

New EU-project to enhance seed quality

Each year massive economic losses are suffered by farmers and the seed trade alike due to poor seed quality. These losses are partly due to inadequate storage conditions, and are predicted to be exacerbated by climate change. A team of European scientists has committed themselves to unravel how environmental stresses to the mother plant will impact upon seed quality, and if seed storage conditions prior to the next sowing can be improved to enhance seed quality. The €3 million project will be coordinated by the University of Innsbruck, Austria.

Every seed has a life of its own. Information received during its development on the mother plant determines its quality: how long a seed can be stored, if it will be dormant (see below), if it will germinate readily after storage and if it will grow into a healthy, vigorous new plant. Seed quality is further influenced by storage conditions, and is essentially important to agriculture and industry. It has been estimated that yield loss from major cereals due to rising temperatures between 1981 and 2002 was \$5 billion per year. Importantly, seed wastage resulting from sub-optimal seed performance undermines food security and livelihoods. High-quality seed and a capability to store them adequately are also pivotal to safeguard the seeds of wild plant species required for the conservation of plant biodiversity. “Seed quality is determined by highly complex interactions between biochemical, biophysical and molecular processes within the seed, which are only very poorly understood” explains Ilse Kranner, Professor of Plant Physiology at the Austrian University of Innsbruck, who is the coordinator of the EU-project EcoSeed. In this project, three crop species, barley, sunflower and cabbage will be studied together with the model plant *Arabidopsis*, to see how drought and elevated temperatures suffered by the mother plant, impact upon seed quality. As a next step, the scientists want to find out how changes in temperature, humidity and oxygen concentrations during storage further affect seed viability, storability, and seedling vigour. The knowledge gained from the detailed study of the above four plant species will then be transferred to wild plant species to the benefit of conservation projects. Eleven renowned European teams participate in the EcoSeed project. Among them are the Seed Conservation Department of the Royal Botanic Gardens, Kew, maintaining the largest *ex situ* genebank for wild plant species globally, and the Federal *ex situ* Genebank of Germany, the IPK Gatersleben, which is the largest crop genebank in the EU. “EcoSeed combines aspects of food security and conservation, and we are lucky to have top-class scientists in the consortium” says Ilse Kranner.

Signalling hubs that determine seed fate

Seed dormancy is an example for the highly complex processes that occur within seeds. Dormancy is the inability of a seed to germinate in spite of favourable conditions before certain environmental cues have been received. For example, in temperate European climates many seeds shed from the mother plant in the autumn will not germinate, even though the environmental conditions such as temperature and soil moisture are ideal, explains the scientist. Before it will germinate the seed needs to undergo an extended period of low temperature during the winter – it then “knows” that spring has arrived. This important seed trait – as well as other traits that define seed quality – is controlled by “signalling hubs” throughout the seed life cycle, from seed development on the mother plant, through processing, storage to germination. These complex signalling hubs comprise plant hormones and signalling compounds such as “reactive oxygen species”, which are of specific importance to the research area of the Innsbruck team and others in the consortium. The teams will apply the most recent state-of-the-art “omics” (transcriptomics, proteomics and metabolomics) and “post-omics” techniques to unravel factors that determine seed quality on different levels: they will study how genes within the seed are affected by stress, and how this influences the production of proteins and smaller compounds required for a healthy metabolism.

Facts and Figures

Funded by the 7th EU Framework Programme for Research and Innovation, the project „Impacts of Environmental Conditions on Seed Quality“ (acronym „EcoSeed“) was awarded a rounded sum of €3 million. EcoSeed is a four year project running from the start of 2013 to the end of 2016. The project initiation meeting was held at the University of Innsbruck on the 4th of February. Apart from the University of Innsbruck (Austria) the following 10 institutions participate in the project: Royal Botanic Gardens, Kew (United Kingdom), Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung, Gatersleben (Germany), Université Pierre et Marie Curie (France), Max Planck Institute for Plant Breeding Research (Germany), Warwick University (United Kingdom), Institut National de la Recherche Agronomique (France), University of Leeds (United Kingdom), Universidad de Salamanca (Spain), Commissariat à l'énergie atomique et aux énergies alternatives (France) and Limagrain Europe (France). Within the 7th Framework a total of 10 projects are coordinated by Austrian research institutions.

Contact:

Ilse Kranner, PhD, MSc
Professor of Plant Biology
Institute of Botany
University of Innsbruck
Ilse.Kranner@uibk.ac.at

Eva Fessler, MSc
Public Relations officer
University of Innsbruck
Eva.Fessler@uibk.ac.at