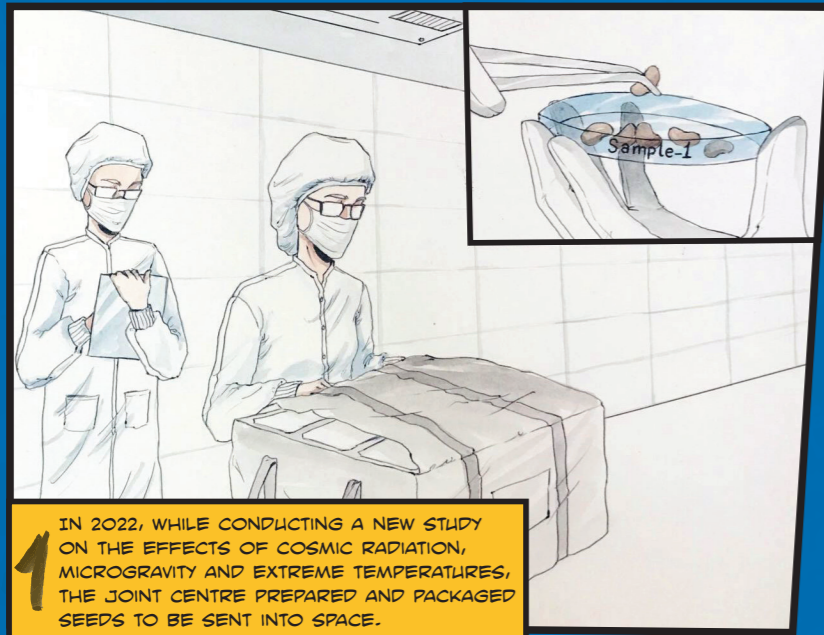


# Seeds in Space

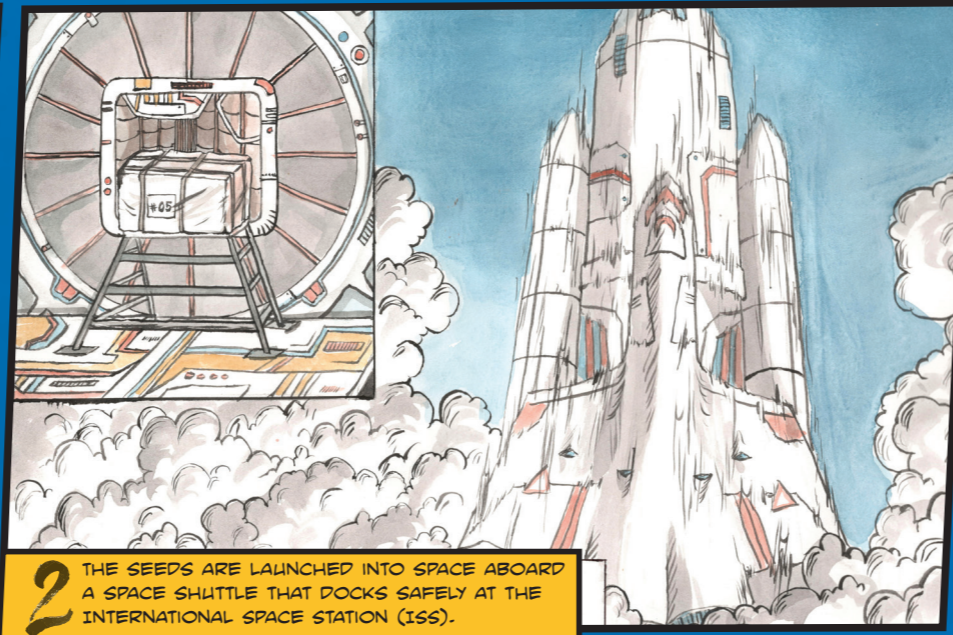
For 60 years, the Joint FAO/IAEA Centre of Nuclear Techniques in Food and Agriculture (Joint Centre), based in Austria, has been speeding up the natural genetic adaptation of plants by using gamma radiation in laboratories to develop more resilient crop varieties and support global food security.

Amid the ravages of climate change, farmers increasingly struggle to produce enough food and the need for these crop varieties has become increasingly urgent. In 2022, scientists at the Joint Centre started exploring new avenues of research that could potentially speed up crop breeding even more.

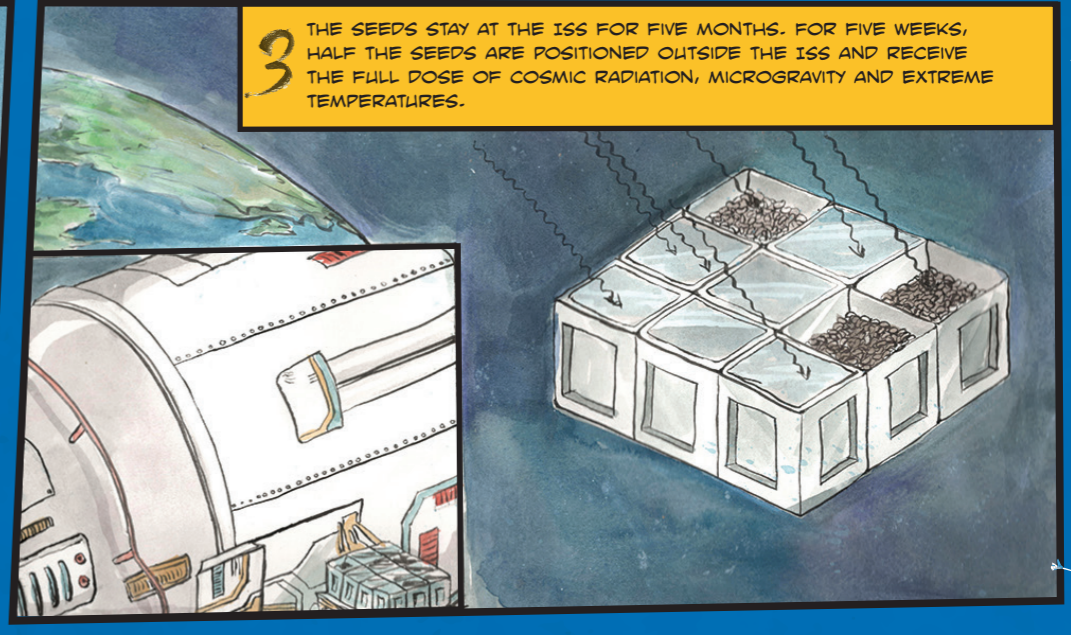
One of the methods they considered was to send seeds up into space...



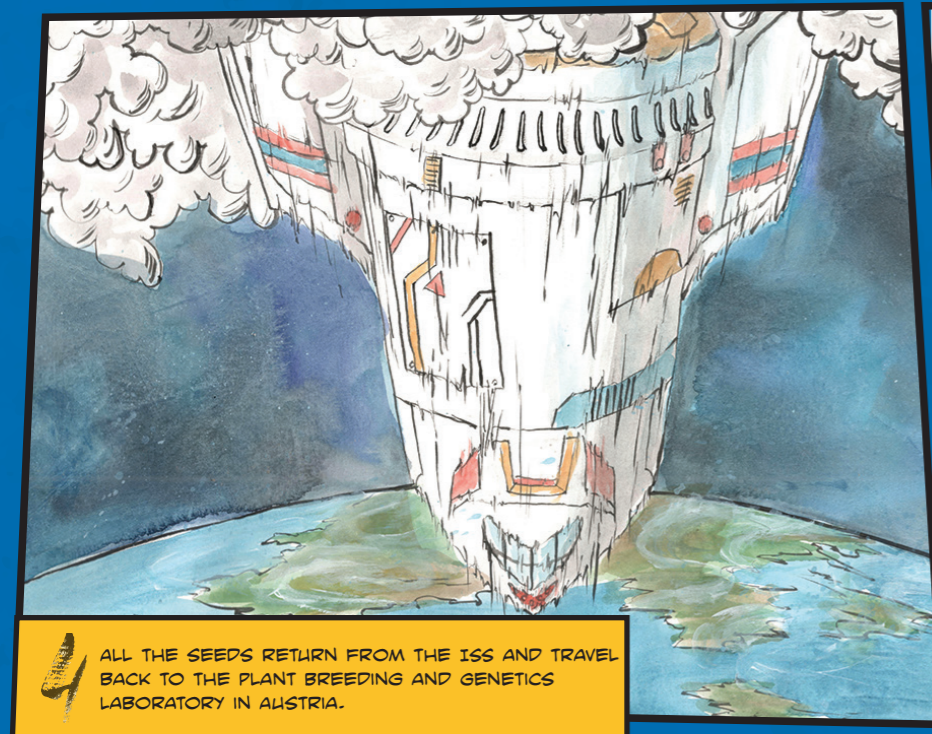
**1** IN 2022, WHILE CONDUCTING A NEW STUDY ON THE EFFECTS OF COSMIC RADIATION, MICROGRAVITY AND EXTREME TEMPERATURES, THE JOINT CENTRE PREPARED AND PACKAGED SEEDS TO BE SENT INTO SPACE.



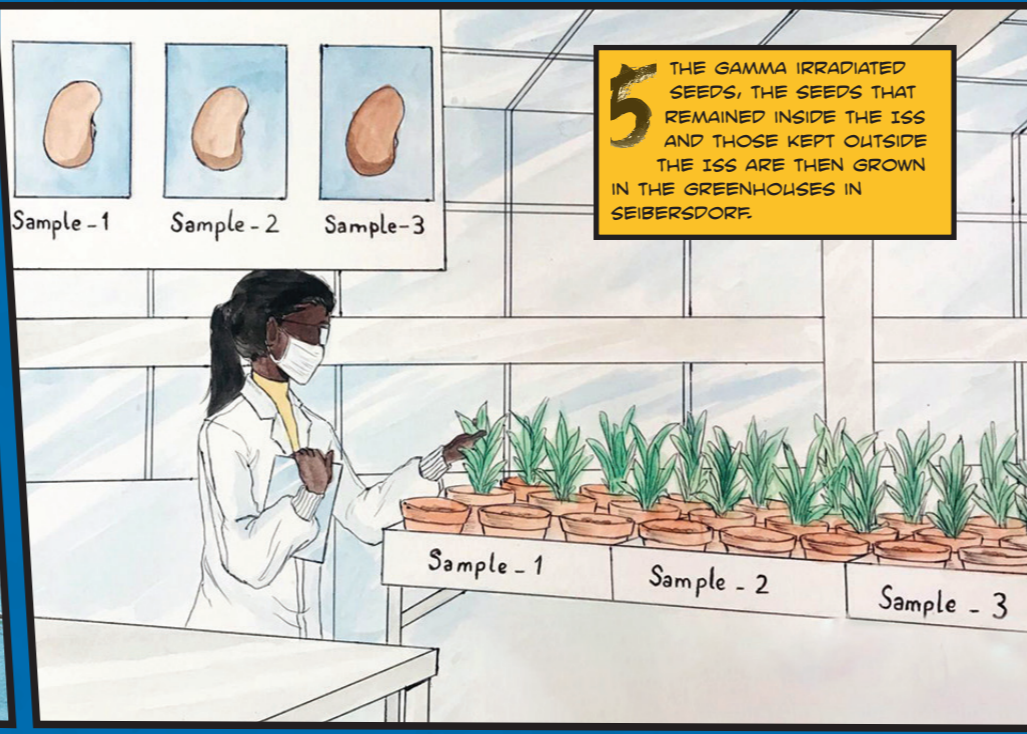
**2** THE SEEDS ARE LAUNCHED INTO SPACE ABOARD A SPACE SHUTTLE THAT DOCKS SAFELY AT THE INTERNATIONAL SPACE STATION (ISS).



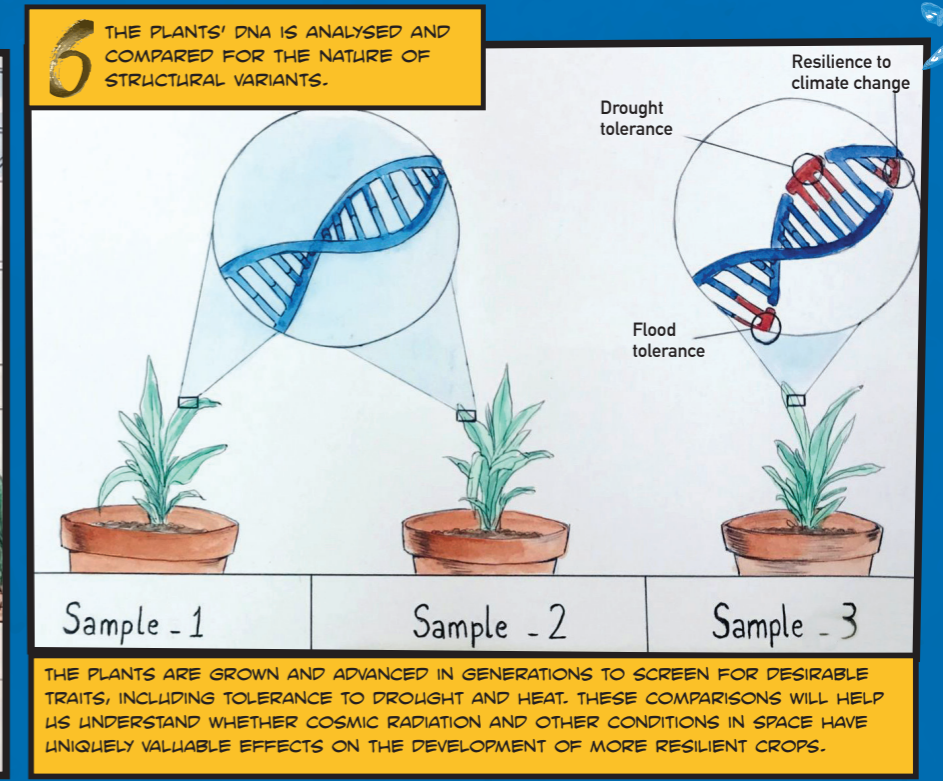
**3** THE SEEDS STAY AT THE ISS FOR FIVE MONTHS. FOR FIVE WEEKS, HALF THE SEEDS ARE POSITIONED OUTSIDE THE ISS AND RECEIVE THE FULL DOSE OF COSMIC RADIATION, MICROGRAVITY AND EXTREME TEMPERATURES.



**4** ALL THE SEEDS RETURN FROM THE ISS AND TRAVEL BACK TO THE PLANT BREEDING AND GENETICS LABORATORY IN AUSTRIA.



**5** THE GAMMA IRRADIATED SEEDS, THE SEEDS THAT REMAINED INSIDE THE ISS AND THOSE KEPT OUTSIDE THE ISS ARE THEN GROWN IN THE GREENHOUSES IN SEIBERSDORF.



**6** THE PLANTS' DNA IS ANALYSED AND COMPARED FOR THE NATURE OF STRUCTURAL VARIANTS.

Resilience to climate change  
Drought tolerance  
Flood tolerance

Sample - 1      Sample - 2      Sample - 3

THE PLANTS ARE GROWN AND ADVANCED IN GENERATIONS TO SCREEN FOR DESIRABLE TRAITS, INCLUDING TOLERANCE TO DROUGHT AND HEAT. THESE COMPARISONS WILL HELP US UNDERSTAND WHETHER COSMIC RADIATION AND OTHER CONDITIONS IN SPACE HAVE UNIQUELY VALUABLE EFFECTS ON THE DEVELOPMENT OF MORE RESILIENT CROPS.

ARTWORK BY  
**SEEMAB FATIMA**

In 2023, more than 70 young artists around the world submitted designs for the Seeds in Space Comic Book Contest, held by the IAEA and the Food and Agriculture Organization of the United Nations (FAO) with the aim of inspiring the next generation of experts in nuclear science and technology. The winner was Seemab Fatima from Pakistan, whose ink and watercolour artwork will be the inspiration for a comic book showing how cosmic radiation and the harsh conditions in space could help develop better crops and contribute to food security on Earth.



LEARN MORE ABOUT  
**SEEDS IN SPACE**