

# Seeds keep vital much longer when stored without oxygen

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If seed breeding companies, gene banks and the Svalbard Global Seed Vault on Spitsbergen should store plant seeds under oxygen-poor

conditions, it would be possible to store them for much longer while still maintaining their germination capacity. This is indicated by research carried out by seed physiologists from Wageningen UR and seed experts from the Centre for Genetic Resources, the Netherlands, a Dutch gene bank which is part of Wageningen UR. They studied pregerminated celery seeds, which generally speaking lose their germination capacity after only three weeks. When the seeds were stored without oxygen, 98% of them germinated after three weeks.

Many breeding companies and gene banks outside the Netherlands store seeds for modern varieties and wild species in regular air. The air contains 21% oxygen, which reacts with vital substances in the [plant seeds](#). This reaction with oxygen reduces the quality and germination capacity of the seeds. A brief period under oxygenated conditions is not a problem, because the antioxidants in the seeds can capture the oxygen. But now it appears that the effects of oxygen under long-term storage conditions are so severe that oxygen is the limiting factor in the longevity of the seeds. If seeds were to be stored without oxygen, they would maintain their germination capacity for much longer.

## **Easier for gene banks**

In their scientific article, the Wageningen researchers propose gene banks to package seeds under oxygen-poor conditions immediately after harvest and drying, because this will slow the loss of antioxidants. This means that the seeds can be stored for much longer periods of time, reducing the costs for regeneration.

Many gene banks outside the Netherlands use storage jars from which seeds are taken from time to time (the Dutch gene bank does not use this method). This creates a dilemma for the gene banks: On the one hand, they want to be able to supply seeds on demand, but on the other hand they want to open the storage jars as infrequently as possible, because

the seed quality deteriorates once the package has been opened. If the oxygen could be removed from seed packages after opening, the seeds would not lose so much quality after the jars have been opened. This can be easily and inexpensively done by including a package of iron powder in the jar.

## **Spitsbergen**

On the Norwegian island Svalbard, a seed [vault](#) has been built in the permafrost, where gene banks can store a back-up in case their collection is lost through war or other disasters. Jan Engels, a researcher with Biodiversity International, expects that the discovery made by the Wageningen researchers can also have a positive effect on the longevity of the seeds in the Seed Vault. Engels states, 'The findings confirm the impact of oxygen on seed longevity. It is still too early to precisely quantify the gains in seed longevity. But I am convinced that it is a good idea for the Svalbard Global Seed Vault to see whether it can make use of the Wageningen discovery, because the effect on the longevity of the seeds has the potential to be very positive.'

## **Pregerminated seeds**

Oxygen-poor seed storage can also benefit plant breeding companies, particularly in the case of seeds with a short shelf life, such as lettuce, onion and leek. Breeding companies often pregerminate their seeds, so that the seeds all germinate at approximately the same moment after sowing. This treatment often reduces seed longevity. By packaging the seeds in oxygen-poor conditions, the breeding companies can guarantee a higher quality of the seed for sowing for a longer period of time.

## **New research technique**

It had been demonstrated before that seeds for crops can survive longer when stored under anoxia, but the anoxia storage effects were not always positive. Wageningen scientists were sure that oxygen-impact would be crucial for the viability of seeds. But seed industry was not so sure about that. To convince seed companies and gene banks about the deteriorating effect of oxygen upon seeds, the researchers developed a research technique that allows for studying the oxygen-impact in a fast test.

Even when using 100% oxygen, experiments to show effects on the rate of seed ageing would take too long. One of the involved researchers of Wageningen UR is also SCUBA diving instructor and therefore knew that the oxygen concentration can also be increased by increasing gas pressure. He put lettuce and cabbage seeds in his SCUBA tank with 200 bar air pressure. After only three weeks of storage under these conditions most of the seeds did not germinate properly any more. The seeds had aged very fast due to the high [oxygen](#) pressure.

Using this result the scientists developed an experimental setup to study the mechanisms seed have evolved in order to survive dry conditions for a long period of time.

**More information:** "Prolonging the longevity of ex situ conserved seeds by storage under anoxia." Steven P. C. Groot, et al. *Plant Genetic Resources* [DOI: 10.1017/S1479262114000586](https://doi.org/10.1017/S1479262114000586), Published online: 11 April 2014

Provided by Wageningen University

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