The future in seeds of the past

Simon Grose

The farmer's tanned, furrowed, face is thoughtful. "You should ask the old women," he says after a pause. He smiles, dull veins of gold in his teeth. From village to village, farm to farm, others agree. "Ask the old women." They are helpful and nostalgic, and after an obligatory vodka or two, melancholic.

Ken Street. Photo: Brad Collis

We are high in the mountains of southern Armenia on a mission they understand. They are farmers in the land where farming began.

So we start calling out the old women, who emerge from lightless kitchens and farm buildings reliable electricity also just a memory in these remote pockets of the old Soviet empire and we explain our quest. They hurry away and with extraordinary generosity re-emerge with tins, jars and knotted cloth containing biological treasures the seeds of bygone crops.

Grains of wheat, barley, beans and peas disappear into small yellow envelopes, marked with the name of the village, the name of the family, and the GPS position the hand held satellite positioning device an object of wonder to scores of children.

The old women wish us well. Some cry, because these visiting scientists seem to understand what they have known intuitively all along: that the traditional varieties were special.

There is a surrealism to these meetings, underscored by the dissonant chatter of Australian, Russian and Armenian accents as the team probes for knowledge of yesteryear crops, and asks for a little of the seed that might be hoarded. As we travel over rutted mountain roads we are also looking for places where ancestral plants might still grow on high plains.

We are on a hunt for genes; for lost genetic resources that agricultural scientists say will be crucial for the world to keep feeding itself despite climate change and deteriorating agricultural landscapes.

And so this small band of genetic detectives is scouring the birthplace of agriculture, the Caucuses Georgia, Armenia, Azerbaijan and parts of Russia for remnant on-farm storages, and for ancestral wild grasses from which modern crops like wheat and barley were first bred some 5000 years ago.

The mission is led by a Syria-based Australian, Dr Ken Street, an agricultural ecologist with the International Centre for Agricultural Research in Dry Areas (ICARDA), and comprises Russian and Armenian plant researchers, as well as another Australian, Perth-based Dr Clive Francis from the Centre for Legumes in Mediterranean Agriculture.

Their work is partly funded by Australia through the Australian Centre for International Agricultural Research and the Grains Research and Development Corporation.

While a two- or three-degree increase in average temperatures may be perceived by people as merely a comfort issue, a fraction of a degree change can be enough to stop many food plants from flowering and delivering grains and fruits.

So the genes that allow the old relatives of modern crops to flourish in frozen or arid landscapes need to be found and reintroduced.

"We are going back through time, backwards through man-made evolution," explains Dr Ken Street, who has been leading seed collecting expeditions into Georgia, Armenia, Azerbaijan and Tajikistan over the past six years.

"We are looking for the grasses that were used for bread-making thousands of years ago at the start of civilisation when people first saw that keeping and sowing seeds from the best plants gradually improved what they were harvesting. We are searching for what our far distant ancestors were using; not because they are better but because they have a wider genetic base. A modern wheat plant might have a few hundred parents from a breeding program, but the ancient wild varieties had hundreds of thousands, perhaps millions, of parents."

The genetic diversity of the Caucuses, and the lure of discovery, is also what keeps pulling Clive Francis back, long after he had intended retiring.

Gazing across a meadow brimming with plant life, he explains that in Armenia alone there are 125 species of Astragalus, part of the legume family. Legumes are his passion.

"The legumes we grow in Australia are annuals, but there are perennial crop plants here that could help us manage our wheatbelt water table and limit the build-up of salinity," he says.

Collected seed is planted and assessed at ICARDA in Syria and the most promising lines sent to plant breeders in Perth, Adelaide, Horsham and Tamworth for introducing to local crop improvement programs.

Legumes are increasingly important in Australian agriculture as rotation crops between wheat and barley plantings, as they break potential disease cycles, and increase soil nitrogen. Their deep roots improve soil structure and closely mimic native plants in the way they help prevent rising water tables that cause most of the wheatbelt's salinity.

Aside from benefiting Australian farmers, improved generations will be sent back to ICARDA to help agricultural development in developing countries. Legumes' ability to transfer nitrogen from the atmosphere to the soil, and research being done to adapt them to sub-tropical environments, is seen as a low-cost, practical way to restore impoverished soils in hunger-ravaged areas of Africa.

But in contrast to the almost ready-to-use legumes, harnessing genes from wheat's ancestral grasses is a 10 to 15 year proposition, a process that could be accelerated by using genetic engineering. Wheat's ancestors are too far removed to be able to be crossed with modern plants, given that wheat is essentially a man-made crop. However, while the use of GM technologies would allow researchers to retrieve from ancestral grasses the gene sets capable of delivering traits such as drought and frost tolerance comparatively quickly, this cannot be contemplated until the moratoriums on growing GM crops in NSW, Victoria, South Australia and Western Australia expire in 2008.

The frustration for Australian researchers is that their counterparts in North and South America have no such restrictions and are enjoying a handy head-start.

In recent years, Street's seed collecting missions have become part of an international program developed under the auspices of the Global Crop Diversity Trust, set up as an instrument of the International Treaty on Plant Genetic Resources for Food and Agriculture. This was established two years ago to try and arrest the erosion of the world's plant genetic resources.

"It's a survival issue," says Street. "For most people around the world that means avoiding starvation, while for farmers in countries like Australia it is economic survival."

Late-season frosts destroy millions of dollars worth of cereal crops in Australia because the European origins of Australian varieties do not have the ideal genetic lineage for the Australian environment. "There are wheat varieties in central Asia and the Caucuses that comfortably tolerate frost and low rainfall,"

Street says.

The work by Street and Francis also involves trying to save, or rebuild, the once pre-eminent plant collections housed in the neglected botanical institutes of the former Soviet republics in central Asia and the Caucuses.

"The world is losing irreplaceable seed from these collections simply because the local people can't afford to replace water pumps, or stored seed is being eaten by mice," says Street.

"This is frightening, because the genetic origins for a very large proportion of the world's food crops, including the crops we grow in Australia, do not exist anywhere else."

He says it's all about making sure that despite the environmental pressures facing global agriculture, the world's farmers can still keep bread on the table figuratively and literally.

Dr Ken Street is profiled in FutureCrop, published by the GRDC.

www.grdc.com.au/director/events/grdcpublications/futurecropsect2

Summit Sun