



## Series 7: Programme 3 (of 8) - 'From Plague to Plenty'

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### Sweet Success – China

Shandong province, in the east of China, has the country's highest levels of agricultural exports. Rice is the area's most important crop but in the dry, infertile hills, where the poorest communities live, rice will not grow. These communities depend on sweet potato for their livelihood, but it is susceptible to an afflicting virus. Now new techniques are combating this.

#### Sweet Potato

Although normally thought of as a rice-producing country, China is also the world's largest sweet potato producer, accounting for 90 per cent of global production. In Shandong most of the income for poor mountain people comes from this crop.

Sweet potatoes (*Ipomoea batatas*) are native to the tropical Americas and were farmed there at least 5000 years ago. They spread throughout that region, and are now cultivated in tropical and warm temperate regions wherever there is sufficient water to support their growth. They are long, starchy, sweet-tasting tuberous roots with a smooth skin whose colour ranges between red, purple, brown and white. The flesh can be white, yellow, orange, or purple.



Sweet potatoes (*Ipomoea batatas*)

Sweet potatoes can produce more edible energy per hectare per day than wheat, rice or cassava. Besides starch, they are rich in dietary fibre, vitamin A, vitamin C, and vitamin B6. The roots are generally boiled, baked, or sliced and fried like chips. They can be processed to make starch and a partial flour substitute for noodles, and used in the production of industrial alcohol. Young leaves and shoots are sometimes eaten as greens. Most of

China's sweet potato crop is grown in seasonal rotations and almost half is used for livestock feed.

## Seed Production

Sweet potato is a useful crop as it can be grown on poor soils without irrigation, and it has few natural pest enemies. However, it is susceptible to yield-reducing viruses which the traditional propagation methods easily transmit. Instead of using fresh seed, small vine cuttings are taken from the previous year's root crop to produce new seedlings for planting. This method, although very cheap and easy, provides ideal conditions for spreading the viral diseases that reduce yield. As the plants grow, the virus spreads from root to root each year. It is not possible to control the virus disease by spraying, so other methods have had to be explored.

The Shandong Academy of Agricultural Sciences and the International Potato Center are working with farmers to improve yields and help alleviate poverty. Chinese farmers have used a novel seed production technique that has increased sweet potato yields by as much as 30-40 per cent without additional fertilisers, pesticides, or genetic improvements.



### ELISA Test

The Enzyme-Linked Immunosorbent Assay (ELISA) test is a technique that can be used to detect the presence of a virus in a sample. It uses two antibodies, one of which is specific to the virus and the other of which is coupled to an enzyme. When tested with a suitable reactor the sample changes colour, indicating the level of infection.

The virus clean-up technique was introduced into China through the Peru-based International Potato Center (CIP), and was later adapted to local conditions by researchers at the Shandong Academy of Agricultural Sciences. The technique allows the sweet potatoes to flower and go to seed. Then, in the lab, tissue cultures are used to produce plantlets.

These plantlets are checked with an ELISA test to make sure they are virus free, and then they are grown on under sterile conditions. The resulting virus-free plants are used as mother plants for further propagation in disease and pest free soil in greenhouses. Here, over a period of around five months, they form small roots that can then be used to grow virus-free vine cuttings. Because the ELISA test is cheap and reliable – only 4-5 Yuan (around 30p) for one test sample, whereas overseas kits cost about 25 Yuan (£17.50) – it is possible to scale

up and conduct the replication on a large scale. Starting with only 500 plants, technicians can produce enough virus-free planting material to seed 25,000 hectares (62,000 acres).



Sweet Potato plantlets are grown on under sterile conditions

Virus-free plants increase yields by 30 per cent in the first year, though this drops over following years as the virus slowly re-infects the crop. After every third year the farmers need to replant again with healthy tubers. Although this is an additional cost for the farmers, the increase in crop yields makes it worthwhile as they can still make a profit. In recent reports, Chinese sweetpotato farmers are planting an estimated 330,000 hectares (815,000 acres) of virus-free sweet potato annually in Shandong Province alone. The value of this technology over the past four years is estimated at \$80 million (£46 million). The success of the research suggests it may be possible to extend the propagation programme through the private sector in the region.

### **Further Information**

### **Participating Organisations**

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Pages on Sweet Potato

Website: <http://www.cipotato.org/sweetpotato/sweetpotato.htm>

## Further Reading

Economic impact of virus-free sweet potato planting material in Shandong Province, China. *F.O. Fuglie, L. Zhang, L.F. Salazar, T.S. Walker*. International Potato Center, Peru, 1999

<http://www.eseap.cipotato.org/MF-ESEAP/FI-Library/Eco-Imp-SP.pdf>

