THE SASA POTATO STOCK COLLECTION

Disease control starts with clean seed. While this sounds obvious, the process of getting there is by no means short or easy. With multiple generations required from the time a new variety is produced to when it reaches a retailer shelf, every step must be carefully scrutinised to ensure no pathogen has crept in.

By Dr Jenny Ekman

In June this year I was fortunate enough to visit SASA – the Scottish Agricultural Science Agency. SASA staff are involved in a range of activities, from wildlife and environment to EU trade guidance. Importantly, they are also they key authority responsible for the Scottish seed potato classification scheme, as well as the keepers of the nuclear stock collection.

NUCLEAR POTATOES??

In this case nothing to do with energy or uranium, but rather the establishment of a core collection of 'motherstock' plant material, from which all else can be derived.

It is incredible to think that 95% of the potato seeds grown in Scotland have their origin in the tiny, test-tube-grown microplants held in the SASA Nuclear Stock collection refrigerators. The collection includes over 1,000 different varieties, each of which has been rigorously tested for a huge range of diseases. This ensures that the starting material is absolutely pathogen-free.

Nuclear Stock Manager Jackie Gibson explains how the system works

"Every year we get in around a hundred new breeding lines and varieties. Material from Scotland is usually supplied as tubers, whereas the European community tend to send microplants."

Tubers are initially tested for bacterial diseases, mop top virus and others using plugs taken from the heel ends. Eye plugs are also scooped out, these being grown into full size plants in the glasshouse. Similarly, if microplants have been supplied, the plant tissues are tested directly as well as grown into larger plants in clean growing media.

The glasshouse grown potato plants are then screened further, particularly for viruses. Scotland is free of many important viruses as well as potato spindle tuber viroid, ring rot and brown rot. It is essential that such diseases are not introduced, let alone spread on seed.

"Brown rot was detected in one of the tributaries to Loch Tay 20 odd years ago. Fortunately, it was eradicated, mainly by removing all the nightshade plants from the riverbanks. There are still surveys of all the rivers and tributaries every year to check that it's not there. A lovely job in good weather," smiles Jackie.

"Actually, PVY is the most common virus, but we can pick it up really early, so it's not a problem."

Virus testing uses ELISA (an enzyme-based assay) as well as indicator plant techniques. The latter involves taking

SASA Export Liaison Officer Jacquie Gibson with a small selection of the SASA seed potato nuclear stock collection.

samples of plant sap and spraying onto lightly damaged capsicum, tobacco and *Chenopodium* species, including quinoa.

Similarly, bacteria can be detected both by using plates of selective media and by directly injecting macerated tuber into young eggplant (ring rot) and tomato (brown rot) plants. This really does literally involve using a syringe to inject the stems of young plants.

"The plant-based assay is really useful for a couple of reasons," explains Jackie.

"As it's less specific than ELISA, it will pick up things not otherwise tested. For example, if a new virus strain is present, we still see symptoms in the test plants."

"Secondly, if only tiny amounts of the pathogen are present, it will bulk up in the indicator plants. The symptoms then become more obvious, making the pathogen easier to detect."

MAKING ONE INTO MANY

Once the source material gets the all-clear, it can be micropropagated. Sprouts from the tubers are dissected into nodes, each then planted into agar at a rate of six per tube. Placed under grow lights, each node develops into a microplant. After four to six weeks, the tiny plant can be re-subdivided and transferred to fresh medium, the process being repeated until a few plants become hundreds.

The microplants are then sent to the next stage of the multiplication process. This is performed by private micropropagation laboratories and 'pre-basic' growers. They grow on the tiny plants in sterile media in polytunnels or using aeroponics, producing millions of mini-tubers ready to plant in the field.

A few precious microplants are also added to the nuclear stock collection. At 14°C with 3% mannitol (a type of sugar) added to the media, the microplants can survive for up to a year before re-subdivision and addition to fresh media.

"Some of these plants might look dead, but once they are cut and given a dose of nutrients they come back to life," observes Jacquie.

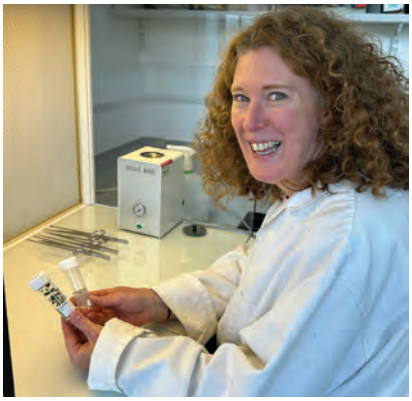
"What's more, most varieties will throw microtubers. These tiny little dried brown things will all grow, no problem. It's amazing really."

It's quite a job though. With four tubes each of 1,000 accessions, it takes the three staff two months to replenish the collection each year.

And that's not the only task. Every year, half of the stored varieties are re-grown at SASA's field site to check that no genetic changes have occurred during storage. The plants are grown right through to tuber bulking, with inspection at every step to make sure they remain true to type.

It's a lot of work. However, it's still a better and more efficient way to maintain varieties than annually replanting tubers in the field.

Microplants ready for propagation. The tube at right also contains sprouting microtubers (circled).



Microplants are cut into nodes, with six nodes planted into each new tube of media; Jackie Gibson demonstrates the tiny pieces of material used as initial plugs and the finished tube.

PLANTLETS ON THE MOVE

While most of the material generated by the unit goes to pre-basic growers, others are used by researchers, or exported overseas.

"These plants here are going to Indonesia" says Jackie, indicating a group of 20 tubes, "and these are for Africa."

The breeders at James Hutton have developed a lot of varieties for Kenya and other places in Africa.

"In this case, we're just sending 20 plants of each variety. They have to multiply them locally using tissue culture, then plant them in the field."

Amazing to think that those 20 tiny plantlets in their small glass vials could hold the key to potato production in Kenya, generating thousands of tonnes of PCN resistant potatoes.

From such a tiny thing, to one so large.