how to replicate it when the need comes,' he says.

There did actually exist a prototype of urban agriculture in Singapore, which had even won some international recognition.

It was a roof-top hydroponic farm created for the Changi General Hospital (CGH) in 1998 with the help of Ngee Ann Polytechnic and its senior lecturer at the School of Life Sciences

and Chemical Technology, Gregory Chow.

It was initiated by then CGH CEO Liak Teng Lit who was looking to reduce the hospital's energy consumption by using greenery to cool parts of the buildings. The roof top that was used had also been reflecting sunlight into the wards.

It was an ambitious project. 'Unlike a garden, the moment you plant edible food, you attract a different set of problems,' says Mr Chow. Food production is high maintenance. The produce needs to be fertilised, kept pest free, and then it has to be harvested, or it will rot and attract other pests. Moreover, as this 'farm' was part of a government hospital, it required a certain management will to keep it going. At CGH, hospital staff 'adopted' sectors of the roof-top farm and maintained the crops.

It thrived for about 10 years, producing about one tonne of vegetables per year, winning awards such as the Environmental Achievement Award in the process.

Based on today's prices, it costs \$60,000 to \$65,000 to set up a hydroponics roof-top farm the area of an Olympic-sized swimming pool. And assuming that leafy crops are grown, a yield of approximately 22 tons per year can be achieved, says Mr Chow.

A change of management, however, ended this experiment and the hydroponics farm was converted into an ornamental garden recently.

Mr Chow is also passionate about food security, but believes that it might be an uphill battle. 'If Singapore can produce 10-20 per cent of the vegetables consumed, it would already be very good,' he says. Yet, according to a recent study he conducted, he believes that there could be about 200 ha of potential roof tops for urban agriculture in the northern region alone.

One model of urban agriculture that may work is the 'co-op', says Mr Chow. He envisions groups of people - most likely the elderly - organised by professionals to grow food as a business. If it is community based, it may have the critical mass to support the enterprise, he believes. 'If you look at it as a business, it can be done, but not as a hobby,' he adds.

Challenges abound

There are challenges: Singaporeans are accustomed to a conventional urban lifestyle, imported vegetables are cheap and few people want to invest the capital needed to set up a farm on land with a short lease. Electricity, water and labour are also expensive here.

A check with the Agri-Food and Veterinary Authority (AVA) reveals that there are no subsidies for local vegetable farmers and their produce has to compete on an equal footing with imported vegetables.

Of the 110.2 ha of land in the 'Agrotechnology Parks' for the cultivation of vegetable produce, 87.6 ha are used solely for soil cultivation of vegetables; 12.9 ha are for hydroponics cultivation, 6.3 ha for the production of bean sprouts, and 3.4 ha for the production of mushrooms.

The vegetable farms grow a range of leafy vegetables such as xiao bai cai, caixin, kailan, baicai, Chinese cabbage, bayam, kangkong, lettuce and mustard with ex-farm price ranging from \$0.76 per kg to \$2.26 per kg.

Lam-Chan Lee Tiang, head of AVA's Horticulture Branch added: 'The big commercial vegetable farms are usually vertically integrated from production, harvesting, packaging under cold chain, distribution and marketing to niche markets in Singapore, and this enables them to compete on equal footing with imported vegetables though production cost here in Singapore is high.'

For now, it looks like Ms Harris' vision of Singapore as a urban agropolis will take some to realise.

For its part, SIP thinks that urban agriculture is not impossible and could even be part of Singapore's Total Defence strategy.

A spokesman for SIP added that it would seek cooperation and advice from HDB, NParks, AVA and may make recommendations of their own.

Giving an example, he said: 'We would recommend an assembly kit for urban vegetable plots suitable for HDB and high-rise living. If necessary, we can persuade HDB to change its common corridor design to be able to accommodate this effort.'

Will this be enough to provide food security?

It's food for thought.