

Cytoplasmic-nuclear male-sterility-based pigeonpea hybrids yield up to 40% more than conventional cultivars

Overview

Annual pigeonpea production across the globe is 3.5 million tons, but productivity has remained low (750 kg/ha) for over five decades. Hybrid breeding technology can break the yield plateau.

ICRISAT developed the first commercial cytoplasmic-nuclear male-sterility- (CMS) based hybrid in the world.

Pigeonpea hybrids have demonstrated 30-40% yield advantage in farmers' fields. A good seed production technology is also available.



ICPH 8, the world's first (CMS based) pigeonpea hybrid.



A progressive farmer observing ICPH 2671 hybrid plot in Gulbarga.



ICPH 2740, a promising medium-duration pigeonpea hybrid.

The innovation

- ❖ In 1991, a milestone in the history of food legume breeding was achieved when the **world's first pigeonpea hybrid, ICPH 8**, was released.
- ❖ ICRISAT and ICAR jointly developed the hybrid using a genetic male-sterility (GMS) system, although high production costs prevented acceptance by seed producers.
- ❖ In 2005, another **breakthrough** was achieved when a cytoplasmic nuclear male-sterile (CMS) hybrid was developed



Principal Scientist KB Saxena worked with partner scientists to develop the world's first pigeonpea hybrid.

by crossing a wild relative of pigeonpea (*Cajanus cajanifolius*) and a cultivar.

- ❖ The new hybrid technology is based on a three line system that includes A-line (male-sterile); B-line (maintainer), and R-line (restorer).
- ❖ Several experimental hybrids were evaluated at ICRISAT and various ICAR centers, which demonstrated 50-150% superiority in yield over popular varieties.
- ❖ In over 2000 on-farm trials conducted in five states of India the hybrids ICPH 2671 and ICPH 2740 respectively exhibited 47% and 42% yield advantage over the best local variety.
- ❖ Seed production of hybrids, mediated by honey bees, is easy. Under congenial growing conditions, 700-1200 kg/ha of hybrid seed was produced.

The impact

- ❖ Several farmers have registered high seed yields in different states of India and a farmer from Andhra Pradesh received '**Best Farmer Award**' for harvesting yields of 3250 kg/ha, a record for this state.
- ❖ The world's first CMS hybrid, ICPH 2671, was released by a private company in 2008 and also by State Variety Release Committee in Madhya Pradesh in 2010.
- ❖ Hybrid ICPH 2740 produced 30% more yield than local cultivars in the states of Andhra Pradesh, Maharashtra and Madhya Pradesh. A farmer in Jalgaon district, Maharashtra, harvested 3300 kg/ha grain. This hybrid has recently been recommended for release in Andhra Pradesh.

Over all performance of ICPH 2671 in ON-FARM TRIALS (2007-2010)

State	Distt	Farmers	Mean yield (kg ha ⁻¹)		%Gain
			Hybrid	Check	
Maha	7	782	969	717	35.1
A. P.	8	399	1411	907	55.6
Karnataka	4	184	1201	951	26.3
Jharkhand	9	288	1460	864	68.9
M. P.	10	360	1940	1326	46.3
Total		2013	1396	953	46.5



(Right) G Janardhan, a progressive farmer receiving best farmer award for 2009 from the Government of Andhra Pradesh.



Private Sector Consortium members visit to ICPH 2671 seed production plot, ICRISAT.

- ❖ ICRISAT plans to reap the benefits of hybrid technology by cultivating the two hybrids on over 1,00,000 ha by 2014.

Partners

The hybrid pigeonpea research and development program is supported by Department of Agriculture, India, under National Food Security Mission and ICRISAT's Hybrid Parents Research Consortium.

Public seed companies

- ❖ National Seeds Corporation (NSC)
- ❖ State Farms Corporation of India Ltd (SFCI)
- ❖ Maharashtra State Seeds Corporation (MSSC)
- ❖ Andhra Pradesh State Seeds Development Corporation Ltd. (APSSDC)



Mr Patil at Rewar, Jalgaon, in his ICPH 2740 on-farm trial field.



Hybrid seed distribution at KVK, Durgapur, Amarawati.

Private seed companies

- ❖ Adriana Seed Company, Londrina, PR Londrina, PR Brazil
- ❖ Biogene Agritech, Ahmedabad, Gujarat
- ❖ Bioseeds Research India Pvt Ltd, Hyderabad, Andhra Pradesh
- ❖ Nimbkar seeds Pvt Ltd, Phaltan, Maharashtra
- ❖ Vibha Agrotech Ltd, Madhapur, Hyderabad
- ❖ SM Sehgal Foundation, Hyderabad

State Agricultural Universities

- ❖ Acharya NG Ranga Agriculture University, Hyderabad
- ❖ Dr Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola
- ❖ Maharashtra Krishi Vidyapeeth (MKV), Parbhani
- ❖ Agricultural Research Station (ARS), Gulbarga
- ❖ All ICAR Institutions