An ICRISAT Success Story

The World's First Pigeonpea Hybrid

The problem

Pigeonpea is cultivated throughout the semi-arid tropics of South Asia and East Africa. But increases in the total cultivated area over the past 10 years have not kept pace with demand.

In spite of significant gains, pigeonpea production falls short of demand.

Getting started

Dramatic yield enhancement was necessary. So ICRISAT scientists and partners initiated research on a new technology – hybrid breeding. This was a Herculean task because pigeonpea is a self-pollinating crop, with only 20-25% cross-pollination. No hybrid pigeonpea had ever been developed. But ICRISAT scientists rolled up their sleeves and got busy. They identified genetic male-sterility that would enable making hybrids easier, compared to hand pollination.

The process

1. Partner scientists used both genetic male-sterility and existing natural outcrossing to produce hybrids.

2. Technology was transferred to the Indian Council on Agricultural Research (ICAR) and private sector scientists in India.

3. ICPH 8, the world's first pigeonpea hybrid, was released jointly by ICRISAT and ICAR in 1991. The hybrid yields 25-30% more than pure line cultivars in farmers' fields. Moreover, it is drought-tolerant.

Back to the drawing board

Unfortunately, despite its superiority in yield and stability, ICPH 8 did not become popular with seed companies because of inefficiencies of seed production technology involving genetic male-sterility.

The call of the wild

To overcome the seed production constraints, ICRISAT and partners launched a strong breeding program to develop a cytoplasmic male-sterility (CMS) system. CMS is essential for efficient and large-scale quality hybrid seed production. But how to do it?

- ICRISAT scientists integrated cytoplasm of a wild relative, *Cajanus sericeus,* with the nucleus of cultivated pigeonpea.

Technologies developed by the Institute and its partners have been transferred to NARS and the private sector.

The CMS system integrates cytoplasm of wild C. sericeus *(above) with the nucleus of the cultivated type.*

- So far, three stable CMS lines in different phenologies have been bred and more than a dozen are in the final stages of development.
- Maintainers and fertility restorers of CMS have also been identified and their genetic base diversified to develop hybrids in early-, medium- and long-maturity durations.
- Breeding for high-yielding, CMS-based hybrids is in progress, in collaboration with partners.
- CMS lines from *C. cajanifolius* and *C. scarabaeoides,* other wild relatives of pigeonpea, appear very promising for plant type and fertility restoration.
- Research support has been received from the private sector, both Mahyco Research Foundation and JK Agri-Genetics. Collaboration with the Indian Council of Agricultural Research (ICAR) has also been invaluable.

Achievements

The hybrids offer many advantages to the farmers. Pigeonpea hybrids have more seedling vigor than their parents, making them suitable for sole cropping because they establish quickly and utilize light and water resources efficiently.

- Scientists are now working on developing region-specific hybrid cultivars that yield well and resist diseases.
- Training has been provided to a number of scientists and technicians from various private and public seed companies as well as research organizations to transfer technologies.

Potential for impact

The availability of CMS in diverse genetic backgrounds holds the key to a successful commercial exploitation of hybrid vigor in pigeonpea and ICRISAT is opening the doors for farmers and seed companies to gain from this technology.

Partners

- ICRISAT
- Indian Council of Agricultural Research (ICAR)
- Maharashtra Hybrid Seeds Company Ltd (Mahyco)
- JK Agri-Genetics

Donors

- ICRISAT core budget
- Maharashtra Hybrid Seeds Company Ltd (Mahyco)
- JK Agri-Genetics

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