

SAVING HARVESTS THROUGH



- 1 Crop diseases are one of the most challenging threats we face, affecting everyone on the planet directly or indirectly. Like so many crops, wheat — a key component for bread making — has over periods of time faced horrific destruction from diseases. One such disease, a wheat stem rust caused by a new virulent race (Ug99) can destroy whole wheat crops in a matter of days.



- 2 Getting into action, the international community has strived over the years to protect crops against plant diseases. Leading in the use of nuclear techniques, the Joint FAO/IAEA Laboratories at Seibersdorf, Austria, irradiate seeds to induce biological variation from which varieties with disease resistance may be developed, thereby helping farmers as well as consumers.



- 3 The FAO/IAEA Laboratories focus on inexpensive, quick and easy-to-use nuclear technologies to increase variation in plants that may then be used in plant breeding. Such variation can be induced by, for example, irradiating seeds with gamma- or X-rays. The resulting plants can then be selected for desired traits such as disease resistance, tolerance to environmental stress, or other desired qualities.



- 4 Member States regularly send their seeds to the Joint FAO/IAEA Laboratories where they are subjected to a range of irradiation dosages. These seeds are then returned to the Member State for local plant breeders to screen out the rare variants that possess the exact traits of importance to that specific country or region, such as for example diseases resistance.

HIGH NUCLEAR TECHNOLOGY



- 5 For the past 50 years the Joint FAO/IAEA Laboratories have been working continually to help develop plants resistant to diseases that affect important crops like wheat, rice, barley, potato and banana. In this endeavour the irradiation dose is crucial; low doses can stimulate growth, while too high a dose may stifle it. The decisive point is to dispense the optimum dose for mutagenesis, which lies somewhere in-between.



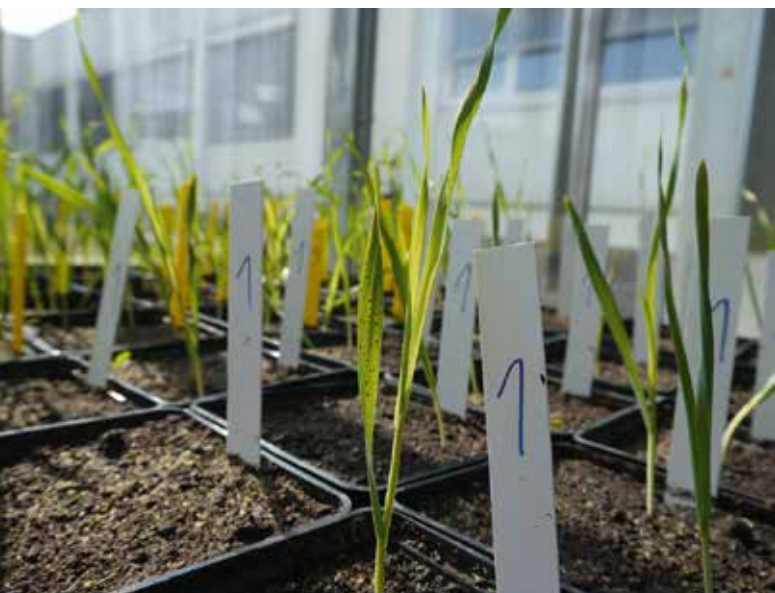
- 6 Dr Brian P. Forster, Head of the Joint FAO/IAEA Division's Plant Breeding and Genetics Laboratory, explains the irradiation techniques that are used to increase variation in plants: "Mutation induction takes seconds, minutes or a few hours, screening for beneficial mutants takes months or maybe even a few years. Mutation breeding is quicker than conventional breeding, generally taking 7-8 years to produce a variety as opposed to 10-15 years by conventional methods. Additional techniques are being developed to reduce the time further".



- 7 At the Joint FAO/IAEA Laboratories, screening of mutant plants takes place in large greenhouses. The greenhouses have carefully controlled temperature, water, lighting and humidity to imitate the conditions where the seeds will eventually be sown. In the picture rice is being grown in salty water in conditions simulating Vietnam.



- 8 In Vietnam, numerous villages and whole populations depend on the fate of each season's rice crop. The FAO/IAEA Laboratories have supported rice mutation breeding in Vietnam for many years. One success has been the development of new varieties of export quality rice that are also tolerant to soil salinity and can therefore now be grown in the Mekong Delta.



- 9** Spots are a common symptom of many crop diseases. Single gene mutations can provide resistance to such diseases.



- 10** Barley is used extensively as an animal feed. The barbed brittle 'whiskers' on the ears, which in nature act as a seed dispersal mechanism, cause lacerations in the mouths of feeding animals and have no nutritional value. The FAO/IAEA Laboratories have developed mutant lines without these "whiskers" to improve barley as an animal feed.



- 11** The FAO/IAEA Laboratories contributes to crop improvement tailored to Member States' needs. In East Africa unpredictable rainfalls play a crucial role in food security and hence in people's livelihood. Drought tolerant wheat mutants are here being screened and tested in a 'Kenyan environment' before being sent to Kenya for further trials.



- 12** The FAO/IAEA Laboratories is one of several international agencies that support Member States in their endeavours to enhance harvests of crops. After treatment with irradiation to increase variation, treated seeds are returned to Member States to be tested in the field. A recent success was the UG99-resistant wheat varieties, irradiated at the FAO/IAEA Laboratories and isolated and screened in Kenya. Two of these disease resistant lines have now been developed into varieties.

Text: Aabha Dixit and Michael Madsen, IAEA Division of Public Information; Photos: Michael Madsen & Greg Webb/IAEA