A direct release from the ICRISAT genebank helped revitalize the pigeonpea industry in Karnataka, India

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Sharanappa Pujari’s face started to glow when I asked him how the pigeonpea variety, Maruti, had helped him to prosper. He spoke quickly in Kannada, the predominant language of the Indian state of Karnataka. “Achchhee cheei,” he kept saying. A farmer next to me interrupted Sharanappa and started shouting out in excitement. I eagerly awaited a translation to see how such a simple question could generate such emotion.

Dr. Hari Upadhyaya, the head of the genebank at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), translated for me. “Achchhee cheei means ‘a very good thing’,” Hari said. He explained that Sharanappa told a story about how he has been planting the wilt-resistant Maruti for 15 years on his farm and had prospered. He sent his children to university, constructed a three-bedroom home and even bought a gold chain for his wife. Sharanappa’s success with Maruti had prompted his neighbor, Abdur
“Maruti, or rather ICP 8863, saved this area,” Hari said as he held up the pea pods. “Thirty years ago, wilt decimated the pigeonpea industry here. Now this area prospers with pigeonpeas.”

The pigeonpea discovery tour

Several months earlier, Hari had told me the story of ICP 8863, a pigeonpea line released from the ICRISAT genebank. The story of ICP 8863 intrigued me so I travelled to India with my Crop Trust colleague, plant genetic resource scientist Dr. Benjamin Kilian, to see the long-term impact of the release of ICP 8863 where it matters most: in farmers’ fields. ICP 8863 was released as Maruti in 1986 at a time when the pigeonpea industry in parts of India was being hit hard by Fusarium wilt. Within a few seasons, Maruti helped revitalize the pigeonpea industry and today, 30 years after its release, it is still being planted and is still a preferred variety in areas at risk of wilt.

Dahl for all

On arriving to India, I realized I knew very little about pigeonpea (Cajanus cajan). In fact, I had never even eaten it. Hari brought Benjamin and me to a vegetarian restaurant and, as we ate pigeonpea dahl, Hari told us about the crop.

“Pigeonpea is a particularly important pulse crop in India as well as other countries such as Myanmar, Tanzania, Malawi, Haiti and Kenya,” Hari said while he scooped some dahl unto his bread. “Here in India, we split the seed and eat it as dahl. It’s an important source of protein in our diet. But we also use it for forage, fodder and fuel.”

Hari explained that pigeonpea is being touted as an ideal crop for sustainable agricultural systems
production of pigeonpea increased by only 43% in India. Hari waved his bread and dahl to make a point. "But 30 years ago, Fusarium wilt nearly wiped out pigeonpea in parts of India and if farmers hadn’t found a wilt-resistant pigeonpea variety, we might not be enjoying this dahl now."

Direct releases

Hari showed me where the story of Maruti began: the RS Paroda Genebank at ICRISAT. The genebank is one of 11 international genebanks which comprise the Genebank Platform, a partnership between the Crop Trust and CGIAR. The ICRISAT genebank safeguards more than 126,000 accessions, or individual samples, of crops from 144 countries. Among those accessions are nearly 14,000 samples of pigeonpea.

The genebank is Hari’s second home and as he proudly showed me poster displays highlighting the impact of direct releases from the genebank, I asked him about his career.

“How long have you been curator of the genebank?” I asked.

Hari stopped abruptly, turned and raised a finger. “I am not a curator. I am not a manager. I am a genebank scientist.” For Hari each and every one of the thousands of seeds in his genebank is a science experiment. Curators count and manage but Hari wants to delve into the secrets that each of the seeds in his genebank contain.

“But I’ve been the head of the genebank since 2002,” Hari said with a smile and tapped in a code to open a door. Hari opened the door to the medium-term storage facility and ushered me in.
“Ah, here it is. The famous ICP 8863,” he said as he opened a tin and poured out some dark reddish brown seeds into his hand. “This is where Maruti began its journey.” I stared at the seeds and struggled to comprehend how a few seeds which looked no different to the hundreds of other pigeonpea seeds in the ICRISAT collection could have revitalized an industry. Hari and I stepped out of the cool storage room and he told me of the early days of ICP 8863.

“This is what we call a direct release,” Hari said. “Generally, these start as landraces, which are crops that have been traditionally cultivated and improved by farmers through selection. A direct release is a germplasm line that was collected as a landrace or local selection from the farmer’s field. It is then conserved and distributed from a genebank. It could also be a selection from a distributed genebank accession that has useful traits and formally released as a cultivar. They have not been improved by breeding.”

Hari emphasized that the ICRISAT genebank has promoted the testing and release of 101 accessions directly as 138 cultivars in 52 countries.

“It took 11 years from the time the progenitors of ICP 8863 were first collected in farmers’ fields until its release as Maruti in Karnataka,” Hari said. The progenitors of ICP 8863 were first selected from a landrace, ICP 7626, from Badnapur in Maharashtra state in India in 1975. Between 1978 and 1983, ICRISAT carried out screening in different locations to identify lines with broad-based wilt resistance. Of the large number of lines tested, five appeared promising. They showed
“The best performer in these trials was ICP 8863,” Hari said. “It maintained its resistance since 1977 and also exhibited high yield potential.”

“So what happened next?” I asked Hari. “How do these seeds go from a tin in the genebank to a farmer’s field?”

“To answer that, we must travel to Gulbarga,” Hari said with his characteristic huge grin.

The Land of Thoordial

Hari, Benjamin and I departed early morning from the ICRISAT campus near Hyderabad and headed due west to the Indian state of Karnataka. After travelling five hours we pulled over to the side of the road to get a closer view of a sign arching across the highway.

“Welcome to Kalaburgi, the land of Thoordial,” Hari said. Thoordial is the local word for pigeonpea and we were indeed in the heart of the pigeonpea growing region. Gulbarga, which is officially known as Kalaburagi, has been called India’s pigeonpea granary.

We rendezvoused with Dr. JR Patil, Dean of University of Agricultural Sciences, Raichur, who spoke of the agricultural situation in the mid-1980s in Gulbarga.

“Pigeonpea was commercially cultivated in the Gulbarga district in the 1970s; earlier, it was mainly cultivated for household purposes,” Dr. Patil explained. “Every few years, farmers would plant pigeonpea since it is a nitrogen fixing crop and can improve soil fertility.” However, pigeonpea would be used much more than as a
“Fusarium wilt almost killed the pigeonpea industry in the early 1980s,” Dr. Patil said. “Wilt is one of the most widespread and destructive diseases of pigeonpea. It can lead to total loss of a farmer’s harvest.”

“Farmers started planting sunflower and pearl millet as commercial crops but these did not drive the economy like pigeonpea did,” Dr. Patil said. “We needed to address the issue of wilt and restore our pigeonpea industry quickly.”

Production losses mounted, and farmers sought wilt-resistant materials from the Gulbarga Agricultural Research Station of the University of Agricultural Sciences. Scientists from the station approached ICRISAT, who by this time was recognized as the main source of disease-resistant pigeonpea lines.

“Farmers expressed one demand ... they needed a wilt-resistant variety immediately,” Dr Patil said. “They couldn’t wait for the results of an extensive breeding program, which could take up to 15 years.”

Fortunately, ICRISAT was well advanced with its multi-location screening of wilt-resistant pigeonpea. Scientists at the Gulbarga Agricultural Research Station, who initiated the release of Maruti, estimate that the ready availability of the ICP 8863 material from ICRISAT essentially shortened their R&D lag by 50%.

**Maruti, son of the wind god**

“When ICP 8863 was released in Karnataka it was named Maruti,” Dr. Patil said. Maruti is the Hindu god Hanuman, the son of the wind god.
I was itching to see the proof of the pudding. I had never seen pigeonpeas in farmers’ fields and was keen to actually see Maruti. Dr. Patil joined us as we formed a convoy of vehicles and drove along dust dirt roads until we were surrounded by pigeonpeas.

Basavaraj Patil, a farmer from Udagi village, greeted us at his field. He stood amongst some of the 20 acres he had planted to Maruti. I asked Basavaraj why after 30 years he was still planting Maruti when so many other new and improved varieties were available.

“Because it is stable,” Basavaraj said without hesitation. “Newer varieties give unpredictable yields every year, but Maruti is stable and well adapted. It’s my insurance policy. I know it is 100% wilt resistant and I know I will get good yields.”

Across the road, Basavaraj had planted another 20 acres to a different pigeonpea variety and I questioned why he did that instead of planting only Maruti.

“Because of climate change,” University of Agricultural Sciences, Raichur pigeonpea breeder Dr. Sonnappa Muniswami said. “We aren’t seeing the yields we once saw with Maruti. So we’ve started a breeding program which uses Maruti as a parent and brings in all of the favorable traits of Maruti like taste, cooking time and milling qualities. But we want to shorten the growing duration by about 10 days to avoid the heat and stress of the dry season and maximize yield.”

The miller says
the Yash Proteins pigeonpea processing mill in Gulbarga.

We stood in the sun and watched workers rake an orange sea of pigeonpea seeds. “I wish all the farmers would bring in Maruti for processing,” said the mill’s owner, Jumberlal Khandelwal. “We pay top prices for Maruti because of its taste and milling properties.” Jumberlal invited us into his office for tea and I looked at the wall behind me. Maruti had indeed rewarded Jumberlal and he recognized that by placing an image of his benefactor on the wall.

Seeds for tomorrow

Thirty years after its direct release from the ICRISAT genebank, Maruti is still clearly having a big impact on the economy of Gulbarga. But what about next year, I wondered? Will farmers continue to plant it? To find out, we travelled through endless acres of pigeonpea fields to the east of Gulbarga until we reached the village of Gotur. Ramalinga Kotagi, a local farmer, was awaiting us in front of six acres of pigeonpea.

“We are seeing large demands for breeder’s seeds of Maruti not only in Karnataka but also in other Indian states like Madhya Pradesh and Maharashtra,” Dr Muniswami said. “After the breeder’s seed is produced, farmers like Ramalinga grow foundation seed, which is then certified and distributed to farmers.”

I looked out across Ramalinga’s field and could see why he appeared happy. His field of Maruti was looking very promising and as a foundation seed grower he would receive 10% more than the market value of pigeonpea.
Many improvements have been made in pigeonpea research to which ICRISAT safeguards. Any one of those could hold a special trait that could help pigeonpeas become resilient not only to wilt but also any number of stresses caused by a changing climate, like drought and heat, which will no doubt challenge farmers in the coming years. I was comforted to know that around the world genebanks like ICRISAT’s had the foresight to save those potential Marutis.