



**Joint FAO/IAEA Centre**  
Nuclear Techniques in Food and Agriculture

# *Induced Genetic Diversity for Resistance to Fall Army Worm in Maize*

**The Joint FAO/IAEA Centre of  
Nuclear Techniques in Food and Agriculture**

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# Plant Breeding & Genetics (PBG)

## Demand-driven research innovations, applications

Develop improved, climate-change adapted, crop varieties for food and nutrition security, reduced poverty through nuclear and related biotechnologies

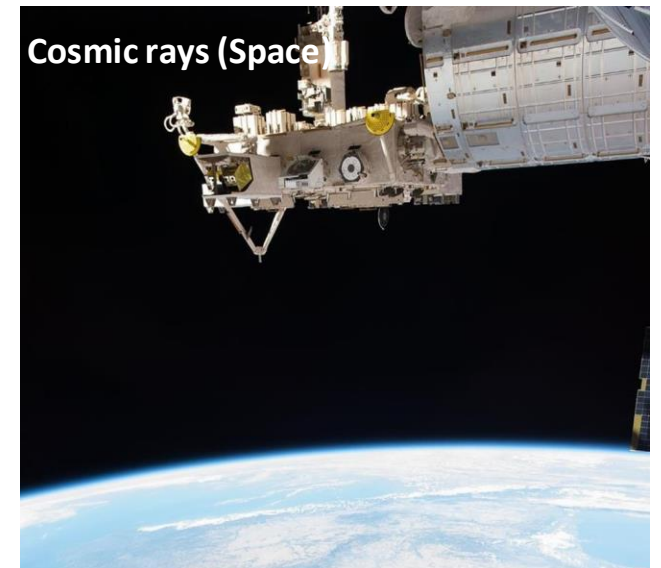
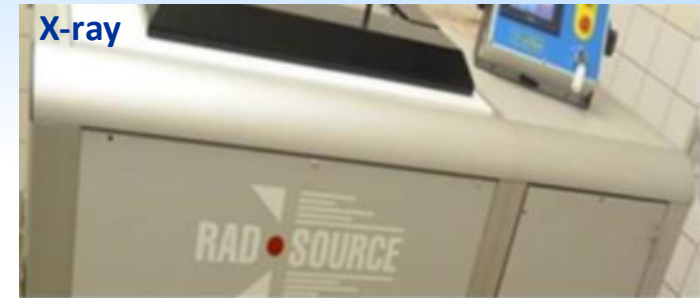
- **Induced genetic variation**
- **Genomics**
- **Precision phenotyping (selection)**
- **Speed-breeding technologies**
- **Seed systems for farmers' access to new varieties**

Delivered through: **Coordinated Research Projects** *and*  
**Technical Cooperation Projects**



# Induced Genetic Variation & Mutation Breeding

- Spontaneous mutations are the basis of evolution
- Naturally occurring mutations were selected during crop domestication, crop improvement
- Induced genetic variation provides wider selection pools of improved plants



# Ongoing Projects in Insect Pest Resistance

## Induced genetic diversity for pest resistance Non-Bt alternative

- Resistance to Fall Army Worm in Maize
  - IAEA Technical Cooperation Project, CAF 5015
  - National project, Central African Republic
- Resistance to chickpea pod borer, *Helicoverpa armigera*
  - Coordinated Research Project, CRP D22006
  - India, Pakistan
  - Duration 2019-2023
- Resistance to cowpea pod borer, *Maruca vitrata*
  - Coordinated Research Project, CRP D22006
  - Burkina Faso, India, Kenya, Namibia, Nigeria, Senegal, Zambia



Photo: Mahendar Thudi, ICRISAT



Photo: Dhanasekhar P, BARC

# Improving Productivity of Maize and Developing Resistance to Fall Armyworm Using Radiation-Induced Novel Genetic Diversity — Phase II

## Scope:

To increase resistance to fall armyworm in maize to enhance productivity through induced genetic variation, mutation breeding and the development and release of improved varieties.

- Initiate mutation breeding in maize with radiation-induced novel genetic diversity
- Capacity development to screen and select for FAW resistance
- Advance mutant lines showing FAW resistance in the breeding program

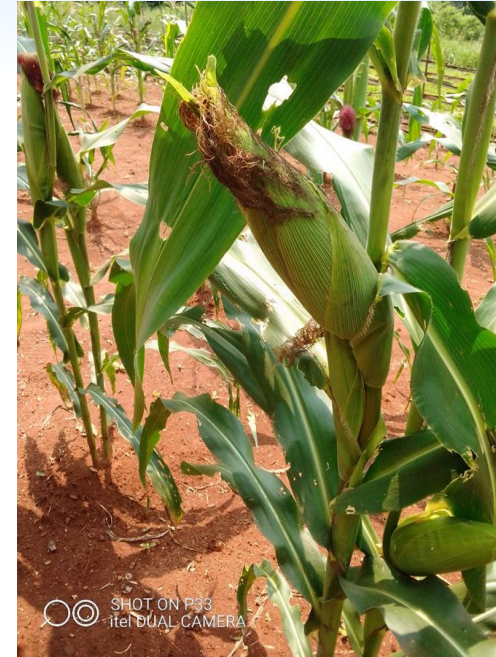


Photo: Lucie Aba-Toumou  
Univ of Bangui



Photo: CIMMYT

# Radiation-Induced Genetic Diversity and Mutation Breeding for Resistance to Fall Army Worm (FAW) in Maize

## Timeline

- Current project is Phase II
- IAEA national Technical Cooperation (TC) Project
- # CAF 5015 for Central African Republic
- Main Counterpart: Univ of Bangui
- Two-year project from Jan 2022 to Dec 2023
- Phase I project in 2020 – 2021 (CAF 5013)
- A follow-up Phase III project will be required for:
  - Variety registration and release
  - Molecular analysis of genetic associations for FAW resistance in maize



Photo: Lucie Aba-Toumou, Univ of Bangui

# Relevance to IPPC

- FAW, a serious transboundary insect pest
  - Severe threat to food security
  - Estimated annual loss up to 6.2 billion USD in Africa
- CAF 5013, 5015
  - Complements FAO's global action against FAW
  - Genetic resistance in maize
  - Durable and sustainable measure
- FAO's Global action against FAW
  - Detection and surveillance
  - Prevention of entry/spread
  - Reduced pesticide use



Photo Courtesy: FAO

# Main Outputs

## Phase I

- Germplasm for breeding identified
- Seed irradiated, generation advance in progress
- Capacity development
  - Infrastructure: Greenhouse constructed

## Phase II

- Screening for FAW resistance
- Generation advancement
- Capacity development for researchers
  - Screening for genetic resistance (Fellowship, Scientific Visit)
  - Mutation breeding (Fellowship, Scientific Visit)
  - Mutation breeding (National Training Course)
  - Establishment of insect rearing facility for FAW screening
  - Small equipment and consumables





# Mutation Breeding Examples – Seed Crops

- Over 3400 global records in the FAO/IAEA Mutant Variety Database  
[Mutant Variety Database - Home \(iaea.org\)](http://iaea.org/Mutant-Variety-Database-Home)
- Predominantly seed crops



**Drought tolerant groundnut in Sudan  
(SUD5033, SUD5037)**



**Heat tolerant cotton in Pakistan  
(RAS5075)**

# Mutation Breeding Example – Vegetative Crop

Developing banana varieties resistant to TR4 (CRP D22005)



Screening for resistance under controlled greenhouse conditions  
(PBG Laboratory)



Field testing for resistance to TR4  
(Ganjun Yi, GDAAS)



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# *Thank You*

*FAO/IAEA Agriculture and Biotechnology Laboratories*