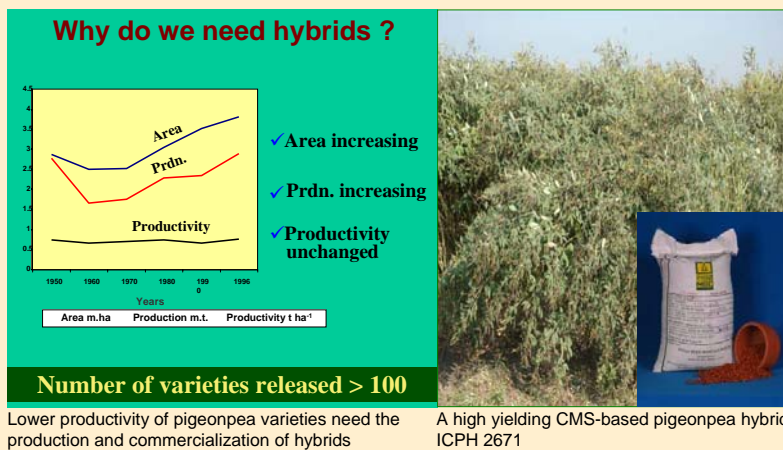


Abstract

Pigeonpea [*Cajanus cajan* (L.) Millspaugh] is an important food legume of sustainable agriculture of Africa and Asia. In spite of developing a number of pure line varieties, the productivity of pigeonpea has remained low. To achieve a break through in the productivity, ICRISAT scientists developed a hybrid breeding technology based on a cytoplasmic-nuclear male-sterility (CMS) system and natural out-crossing. For wider adoption of hybrids, it is mandatory to have hybrid seed of highest genetic purity. Therefore, efforts were made to establish a hybridity test based on molecular (microsatellite) markers. To diversify hybrid parents, we are mapping fertility restorer gene(s). The genes conferring male-sterility are also being identified through characterization of mitochondrial genomes. Thus, the integration of breeding and genomics will speed-up the process of hybrid development.

Hybrid Technology



Number of varieties released > 100

- **Source- CMS derived-** from a wild relative (*C. cajanifolius*).
 - It is stable across environments
 - produces high frequency of fertile hybrids
- **Agronomic performance-**
 - 180% heterosis over the best available cultivars
- **Technology transfer-**
 - Both public and private seed companies are engaged
 - Two hybrids ICPH 2438 and ICPH 2671 targeted for commercialization
- **Quality control-**
 - Grow Out Tests (GOT) based on molecular markers has been designed in pigeonpea.

Mapping of Fertility Restoring Gene(s)

- Based on molecular diversity as shown in table below, five diverse cross combinations were selected.
- The BC₁F₁ and F₂ populations are being developed for genotyping and phenotyping of fertility restoring gene(s).

Diversity among the A-, B- and R- lines of pigeonpea

	A- lines	B- lines	R- lines	Total
Number of lines	37	24	72	133
Markers used	148	148	148	148
Polymorphic makers	40	34	39	41
Number of alleles	2 - 6 (2.6)	2 - 6 (2.5)	2 - 6 (2.9)	2 - 6 (3.0)
PIC value	0.05-0.75 (0.34)	0.06-0.78 (0.39)	0.03-0.78 (0.37)	0.01-0.81 (0.41)

Molecular Marker Based Grow Out Test

A molecular marker kit is being developed at ICRISAT for assessing the purity of hybrid seeds. After screening all available SSR markers on A-, B- and R- lines, a set of two (CCB4 and PGM7) markers has been identified that can be used for this purpose in the hybrid ICPH 2438.



Molecular profiling pattern for CCB4 marker in male, female parent and hybrid

Diagnostic SSR markers for assessing seed purity of hybrid ICPH 2438

Seed source /marker	No. of hybrid seeds tested	Allele in A- line	Allele in B- line	Allele in R- line	*Purity index (%)
ICRISAT					
CCB4	379	228	228	221	94.2
PGM7	379	294	294	291	98.7
Mahabeej					
CCB4	91	228	228	221	95.6
PGM7	91	294	294	291	97.8

*Purity index= $\frac{\text{Number of true hybrids (containing alleles of both the parents)}}{\text{Total number of hybrid seeds tested}} \times 100$

Future Activities

- Marker based GOT test will be developed for other elite hybrids.
- In order to reveal the differences between fertile and sterile lines, mitochondrial genomic DNAs are being isolated for sequencing using next generation (454) sequencing technology.

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