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Apples beat pears on crunch issue

By Jonathan Amos
Science reporter, BBC News

Inside a pear: Tiny interconnected channels do not carry oxygen to the fruit's core as efficiently as apples

Just why pears rot faster than apples can now be explained by science.

It is all to do with how oxygen is able to find its way to the centre of the fruit after it has been picked.

Belgian researchers used one of the world's most powerful X-ray machines to image the tiny pores and channels that carry air through the two foods.

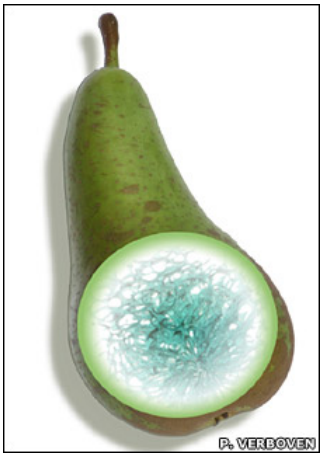
Pieter Verboven's team was able to show how the structures in pears meant they got "out of breath" quicker than apples - key information for growers.

The results of the study will improve the models used to determine optimal storage conditions.

"If we know how the pears get into storage, we can better predict how they will behave," the Catholic University of Leuven scientist told BBC News.

"From season to season, from batch to batch, even from orchard to orchard - we can give advice to the grower, saying 'well, for these pears, you may have to elevate the oxygen concentration in your storage room because there is the potential for problems'."

There is a clear economic driver to minimise wastage in the fruit industry; and supermarket shoppers certainly do not want to cut into the flesh to find a brown, mushy mess.



The study will help reduce waste in the fruit industry

Year on year, very practical experiments are run to see how different crop varieties cope under a range of shelf conditions; but science is also trying to improve its understanding of the biochemical and physical mechanisms that underpin decay.

After picking, the cells in the fruit need oxygen for respiration - to

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produce the sugars and energy required to maintain good health. If air cannot pass through the fruit, cells close to the core will eventually start to brown and rot.

Pieter Verboven's group put apples and pears inside the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, which produces an intense, high-energy light that can pierce just about any material, revealing its inner structure.

Inside an apple: Cavities inside the apple carry oxygen to the core very efficiently

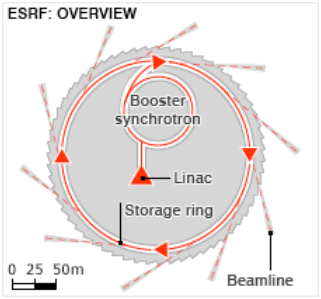
The giant X-ray machine is able to resolve features down to and below a thousandth of a millimetre; and by turning the target in front of the light beam, it is possible to build up extremely high-definition, three-dimensional views of the subject under study.

The latest research illuminated the microscopically small structures for oxygen supply that exist in fruit. In apples, the pathways appear as irregular cavities between cells, whilst in pears they have the shape of tiny interconnected channels.

"We already knew that different apple varieties have a different density which means they have a different fraction of air spaces; but we didn't know the structures," Dr Verboven told BBC News.

"We also knew that pears have a much lower amount of void spaces inside because pears sink to the bottom if you drop them in water whereas apples float, which indicates that one has more air than the other one.

EUROPEAN LIGHT SOURCE



Electrons are fired into a linac, or straight accelerator. They're boosted in a small ring before entering the storage ring. The superfast particles are corralled by a train of magnets. Energy lost by turning electrons emerges as intense light (X-rays).

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"But also in pears, no-one knew what the structure of those air voids was."

Now, the scientists understand not only what the cavities and micro-channels look like but also how they perform. The Verboven team was able to describe the complex mechanisms of gas exchange, respiration and fermentation that take place in the different fruits.

There is much less water in apples to slow the penetration of the gas, and although the channels in pears are connected they just do not work as efficiently as the big pores in apples in allowing oxygen to pass through to the core.

"It is still unclear how airways in the fruit develop, and why apples have cavity structures and pears micro-channel networks", explained

Dr Verboven.

"The micro-channels are so small that oxygen supply to the fruit core is very limited and cells are quickly 'out of breath' when oxygen levels fall below the safety threshold," he said.

The research is published in the journal Plant Physiology.

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