Broadening Genetic Resources through Mutation Breeding for Global Food Security

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Abstract:
The world of agriculture is facing serious challenges in sustaining the livelihood of a growing human population. It is estimated that global food supply, by 2050, will need to increase by about 50% to feed an anticipated population of 9.7 billion. Crop production, which is vital to global food security, is increasingly affected by climate change all over the world. Population growth and climate change affect the crop production and are indicating a need for immediate action regarding the improvement of crops to guarantee food security in developing countries. To end poverty and hunger, to minimize the impacts of the climate change and to adapt to environmental changes, it will be more crucial than ever to develop new crop varieties with improved tolerance/resistance to both abiotic and biotic stresses as well as to improve the nutritional quality.

To meet these challenges, the Joint FAO/IAEA Division has been supporting Member States through national and regional Technical Cooperation Projects and Coordinated Research Projects, to improve their capacities in plant mutation breeding and related biotechnologies. This support, through mutation breeding, has facilitated substantial contributions to food security in Member States. Over 3364 mutant varieties in more than 220 plant species have been officially released worldwide. Thousands of mutant lines contribute to the breeding programmes in Member States and thousands of crop varieties released through nuclear techniques contribute to global food security.

Physical mutagens, mostly ionizing radiation, can increase the natural mutation rate and have been widely used to induce heritable genetic changes and increase biodiversity. More than 70 per cent of induced and released mutant crop varieties have been developed using physical mutagens. Since the 1960s, gamma rays and x rays have become the most commonly used mutagenic agents in plant mutation breeding. During the past two decades, ion beam radiation has emerged as an effective source of mutagen.

Considering ongoing and likely future advances in science, mutation breeding can continue to contribute towards creating new genetic variability that enhance crop adaptability especially to abiotic and biotic stresses, thus promoting the diversification of crop production and broadening crop diversity for climate change adaptation. Recent breakthroughs in high-throughput mutation detection technologies, such as whole genome sequencing, have increased the efficiency of identifying the DNA changes that generate a new improved agronomically important trait. Genomics tools have uncovered important traits that can provide gains to crop varieties in the different parts of the globe.

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