# Decades of cassava research bear fruit

***Keane Shore***

For his pathbreaking research on cassava, Dr Nagib Nassar, a professor at the Universidade de Brasília, has been nominated for this year's World Food Prize. The prize, worth $250,000 and considered by some to be the international development equivalent of the Nobel Prize, will be awarded October 24, 2002.

Cassava, a hardy, drought-resistant tuber, is a staple food for half-a-billion people. Nassar received early support for his research from the International Development Research Centre (IDRC), as part of the cassava breeding research program supported during the 1970s and 1980s. This research led to the development of high protein varieties of cassava and to plants uniquely adapted to West African growing conditions.

You do need to have a long-term perspective on this type of work," says Dr Peter Cooper, Director of the Environment and Natural Resources Management program at IDRC. He notes that development projects are usually funded for three or four years at a time, but that results may take decades to show. Over time, it also becomes harder to draw straight lines from a particular contribution to a particular success as many others may have contributed. But, Cooper adds, Nassar continues to acknowledge IDRC's early support in every research paper he has published.

**One plant, many uses**

Cassava has been cultivated in the tropics for centuries. A staple starchy food, the tubers can be boiled, baked, fried or dried. They are used to make flour, breads, tapioca, sugar, laundry starch, and even an alcoholic drink. More than 800 million people subsist on the edible tubers in South America, Asia, and Africa. While native to the Americas, it is now widely grown in tropical countries around the world, and is a main staple in Nigeria, Uganda, Kenya, Tanzania, and Congo.

Processing cassava to make it edible is complex, because most varieties contain potentially toxic concentrations of cyanogenic glucosides that are reduced to innocuous levels through cooking. And although its popularity as a staple compares with cereal grains in northern climates, most cassava varieties are low in protein – less than one percent, compared with about seven percent in staple grains commonly grown in temperate zones. It can also be grown, then left stored in the ground for long periods as a hedge against future hunger – a "famine food" for poor farmers.

Nassar's interest in cassava began early in the 1970s, when he taught African crop biology at the Institute of African Studies at Cairo University, Egypt. "All indications referred to it as a possible salvation for Africa, from the famines that spread through the continent that decade," he says. "This is because of its high calorie production, year-round availability, and tolerance to extreme (environmental) stress conditions." However, severe drought can keep cassava from producing properly, and it has trouble growing in acid, toxic soils, such as in the Brazilian savanna.

**Finding wild breeding stock**

Nassar has worked with cassava germplasm – or breeding stock – for 28 years, since arriving in Brazil. He carried out work for the Institute of African Studies, then the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, collecting wild cassava strains in northeastern Brazil for two months. This led to IDRC funding two of his projects between 1976 and 1982.

His goal was to collect wild cassava species in their natural habitats in central and northeastern Brazil, evaluate their economic value, build them into a living collection, and cross them with domesticated cassava varieties. Along the way, the collection has helped save these wild species from extinction. He later also collected plants in Mexico.

**Productive and nutritious hybrids**

The wild germplasm lines that Nassar supplied to IITA as breeding stock have contributed to strains of cassava uniquely adapted to West African growing conditions. One of them, he says, helped vault Nigeria to a new position as a leading world cassava producer. Other leading producers include Brazil, Thailand, Democratic Republic of Congo, and Indonesia.

Nassar says IDRC support allowed him to collect some 42 wild cassava species native to Brazil. He still propagates them in a living collection at the Universidade de Brasília, where he teaches, for evaluation and crossbreeding with domesticated varieties. He says he's produced some 14 hybrids. This has been challenging because, over millions of years, evolution and natural selection have led to substantial interspecies barriers, making crossbreeding difficult.

Among his first hybrids was one that nearly doubled cassava's protein content. Nassar attributes a lot of this to luck: usually when a wild species is crossed with cultivated one, it brings with it both desirable and undesirable traits. "This did not happen in this case," Nassar says. The hybrid combined the high productivity with low concentrations of cyanogenic glucoside.

Another hybrid – Nassar says it's the most fascinating to him – was apomictic (capable of producing hybrid seed without sexual fertilization). Breeders can use apomixis to preserve a plant hybrid's desirable characteristics. This line was bacteria- and virus-resistant, and after a single generation the root's nutritional quality was surprisingly high. He's continuing to work on apomixis in cassava and hopes to release his first apomictic clone to Brazilian farmers for commercial use in two to three years.

"I didn't believe it myself – I didn't believe my chemist colleague when he told me the protein percentage," says Nassar. "Doubling the protein content in one generation surpassed my most ambitious dreams. Normally it takes tens of generations to increase protein content by 20 to 30 percent. To double the content in one generation seemed fantastic. I spent several years repeating the chemical analysis to confirm the result."

**Recognizing a contribution**

For his work, Nassar has been nominated for the World Food Prize five years running, each time by Dr Joachim Voss, formerly of IDRC and now director general of the International Center for Tropical Agriculture (CIAT), based in Colombia.

"I think in many ways, where he was considerably ahead of his time was in looking at bringing in characteristics from the wild relatives of cassava into domesticated cassava," says Voss. "His contribution, really, is to very early on identify the potential of some of the wild species for improving domesticated cassava. Cassava is notoriously difficult to breed. Nagib started looking at, and using molecular biology approaches to get those characteristics fixed in commercial cassava."

Voss says he's nominated Nassar because, from a scientific viewpoint, his work has been path-breaking. Both high-protein and apomictic cassava strains hold tremendous potential for Africa's poorest people. He acknowledges, however, that competition for the prize may mean Nassar will never win.

"But I think it's important to recognize the contribution that he's made," Voss adds. "At CIAT, which has the world's biggest collection of cassava, the work that he's done – in particular on improving the protein content of cassava – is something that we've picked up on and are carrying on, simply because of the potential. The reason that we're doing that is very much because of Nagib's early work."

Nassar says that, if he wins the award, he'll dedicate it to supporting younger cassava researchers at the Universidade de Brasília. "I have already stepped toward this and started from my personal savings a fund at the university for this purpose," he says.

*Keane Shore is an Ottawa-based freelance writer*.