



Dr Ken Street seed collecting in Armenia.

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ANCIENT SEEDS OF SURVIVAL

ICARDA-based Dr Ken Street has been managing ACIAR-funded germplasm projects in the Caucasus and Central Asia for several years. He reports on why they are important for future crops

How come two Australian agricultural scientists – a semi-retired professor and a genetic resource scientist – are drinking farewell vodka toasts with a family of villagers high in the mountains of southern Armenia? What do these rugged, friendly villagers have in common with the fair-skinned strangers from across the other side of the world?

The answer concerns us all – an interest in seeds. Seeds of ancient crop varieties, to be specific. Seeds that contribute to the agro-biodiversity that ultimately underpins the survival of the human race.

Within the context of global warming, unchecked population growth, desertification, salinisation and geo-political conflict, agro-biodiversity is becoming more important than ever, because it provides the raw material for modern plant breeding. While there is a multitude of high-yielding modern varieties in use today, the work of plant breeders is by no means finished, because breeding is not a static process. A variety that is successful today can overnight be rendered ineffective by new disease biotypes or changes in the physical environment. So plant breeders have to look to genes within the ancient crop races or wild progenitors to produce varieties that can meet constant challenges to food production.

To support this, seeds of a whole range of farmer varieties, or landraces, as well as wild ancestors, have been assembled in a worldwide network of genebanks. These collections are trying to capture as much genetic variation as possible in the species that are important to world agriculture.

A recent study has found that the use of crop varieties developed

from these genetic resource collections, held by the Future Harvest centres that comprise the Consultative Group on International Agricultural Research (CGIAR), has reduced prices for poor consumers in developing countries, saved thousands of hectares of forests from being turned into farmland and has had a major impact on reducing malnourishment of children.

In Australia, the impact of varieties developed by the International Center for Agricultural Research in the Dry Areas (ICARDA), just one of the 15 Future Harvest centres, using genetic resources held in its genebank, has benefited farmers by an estimated \$10 million a year.

This brings us back to the vodka-toasting Australians (myself and Clive Francis) and the Armenian villagers. The reason for being in a remote and all but forgotten post-Soviet village was, of course, not to drink vodka, but to collect seeds of old crop varieties that have been growing in the region for centuries.

Our mission, comprising Australian, Russian and Armenian plant scientists, covered thousands of kilometres across a tortuous, mountainous landscape, home to an ancient people who, along with their agriculture, have survived an often difficult history dating back to biblical times. The mission's focus was to hunt out isolated villages and highland fields looking for farmer varieties of important crop plants, which over a millennium of passive farmer breeding has resulted in genotypes with extraordinarily broad genetic bases.

This Armenian mission netted more than 600 accessions, including wheat, barley, lentils, chickpeas, faba beans, field peas, a plethora

of vegetable varieties and a host of wild relatives and pasture legumes. Detailed information about the sites where the material was collected has been stored in a database. The seeds and associated site information is now being shared by the genebanks represented on the mission, in this case the Armenian Institute of Botany, the Vavilov Institute of St Petersburg, Russia, and ICARDA.

Once the seeds reach ICARDA they are planted in a field to bulk them up, after which they are stored in a controlled atmosphere environment to ensure their long-term viability. Likewise, the site information is incorporated into the ICARDA database system. This information and the seed are made freely available for research purposes under an agreement which ensures that the original genotype remains for the public good.

Our latest mission was one in a series of successful missions funded by ACIAR since 1998. The missions have seen teams of local and international scientists endure often difficult and dangerous situations, cooped up in rickety Russian 4WDs as they bounce their way over dilapidated roads through the newly independent countries of Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. In total, almost 4000 unique samples have been collected from a staggering diversity of environments and cultures.

But what is so important about Central Asia and the Caucasus (CAC) – an often forgotten but exotic collection of now independent republics that once formed the outer rim of the Soviet Union? The answer is that the CAC region has a physical and climatic environment that is as diverse as the cultures and people who live there.

The landscape ranges from arid desert steppes to lush semi-tropical high-rainfall zones to rugged inaccessible mountain ranges with permanent ice caps. Over time, this diversity of environments and farming systems has led to exceptional plant genetic diversity, both within domesticated species and their wild progenitors.

This was noticed in the early 20th century by the famous Russian plant scientist Nicholai Vavilov, the father of modern plant genetic resource conservation. He mapped out the distribution of diversity

for many agriculturally important crops worldwide. Based on this work, he asserted that the CAC region was an important centre of diversity for a whole range of crops.

Among the crops that originated or evolved there are cereals (wheat, barley, rye), legumes (lentils, chickpea, faba bean, pea), forages (medics, vetches, clovers), vegetables (cabbage, onion, garlic, melons), fruit trees (almond, apricot, apple, pear, pistachio, cherry, plums, walnut, pomegranate, quince, hazelnuts, azarole, cornelian cherry, Russian olive, grape, fig, chestnut, mulberry), industrial crops (safflower, flax, cotton) and countless medicinal and aromatic plants.

These species have been domesticated from the wild, selected by local populations who over time have developed thousands of valuable landraces, highly adapted to a broad range of climatic conditions. Thus the region is a treasure trove of ancient varieties and their wild progenitors.

However, against a backdrop of under-resourced, rapidly changing farming systems and seriously degraded eco-systems, the region's globally important agro-biodiversity is being eroded at an alarming rate.

The crippling economic and social upheaval caused by the collapse of the Soviet Union has left national agricultural and genetic resources programs struggling to address the problem.

That is why the projects funded by ACIAR, the first post-Soviet initiative of this kind in the region, for collecting, conserving and documenting the region's genetic resources, are both timely and important.

While collection missions aimed at securing a representation of the region's biodiversity have been an important facet of the projects, they have not been the only activity. The projects have also focused on developing the capacity within national programs to collect, conserve, document and utilise the region's genetic resources by providing small capital items such as computers, contributing to the development of seed storage facilities, facilitating the development of linkages to the broader global plant genetic resource community and a variety of training activities. ◀



Far left: Dr Clive Francis (CLIMA/UWA) collecting seed in Armenia in 2005.

Left: Natalia Rukhkyan (left), who is being trained in germplasm conservation, with ACIAR support mentor Dr Izabella Arevshatyan, from the Armenian Institute of Botany.



'THE REGION IS A TREASURE TROVE OF ANCIENT VARIETIES AND THEIR WILD PROGENITORS'

Seed collection missions often call on village households, asking for a little of any seed kept from bygone times. Invariably it is the old women, with an innate sense of the seeds' importance, who reappear with samples often kept "from my father's time", even "from my grandfather's time". Dr Izabella Arevshatyan from the Armenian Institute of Botany (left) and the Vavilov's Dr Tamara Smekalova (centre) collect seed from villagers.