Isolcell

CONTROLLED ATMOSPHERE SINCE 1958

HORTGRO

Growing Fruit IQ

CA Technology and Low Oxygen Research Update

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Stellenbosch University

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Agenda

1) What is this Isolcell brand
2) DCA-CF HarvestWatch™ - Dynamic Controlled Atmosphere using HarvestWatch Fluorescence Sensors
3) Abate Fetel pear storage – a preliminary research update
4) CO_2 Scrubber functional developments as consequence to the DCA-CF technology market introduction
5) RQ STOREFRESH by Isolcell
6) Latest Isolcell developments

1) The Isolcell DNA

Family owned company based in
Bolzano – North Italy

Grew up in the center of one of the highest specialized apple production area in the world

More than 60 years of experiences in the fruit & vegetable storage business

Working in more than 60 countries all over the world

Quality 100% made in Italy

Highest capacity to react with tailor- made solutions on customer request

This led us to be

World leader in the production of Controlled Atmosphere equipment for fresh fruit & vegetable storage

2) DCA-CF – HarvestWatch™

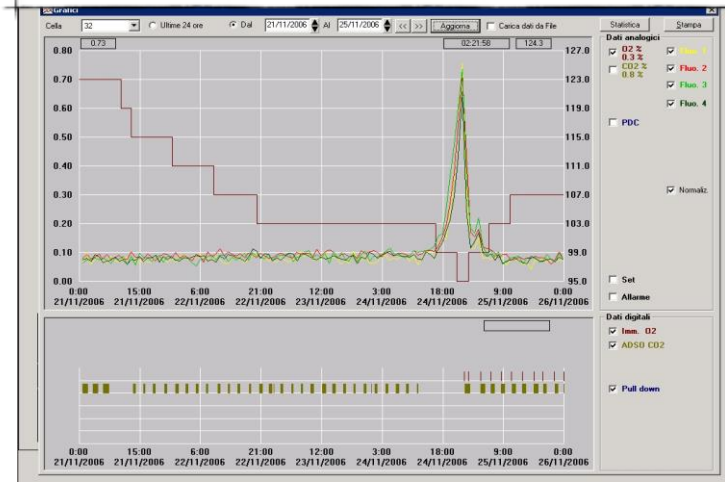
Dynamic Controlled Atmosphere using Chlorophyll Fluorescence Sensors

2) DCA-CF – HarvestWatch™

Dynamic Controlled Atmosphere using Chlorophyll Fluorescence Sensors

- On the market since 2003
- In 2019 more than 2300 commercial CA rooms worldwide (160 in RSA)

- About 25 research institutes in 18 countries world wide are working with DCA-CF HarvestWatch

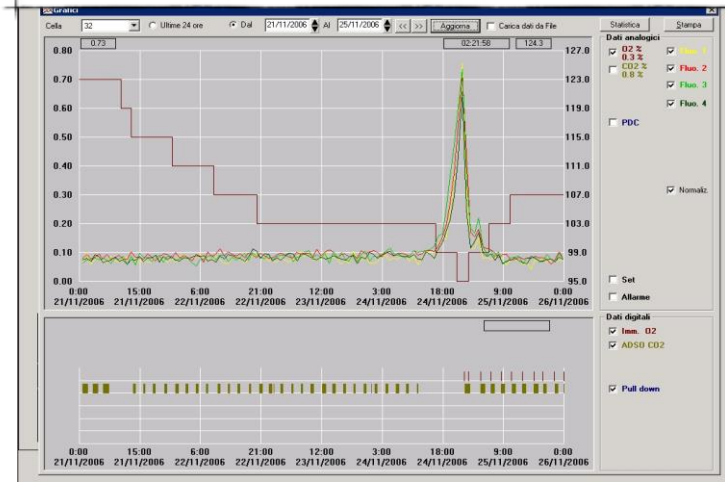


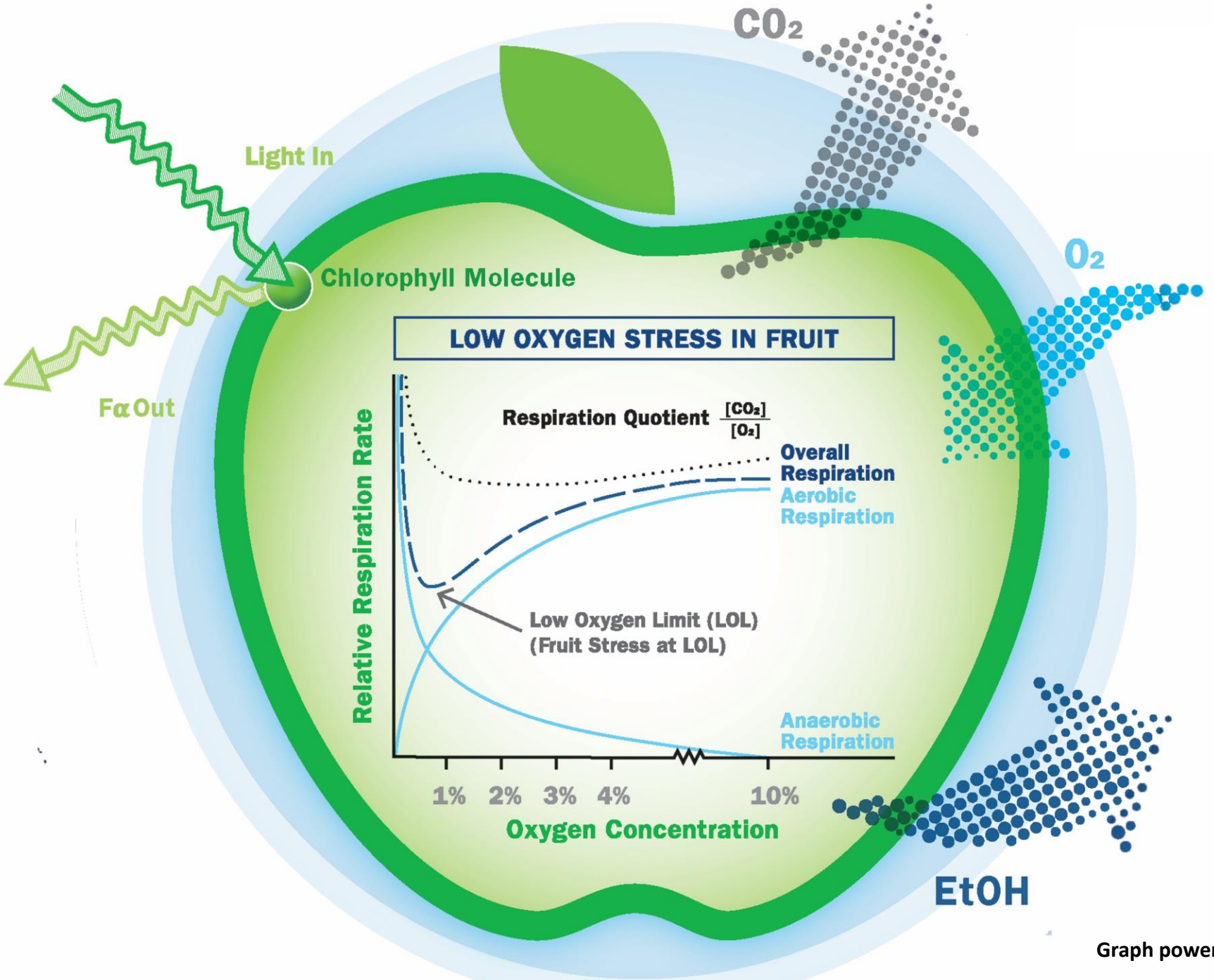
2) DCA-CF – HarvestWatch™

Dynamic Controlled Atmosphere using Chlorophyll Fluorescence Sensors

The principle in short

- Real time communication with the fruits inside a storage room using special sensors
- Measuring the Chlorophyll Fluorescence signal contained in the fruits' peel
- Below a specific oxygen level (ACP – anaerobic compensation point) the fluorescence signal clearly increase
- in this way Dynamically control of the O2 level, adapting it to the physiological fruit conditions





Graph powered by Gas At Site

Advantages of storing @ lowest possible O2 level compared to standard ULO conditions on cultivars …

- Reduction of rots and storage related losses
- Higher firmness and better freshness retention
- Preservation of the natural colour
- Preservation organoleptic properties
- Extended shelf-life after storage
- Delaying of Senescence Scald or Senescence internal browning

Golden Delicious

Gala

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- Delaying of Senescence Scald or Senescence internal browning

- Scald control without post-harvest use of chemicals

Red Delicious

Granny Smith

Advantages of storing @ lowest possible O2 level compared to standard ULO conditions on cultivars …

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- Preservation organoleptic properties
- Extended shelf-life after storage
- Delaying of Senescence Scald
- Scald control without post-harvest use of chemicals

- Control of internal browning (diffuse or radial browning issue)
- Possibility of increased storage temperatures

Rosy Glow – Cripps Pink

Braeburn

….short excursion to

What's about a combination DCA-CF storage with 1-MCP?

- *in Italy on apple storage a common practice*
- *used almost if there are planned long shipping periods after storage*
- *adding the 1-MCP benefits to the DCA-CF storage behavior*

<u>BUT</u>

- *adding also the weaker features of 1-MCP to the DCA-CF storage behavior*

If you plan a combination of both technologies
it is required to discuss an adequate application protocol
with the local 1-MCP representative.
F>or combinations it is recommended to first apply the 1-MCP protocol (step-wise cooling, eventually RA periods …) followed by the DCA-CF protocol,
even if this means that the
application of the DCA-CF protocol becomes postponed.

Advantages of storing @ lowest possible O2 level compared to standard ULO conditions on Pear cultivars …

- Preservation of the natural colour
- Better firmness control and better freshness retention
- Preservation organoleptic properties (ripening on demand)

- Reduction of rots and storage related losses
- Extended shelf-life after storage

- Scald control without post-harvest use of chemicals on Packhams

Forelle

Packhams

Williams

Why DCA-CF

Main benefits compared to other low O2 storage systems

DCA-CF is SAFE and RELIABLE

- About 2300 commercial rooms worldwide with strong research support
- HarvestWatch Sensors are accurate and measurements are independent to other Gas analyzing systems
- Real time communication with the stored fruits is the safest method to keep lowest O_2 levels along the storage period
- Possibility to increase the number of HarvestWatch Sensors getting exact values from selected batches without risk of information losses cause of generalized average values if measuring the entire store
- DCA-CF is not dangerous for the operator because there is no requirement of taking periodic samples out from asphyxiation environments

3) Abate Fetel Pear DCA-CF storage –

A preliminary research update

Abate Fetel general storage limits

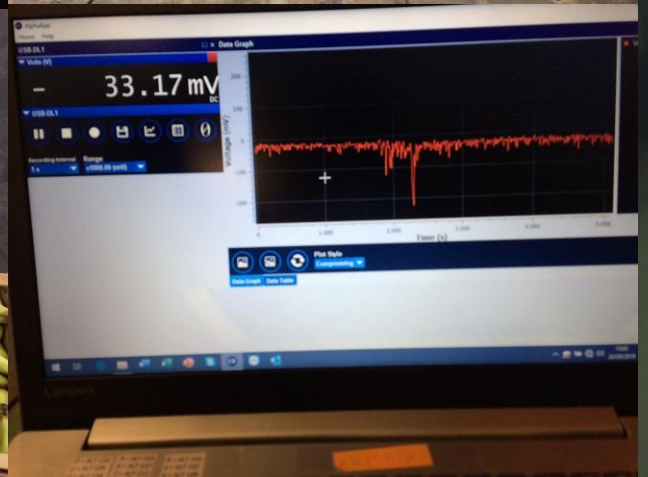
- Sensitive for common scald issue
- High sensitive for soft scald issue
- Sensitive for Internal browning

and what makes it more tricky

All sensitivities are strongly related to production practice, production area and to yearly environmental factors

The Isolcell approach…

…say yes to the challenge



3) Abate Fetel Pear DCA-CF storage –

A preliminary research update

- Trial in collaboration with Opera
- 6 different growers coming from 3 different pedo- climatic production areas around the city of Modena
- 4th year of examination
- 8 different air thigh tends inside a refrigerated storage room, with the possibility to set up 8 different DCA-CF protocols

Main objective

- Find a solution for medium term (6 months) Abate Fetel storage without any use of post- harvest chemical treatments

3) Abate Fetel Pear DCA-CF storage –

A preliminary research update

Actually (but very preliminary) winning DCA-CF protocol

- room filling @ - 0.5°C
- initial storage period in RA
- than O_2 pull-down until reaching fluorescence spike within 3 days
- final atmospheric levels: O_2 = ACP +0,1% / CO_2 = 0,6%

3) Abate Fetel Pear DCA-CF storage –

A preliminary research update

What we learned from the last 3 years

- Initial delay of CA necessary for overcoming the soft scald
- Not exceed the maximal time in CA (about 100 days) for not forcing soft scald
- Keeping O_2 levels near to the ACP point for optimal common scald control
- Keeping CO_2 levels constant @ 0,6% to not force internal disorders (IB, cavities)

4) CO2 Scrubber functional developments

as consequence to the DCA-CF technology market introduction

DCA-CF technology can be implemented

- In new storage rooms and also in existing storage rooms if the air tightness is ok
- New generation of CO_2 Scrubbers are necessary

ADSO line

IS – itelligent scrubber

ECO line
- 50%
Energy consumption

4) New CO2 scrubber functionalities

as consequence to the DCA-CF technology market introduction

Automatic cycle adjustment

- real time communication CO_2 Scrubber with analyzing system
- dynamically modification of the CO_2 Scrubbers operational parameters in relation to the actual atmosphere levels inside the storage rooms
- to optimize the scrubbing cycle reducing both energy consumption as well as quantities of residual oxygen introduced during cycle inter-changes.

4) New CO2 scrubber functionalities

as consequence to the DCA-CF technology market introduction

Cycle Ending Function

- To ensures CO_2 Scrubbing cycle ending on the room and switch to the next room only after the activated carbons has been completely regenerated
- No cross contamination of air from one to another storage room, which can be problematic if there are different atmospheric levels. Also if there is any Ethylene or pathogenic fungi contamination in a room

4) New CO2 scrubber functionalities

as consequence to the DCA-CF technology market introduction

Turbo Regeneration (T.R.)

- More powerful blower for regeneration process enhancement with possibility to complete regeneration of the active carbon
- High increasing of the general CO_2 Scrubber performance (up to 20%), reducing time of operation, reducing energy consumption
- increasing the life of the activated carbon

4) New CO2 scrubber functionalities

as consequence to the DCA-CF technology market introduction

Nitrogen Injection Function (N.I.F.)

- to inject nitrogen into the regeneration tank at the end of the cycle, but only if necessary in order to implement this function it is necessary to have a source of pressurised nitrogen at your disposal.

5) RQ STOREFRESH by Isolcell

STORE FRESH RQ® by Isolcell

NEW FRONTIER OF RESPIRATION CONTROL

Isolcell has always been a pioneer in the technological development and has now conceived a new system for the measuring of the Respiratory Quotient (RQ).

The RQ is the ratio between the CO2 produced and the O2 consumed by the fruit.

The new rivolutionary system Store Fresh searches for the lowest O2 Level, just above the point where fermentation starts.

The system consists on a gastight container inside the C.A. Room, in which via an extremely precised analyzer CO2 produced and O2 consumed by the fruit are measured within a certain timeframe.

The O2 level is automatically adjusted upon the changes in the respiratory quotient of the fruit and fermentation is avoided, while the lowest O2 partial pressure is applied.
This also avoid scald and the energy consumption of the cooling system is lower than in a regular system.

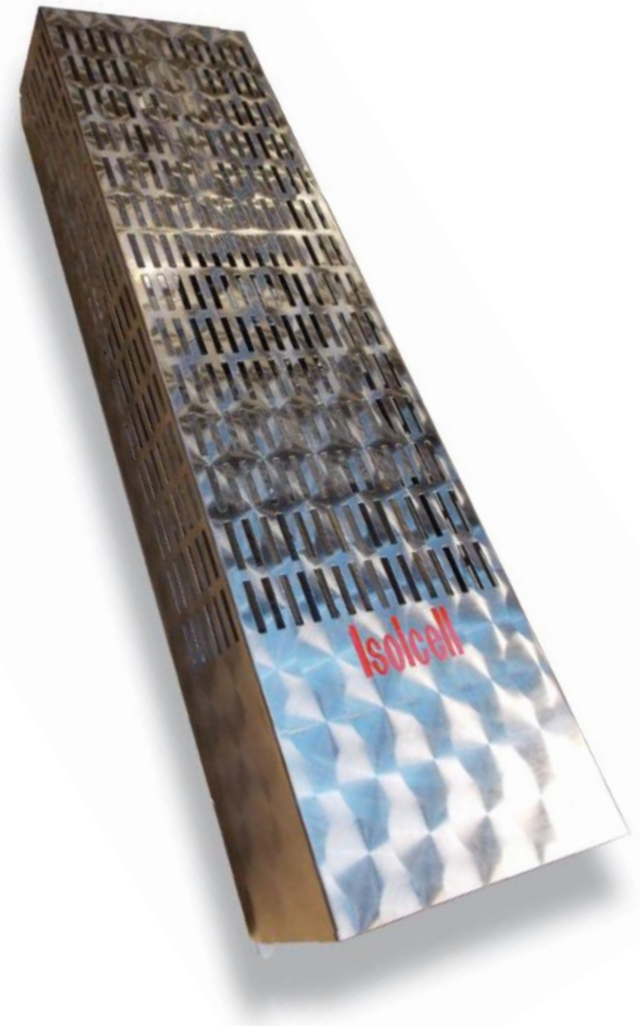
Advantages from measuring RQ values in a separated container

- Overcome TECHNOLOGY ISSUES: RQ measured in the room are very critically: first you need to disable the entire room for a couple of hours to any CA atmosphere action to get accurate readings and second the readings are always average values
- Overcome MATHEMATICALLY ISSUES: Also with extremely precise Gas analyzing sensors it is difficult to get repeated high accurate measurements of the second decimal and small errors of the second decimal are changing the mathematical RQ value extremely
- Overcome SAFETY ISSUES: The entire storage room become stressed continuously when disabled periodically from the CA atmosphere actions

6) Latest Isolcell developments

AEROCLEAN the air ionizer from Isolcell

- To control and avoid the appearance of moulds and fungal pathogens
- Is also efficient in the control of harmful volatile substances, odours and has a collateral effect to reduce Ethylene
- Disactivating microorganisms and contaminations in the air with active oxygene (R.O.S. = Reactive Oxygene Species)



6) Latest Isolcell developments

AMILON

- Automatic determination of the starch level (fruit ripening)
- Elimination of the human error
- Working with the most popular starch scales worldwide

Isolcell

CONTROLLED ATMOSPHERE SINCE 1958

Highest Technology made simple

Thank you for you kind attention