



**The Future of Food: Globalizing Access to Technologies
for
CROP MUTATION BREEDING**

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Mutation Breeding

Introduction:

- Muller demonstrated mutagenic effect of X-ray in 1928.
- Staedler experimented in Maize and barley.
- Mutation breeding refers to the method of **using artificial mutagenesis to obtain new biological cultivars.**

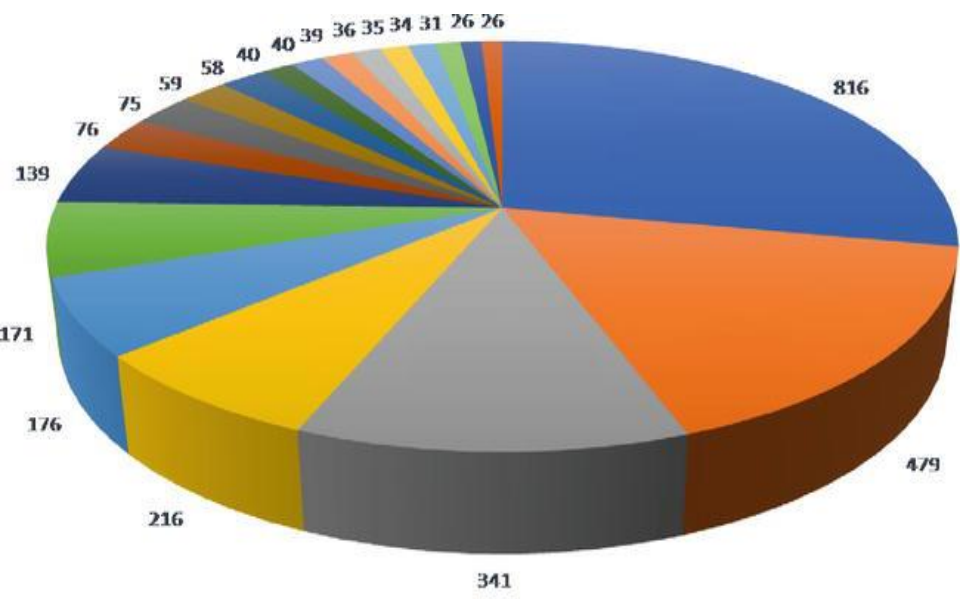
Advantages:

- Accelerate process of developing new varieties
- Facilitate obtaining mutant traits hardly got under natural condition
- Increase genetic variation and biodiversity
- Effective genetic improvement of vegetatively propagated crops



Number of mutant varieties released in top 20 countries till 2020

BINA developed varieties of 19 crops



Total Crop Varieties: 124
Mutant varieties: 87

Cereals: 26

Pulses: 40

Oilseeds: 32

Horticultural Crops: 23

Fiber Crops: 3

- China
- Japan
- India
- Russian Federation
- Netherlands
- Germany
- United States
- Bulgaria
- Bangladesh
- Pakistan
- Viet Nam
- Canada
- Korea, Republic of
- France
- Indonesia
- Italy
- United Kingdom
- Poland
- Sweden
- Guyana

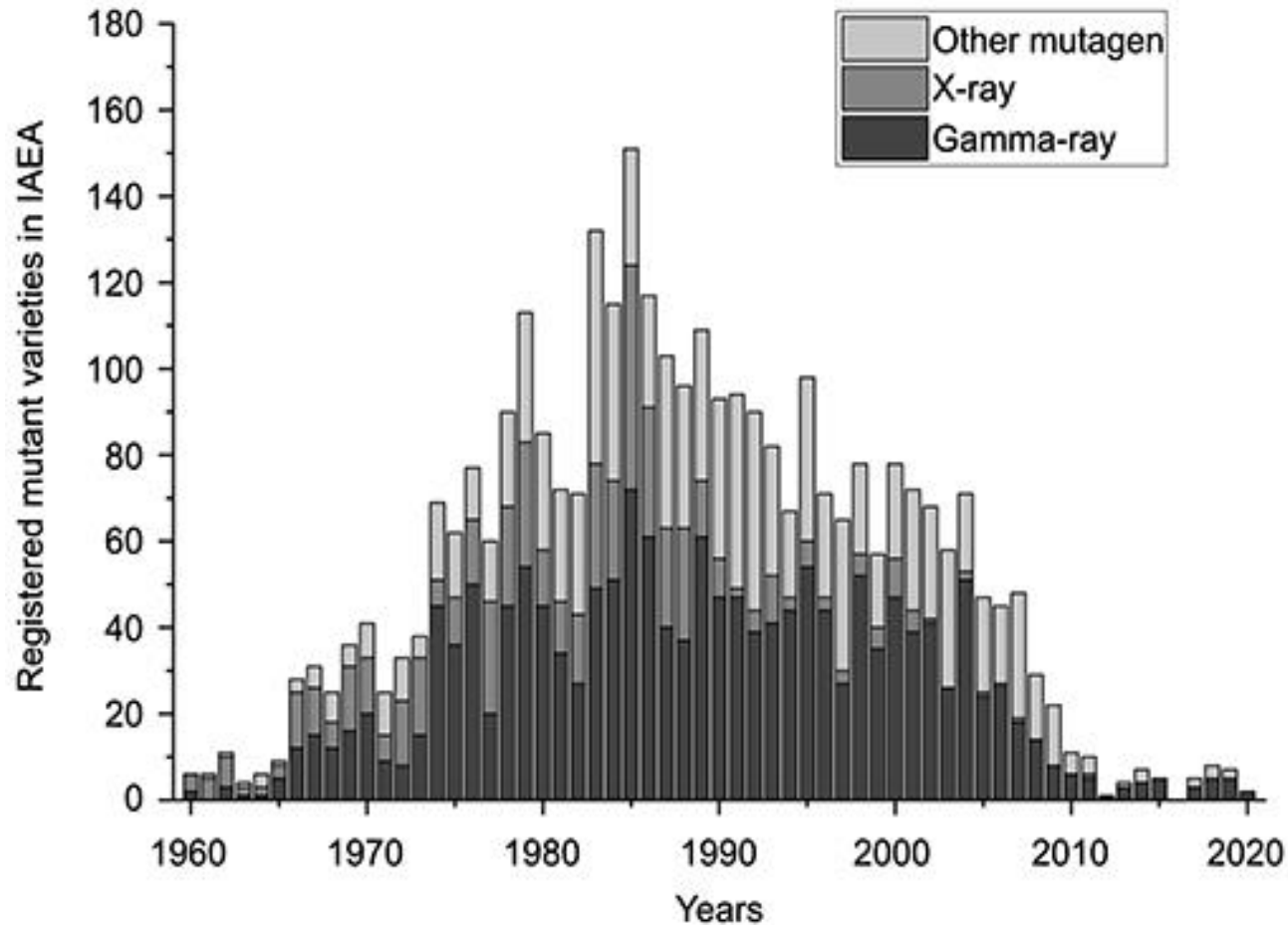
- ✓ Accommodates even 4 crops in a year
- ✓ Eradicated Monga (Seasonal starvation)
- ✓ Tripled rice production

Cobalt-60 and cesium-137-based technologies have been extremely successful for the past 65 years

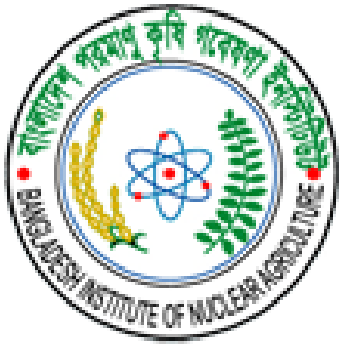
Source: Mutant varieties database, IAEA accessed on 10th September, 2020.



MAJOR CONCERNS



- ❖ Cobalt-60 has major environmental and security issues
- ❖ Cobalt-60 is not available easily
- ❖ Cannot be switched off
- ❖ 12% loss every day due to natural radioactive decay
- ❖ Cobalt-60 cannot be transported easily
- ❖ Today, it is more expensive to build, maintain and replenish a cobalt-60 facility compared to a commercial scale eBeam facility



Advantages of Electron Beam

- **New technology**
- **Radiation emission only on operation state**
- **Required dose rate is much lower than gamma**
- **Double strand break (DSB) is 5.7 times higher than gamma**

Crop	LD50 (Gy)		Mutation Frequency (%)	
	Gamma ray	eBeam	Gamma ray	eBeam
Rice	300.00	275.05		
	300.03	286.45		
Rice	280-350	290-330		
Chickpea			8.64	17.82
Blackgram			6.6	9.6
Mungbean			1.343	1.967
Cowpea			13.38	23.38



THANK YOU