Indian National Seed Genebank
A Goldmine for future trait specific
genetic resources

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The Paradox of Today’s Agriculture

- **300,000** Known plant species
- **100,000** Used by humankind
- **30,000** Edible
- **7,000** Used as food at local level
- **120** Important at national scale
- **30** Provide 90% of plant calories
- **3** Provide 60% (rice, wheat, maize)
Projected changes in world crop supply and demand from 2000 to 2050

Total Calories Delivered Per Capita per Day

Cereals 47.7%
Pork 4.0%
Beef 1.3%
Oilcrops 1.7%
Pulses 2.0%
Starchy Roots 5.5%
Vegetables 2.6%
Fruits 2.7%
Vegetable Oils 10.9%
Sugar & Sweeteners 8.8%
Other 4.8%

Total Calories Delivered Per Capita Per Day in 2000
World Average 2,712

Total Calories Delivered Per Capita Per Day in 2050
World Average 3,226

Global Harvest Initiative 2017
| NBT 1 | People, especially the youth, are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably | Aichi 1 |
| NBT 2 | Value of biodiversity is integrated in National and State planning processes, development programmes and poverty alleviation strategies | 2 |
| NBT 4 | Invasive alien species and pathways are identified and strategies to manage them developed | 9 |
| NBT 5 | Measures are adopted for sustainable management of agriculture, forestry and fisheries | 6, 7, 8 |
| NBT 7 | Genetic diversity of cultivated plants and their wild relatives is maintained, and strategies developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity | 13 |
| NBT 9 | Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization as per the Nagoya Protocol are operational, consistent with national legislation | 16 |
| NBT 11 | National initiatives using communities' traditional knowledge relating to biodiversity are strengthened, with a view to protecting this knowledge in accordance with national legislations and international obligations. | 18 |
Mainstreaming biodiversity for increasing farm productivity and reduction in input cost

Improve nutrient content, quality and reduce post harvest losses

Ensure sustainable production

Climate resilient PGR,

On-farm agro- biodiversity conservation

The Relevant SDG Goals
Sustainable agricultural production

PGR management

NBPGR – in the Service of the Nation for Achieving Sustainable Food Security Since 1976
India - A gene rich region

- One of 12 world mega biodiversity centres
- Three of the 34 Hot Spots of Biodiversity
- Himalayas, Indo-Burma region, Western Ghats & Sri Lanka
- Western Ghats, the hottest spot with 68% endemic freshwater fish species
- 162 breeds of domesticated animals
Center’s of Origin and Diversity

5. Central Asia
- Wheat
- Rye
- Grapes
- Apples
- Apricot
- Plum
- Pear
- Melons
- Onion
- Carrot
- Pea
- Spinach
- Beans
- Walnut

4. Hindustani Region
- Rice
- Mango
- Banana
- Bean
- Cucumber
- Eggplant
- Chickpea
- Mustard
- Sugarcane
- Citrus
PGR – The Backbone of Agriculture

ICAR-NBPGR: In the Service of the Nation for Achieving Sustainable Food Security since 1976

Role of NBPGR in Food Security through Germplasm/Gene Conservation

Plant Quarantine and Health Testing for Pest-free Conservation

Characterization and Evaluation for different traits

PGR Acquisition through Exploration and Import

Long-term Conservation in National Genebank and Field Repositories

Development of Genomic Resources and DNA Fingerprinting

PGR Policy and PGR Informatics
ICAR-NBPGR

Mandate
To act as the nodal institute at national level for acquisition and management of indigenous and exotic plant genetic resources (PGR) for agriculture, and to carry out related research and human resources development, for sustainable growth of agriculture.

Objectives
1. To plan, organize, conduct and coordinate exploration and collection of indigenous and exotic plant genetic resources.
2. To undertake introduction, exchange and quarantine of plant genetic resources.
3. To characterize, evaluate, document and conserve crop genetic resources and promote their use, in collaboration with other national organizations.
4. To develop information network on plant genetic resources.
5. To conduct research, undertake teaching and training, develop guidelines and create public awareness on plant genetic resources.
Evolution of NB PGR was facilitated by growth of infrastructure and human resource

1976-1985
Establishment
Explorations

1986-1995
Infrastructure
(Tissue culture and
Cryo)
(PGR Policy)
International
Collaboration

1996-2005
Modern
Genebank
Collection
(NATP)
NAGS & MTS
NRC On DNA
Fingerprinting

2006-2016
Large-scale
characterization
Multilocation
evaluation
Basic research (NAIP)
PGR Informatics

2017
Modernization of
Gene Bank
High throughput
Genomics
Trait specific
evaluation
Utilization of
Landraces and Crop
Wild relatives
## Status of Base Collection in National Genebank

(as on 31st October, 2022)

<table>
<thead>
<tr>
<th>Crop/ Crop Group</th>
<th>Total Species</th>
<th>Present status of total acc. conserved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>139</td>
<td>173456</td>
</tr>
<tr>
<td>Millets</td>
<td>29</td>
<td>60222</td>
</tr>
<tr>
<td>Forages</td>
<td>203</td>
<td>7473</td>
</tr>
<tr>
<td>Pseudocereals</td>
<td>55</td>
<td>8093</td>
</tr>
<tr>
<td>Legumes</td>
<td>111</td>
<td>68465</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>87</td>
<td>63237</td>
</tr>
<tr>
<td>Fibre</td>
<td>77</td>
<td>16920</td>
</tr>
<tr>
<td>Vegetables</td>
<td>218</td>
<td>28666</td>
</tr>
<tr>
<td>Fruits &amp; Nuts</td>
<td>71</td>
<td>300</td>
</tr>
<tr>
<td>Medicinal &amp; Aromatic plants</td>
<td>682</td>
<td>9090</td>
</tr>
<tr>
<td>Ornamental</td>
<td>122</td>
<td>732</td>
</tr>
<tr>
<td>Spices, Condiments and Flavour</td>
<td>28</td>
<td>3627</td>
</tr>
<tr>
<td>Agroforestry</td>
<td>192</td>
<td>1695</td>
</tr>
<tr>
<td>Duplicate safety Samples (Lentil, Pigeonpea)</td>
<td>0</td>
<td>10235</td>
</tr>
<tr>
<td>Trial Material (Wheat, Barley)</td>
<td>0</td>
<td>10771</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2049</strong></td>
<td><strong>462982</strong></td>
</tr>
</tbody>
</table>

Note- *Included 8262 accessions of Released varieties and 7099 accessions of Genetic Stocks
Crop wild relatives in NGB

National Genebank

- 9174 accessions belonging to 662 genera

<table>
<thead>
<tr>
<th>Top Genera</th>
<th>#Acc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>2125</td>
</tr>
<tr>
<td>Rice</td>
<td>815</td>
</tr>
<tr>
<td>Abelmoschus</td>
<td>408</td>
</tr>
<tr>
<td>Sesame</td>
<td>394</td>
</tr>
<tr>
<td>Solanum</td>
<td>295</td>
</tr>
<tr>
<td>Amaranthus</td>
<td>188</td>
</tr>
<tr>
<td>Pennisetum</td>
<td>187</td>
</tr>
<tr>
<td>Cucumis</td>
<td>174</td>
</tr>
<tr>
<td>Arachis</td>
<td>123</td>
</tr>
<tr>
<td>Brassica</td>
<td>73</td>
</tr>
<tr>
<td>Cicer</td>
<td>73</td>
</tr>
</tbody>
</table>
**CHARACTERIZATION AND EVALUATION OF 20K WHEAT ACCESSIONS**

- **Core set and minicore set of wheat:** A core set of 2,226 accessions out of 21,822 accessions comprising of *T. aestivum* (1,788), *T. durum* (386) and *T. dicoccum* (52) was developed based on 34 descriptors and validated.

- **Reference set for terminal heat tolerance in wheat:** A total of 3,202 tolerant accessions identified out of 21,822 accessions based on five variables related to THT and further evaluated at Issapur Farm, New Delhi.

- **Out of these, 316 accessions were selected based on heat susceptibility index and validated.**

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**RESEARCH ARTICLE**

Evaluation of 19,460 Wheat Accessions Conserved in the Indian National Genebank to Identify New Sources of Resistance to Rust and Spot Blotch Diseases


1 ICAI-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi, India, 2 ICAI-Indian Agricultural Research Institute, Regional Station, Wellington, Tamil Nadu, India, 3 Punjab Agricultural University, Regional Station, Guntur, Punjab, India, 4 Punjab Agricultural University, Ludhiana, Punjab.
NBPRG UNDERTOOK CHARACTERIZATION OF 18,000 CHICKPEA ACCESSIONS

Chickpea Core set: A core set comprising 1103 accessions out of 18,800 accs. was developed based on eight quantitative and twelve qualitative morphological descriptors.
CHARACTERIZATION AND EVALUATION OF WILD SPECIES

- Characterization and evaluation of wild species: A total of 460 accessions of seven wild annual Lens species, 150 accessions of six wild annual Cicer species were, characterized and evaluated for agro-morphological traits and major biotic and abiotic stresses.
- Fifty five accessions brinjal wild species *Solanum incanum* and 86 accessions of okra wild species *Abelmoschus moschatus* ssp *moschatus* were characterized and evaluated for agro-morphological traits and major biotic stresses.
- Development of representative *Lens* core set: One representative set of global wild Lens accessions was developed by extracting 96 accessions using PowerCore approach.
- Interspecific crosses in *Lens* spp: wild species as donors for various traits like more no. of peduncles/plant (*L. culinaris* ssp. *odemensis*, ILWL 116), high no of pods/cluster (*L. culinaris* ssp. *tomentosus*, ILWL 305) etc.
- Agro-morphological evaluation and advancement of F₆ crosses of lentil: A total of 205 interspecific derivative of lentil (ILL 10829 × ILWL 30 and ILL 8006 × ILWL 62) are being forwarded to next generations.
- Preliminary evaluation and wide hybridization in *Vigna* spp: A total of 10 wild *Vigna* spp comprising 30 accessions were characterized and preliminary evaluated for agro-morphological.
Characterization and core set development

Wheat landraces

Linseed

Rice bean

Cowpea
Multiplication and characterization crop germplasm for genotyping and conducting multi-environmental trial under DBT

Wheat germplasm (7350 acc.)

Sesame germplasm (4824 acc.)

a) Jhusia, b) Lal Mishri, c) Pahari Gol Gehun, d) Lal Mundia
Phenotyping of 2634 accessions linseed germplasm for agromorphological traits

Characterization and multiplication of 700 Niger germplasm
Characterization of 2893 germplasm accessions of grain amaranth for core development

Characterisation of 6983 safflower germplasm accessions for core development
Agro-morphological characterization of 3054 Field Pea Germplasm

Maize Inbred Development

- High protein lines, IC617877
- High protein lines, IC617880
- Popping trait, IC623954
- Waxy trait, waterlogging tolerance IC283431
- Chitku maize (Popping quality)
- High carotenoid lines, IC624629
- Chindwara local (Ear girth and drought tolerance)
Characterization and Evaluation of Germplasm

Bael (*Aegel marmalos*) 106 acc.

Hazel nut germplasm

Foxtail millet germplasm

Taro germplasm (53 acc.)
Pre-breeding and genetic enhancement in selected crops

<table>
<thead>
<tr>
<th>Crop</th>
<th>Traits of Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pepper</td>
<td>Chilli Leaf Curl Disease</td>
</tr>
<tr>
<td>Okra</td>
<td>Yellow Vein Mosaic disease</td>
</tr>
<tr>
<td>Brinjal</td>
<td>Fruit &amp; Shoot Borer</td>
</tr>
<tr>
<td>Lentil</td>
<td>Rust, Powdery mildew, <em>Fusarium</em> wilt</td>
</tr>
<tr>
<td>Vigna spp.</td>
<td>Mungbean Yellow Mosaic disease</td>
</tr>
<tr>
<td>Chickpea</td>
<td><em>Fusarium</em> Wilt, Pod number</td>
</tr>
</tbody>
</table>

Inter-specific hybridization in *Vigna* species

>65,000 accessions supplied to researchers from NBPGGR and other NAGS centers in 4 years (excluding germplasm shared in collaborative projects)
### Registration of Trait-specific Germplasm

#### Crop group Present status

<table>
<thead>
<tr>
<th>Crop group</th>
<th>Present status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals and Pesudocereals</td>
<td>698</td>
</tr>
<tr>
<td>Millets</td>
<td>129</td>
</tr>
<tr>
<td>Fibre and Forages</td>
<td>125</td>
</tr>
<tr>
<td>Grain Legumes</td>
<td>199</td>
</tr>
<tr>
<td>Vegetables</td>
<td>132</td>
</tr>
<tr>
<td>Commercial Crops</td>
<td>114</td>
</tr>
<tr>
<td>M &amp; AP &amp; Spices and Masticatory</td>
<td>127</td>
</tr>
<tr>
<td>Narcotics</td>
<td>08</td>
</tr>
<tr>
<td>Ornamentals</td>
<td>85</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>244</td>
</tr>
<tr>
<td>Fruits and Nuts</td>
<td>61</td>
</tr>
<tr>
<td>Tubers</td>
<td>54</td>
</tr>
<tr>
<td>Agro-forestry</td>
<td>08</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>1,984</strong></td>
</tr>
</tbody>
</table>

#### Crop group-wise representation of trait-specific germplasm registered (1996-2022)

- Cereals and Pesudocereals: 35%
- Millets: 3%
- Fibre and Forages: 3%
- Grain Legumes: 12%
- Vegetables: 10%
- Commercial Crops: 7%
- M & AP & Spices and Masticatory: 7%
- Narcotics: 6%
- Ornamentals: 6%
- Oilseeds: 4%
- Fruits and Nuts: 4%
- Tubers: 10%
- Agro-forestry: 17%

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**Galanga**

IC0625983; INGR18038

**Cucumber**

IC0420405; INGR18029

**Oil palm**

IC0597686; INGR17082

**Ber**

IC0625849; INGR19102
**GERmplasm Utilization**

**Yardlong Bean (Vigna unguiculata ssp. sesquipedalis) Variety**

**Name:** Sahasra (RCHYB-1)  
**Pedigree:** IC582859 (KV/ TSA-35)  
**Breeding method:** Pure line selection  
**Released through:** SVRC/ Notified (2019)  
**Released by:** Sri Konda Laxman Telangana State Horticultural University  
**Yield potential:** 169.3 q/ha

**Name:** Mithra  
**Pedigree:** IC582850 (KV/TSA -27)  
**Breeding method:** Pure line selection  
**Released through:** SVRC Notified  
**Released by:** KAU, Vellanikkara  
**Yield potential:** 216 q/ha

**Name:** Kairali  
**Pedigree:** IC045415  
**Breeding method:** Pure line selection  
**Released through:** SVRC Notified  
**Released by:** KAU, Vellanikkara  
**Yield potential:** High yielding & field resistance to Mosaic disease.
Cluster Bean *Telangana Gokarakaya*
Released by: SKLTSHU

**Coriander: Susthira**
Released by: SKLTSHU

**Coriander: Rajendranagar Kottimeera**
Released by: SKLTSHU

**Teasle gourd**

Name: Arka Bharat
Pedigree: Selection from JB/11-178A
Breeding Method: Clonal Selection
Released by: KAU, Vellanikkara
**NBGPR's Knowledge Management Portfolio**

### Databases
- Passport database (IC)
- Import database (EC)
- Genebank database (LTS)
- Cryobank database
- Germplasm registration
- Characterization database
- *In Vitro* genebank database

### Applications
- PGR Portal
- Genebank Dashboard
- Cryo Dashboard
- PGR Map
- PGR Clim
- GRIS
- E-Herbarium
- CWR
SIX databases; TEN applications; FOUR mobile apps

• NBPGR Website: ~ 1lakh hits/year
Acknowledgements: This compilation is a contribution of hundreds of scientists who worked for ICAR-NBPGR and other institutes of ICAR and State Agricultural Universities. The presenter is indebted to all of them and acknowledges their contribution.