

Improving the shelf life of organic table grapes through an innovative packaging system endowed with a breathable device (BlowDevice® Technology)

Challenge

The EU generates 5 million tonnes of food waste annually, composed mainly of fruits and vegetables, accounting for 16% of GHG emissions¹. Reducing waste helps save resources.

Solution

The shelf life of organic table grapes can be enhanced by combining MAP (Modified Atmosphere Packaging) with innovative BlowDevice® micro-technology that provides the packaging with breathable properties and controls the exchange of gases between the inside and outside.

Benefits

Sustainable packaging with BlowDevice® reduces food waste by optimising packaging material and designs. Moreover, it minimises environmental impact and extends product shelf life.

Practical recommendation

- BlowDevice® technology was developed and patented by Ninetek Ltd and the University of Basilicata in the framework of the Italian Operational Group Oltre.bio. The device was designed in several versions and materials (Mater-Bi, PLA). It can control the gas exchange for products with different respiration rates and avoid fog formation on the package's internal surface. The device was combined with MAP to extend the shelf life of organic table grapes in cold storage (cv. Sugraone, Scarlotta and Arra 15).
- In recent trials, the patented invention was also tested on the following fruits: organic cherries (cv. Ferrovia, Lapins and Sweet Heart), organic strawberries (cv. Melissa), clementines², figs (cv. Dottato)³, button mushrooms (Button mushroom), and rocket (Fig. 1).
- A specific packaging machine was built to use the BlowDevice® in several industrial packaging applications (Fig.2).

Applicability box

Theme

Value chain

Context

Technology adapted in packing houses to all highly perishable fresh products.

Application time

All year

Required implementation time

BlowDevice® technology is inserted into the film during the packaging step.

Period of impact

Immediate impact by increasing the shelf life and maintaining the quality of the packaged product.

Equipment

BlowDevice®, machine for inserting the device and film.

- Moreover, the European Commission recognised BlowDevice® micro-technology in biodegradable films as a 'key technology' in Europe on the Innovation Radar Portal⁴.



[Source: Di Renzo \(2023\)](#)

Figure 1. Organic table grapes stored under MAP in breathable packaging equipped with BlowDevice®



[Source Di Renzo \(2023\)](#)

Figure 2. Flow pack machine for inserting BlowDevice® in film packaging at the Romanazzi company

Further information

Videos

- [Oltre.bio – Innovative management of organic cherry growing and organic table viticulture: !\[\]\(aca6fcc8bd95e8255b9ea1b1d08ef300_img.jpg\) <https://www.youtube.com/watch?v=8srV2fHBgyQ>](https://www.youtube.com/watch?v=8srV2fHBgyQ)

Web links

- [!\[\]\(79de0df6c6ddd2d4eb74f1cc5f48ec50_img.jpg\) <http://www.blowdevice.com/>](http://www.blowdevice.com/)
- [!\[\]\(d4c9768318b38eff1042b07478e20b4c_img.jpg\) \[BlowDevice®: the eco-sustainable solution for the shelf-life of table grapes: \\[https://feder.bio/wp-content/uploads/2017/07/Blow-device_Uvadatavola_II_Apr-Mag-2022.pdf\\]\\(https://feder.bio/wp-content/uploads/2017/07/Blow-device_Uvadatavola_II_Apr-Mag-2022.pdf\\)\]\(https://feder.bio/wp-content/uploads/2017/07/Blow-device_Uvadatavola_II_Apr-Mag-2022.pdf\)](https://feder.bio/wp-content/uploads/2017/07/Blow-device_Uvadatavola_II_Apr-Mag-2022.pdf)
- [!\[\]\(27d314856359a9d7feca17161bc1f4a4_img.jpg\) \[Oltre.bio, innovative results for the organic table grape market: <https://www.rinnovabili.it/agrifood/oltre-bio-risultati-innovativi-per-il-mercato-delluva-da-tavola-biologica/>\]\(https://www.rinnovabili.it/agrifood/oltre-bio-risultati-innovativi-per-il-mercato-delluva-da-tavola-biologica/\)](https://www.rinnovabili.it/agrifood/oltre-bio-risultati-innovativi-per-il-mercato-delluva-da-tavola-biologica/)
- [!\[\]\(d355663486c698e3972a8b93ac8b2102_img.jpg\) \[Characterization of an innovative device controlling gaseous exchange in packages for food products: <https://www.sciencedirect.com/science/article/abs/pii/S0925521417308281?via%3Dihub#abs0005>\]\(https://www.sciencedirect.com/science/article/abs/pii/S0925521417308281?via%3Dihub#abs0005\)](https://www.sciencedirect.com/science/article/abs/pii/S0925521417308281?via%3Dihub#abs0005)
- [!\[\]\(1858f6a9022d088c0a7eca873f99643b_img.jpg\) \[Effect of Materials and Assembly Methods on Gas Selectivity of Blow® Device: \\[https://link.springer.com/chapter/10.1007/978-3-030-39299-4_80\\]\\(https://link.springer.com/chapter/10.1007/978-3-030-39299-4_80\\)\]\(https://link.springer.com/chapter/10.1007/978-3-030-39299-4_80\)](https://link.springer.com/chapter/10.1007/978-3-030-39299-4_80)
- [!\[\]\(4a9a9afe1808e44249cde903a007394f_img.jpg\) \[Effect of Packaging Technology on the Quality of Pre-cooled Clementine Fruit: \\[https://link.springer.com/chapter/10.1007/978-3-030-39299-4_78\\]\\(https://link.springer.com/chapter/10.1007/978-3-030-39299-4_78\\)\]\(https://link.springer.com/chapter/10.1007/978-3-030-39299-4_78\)](https://link.springer.com/chapter/10.1007/978-3-030-39299-4_78)
- [!\[\]\(b0b1e1d141c1d30eea8a1d92bb8c534b_img.jpg\) \[A novel breathable package system to improve the fresh fig \\(*Ficus carica* L. 'Dottato'\\) shelf life: <https://onlinelibrary.wiley.com/doi/full/10.1002/jsfa.12093>\]\(https://onlinelibrary.wiley.com/doi/full/10.1002/jsfa.12093\)](https://onlinelibrary.wiley.com/doi/full/10.1002/jsfa.12093)

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This practice abstract was elaborated in the CLIMED-FRUIT project.

Project website: www.climed-fruit.eu

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Cost/benefit analysis



BlowDevice®

Introduction – presentation of ex-ante and post-ante situation


Table grapes grown in the south of Italy, and in Puglia region as well, belong to multiple varieties, both white and black, with or without seeds. The geographical context at stake is characterised by ideal pedo-climatic conditions to obtain a high-quality product, in particular with a high level of sugars and rich aromas, highly appreciated by national and international consumers.

Organic table grapes are a vulnerable fruit due to their perishability, especially in the south of Italy, which is prone to fungal infections. Traditional methods like sulphur dioxide (ex-ante) have drawbacks and are not allowed under organic agriculture. Alternative GRAS (Generally Recognised As Safe) treatments were explored but presented several limits of effectiveness and application. In this context, it is important to foster the use of a specific “intelligent” packaging, based on a label able to control the exchange of gasses in a bidirectional way, i.e. accumulation of carbon dioxide inside the packaging and avoiding the “fog” effect caused by the water vapor. The innovative device (ex-post situation), placed directly on the packaging, plays the role of a barrier to fruit respiration, able to improve the shelf-life of different fresh fruits after harvesting. *(Simplified CBA was conducted on organic table grapes)*






Legend

-  Estimated indicator
-  Measured indicator

Economical costs and benefits

	Ex-ante (total amount €/ha)	Ex-post (total amount €/ha)
Variable costs		
Seedings/plants	None	None
Fertilizers	None	None
Pesticides	1000 €/ha	300 €/ha <i>Use of blowdevice include an earlier harvest, then less pesticides used</i>
Water	None	None
Labour	2000 €/ha	1000 €/ha
Machine costs	None	3000 €/ha <i>Machine costs refer to the machinery needed for application of the blowdevice (packaging)</i>
Interest on previous cost	None	???
Revenues	25000 €/ha (as a standard)	30000 €/ha
Gross margin	22000 €/ha	26700 €/ha
COMPARISON	Global reduction of 21% of the cost: 	

Environmental costs and benefits

Energy	<p>Indicator deterioration between 1% and 24%:</p> 
<p>The indicator refers to fuel consumption (necessary to produce the breathable label), and gas (necessary to keep the packaging at low temperature). The unit of measurement is the amount of Kw saved.</p>	
Water	<p>Indicator improvement between 25 and 49%:</p> 
<p>Water saving (intended as water saved for the extended shelf life of the product) is considered as important in the practice considered with reference to the unit of measurement, i.e. litre per hectares saved of irrigation.</p>	
Soil	<p>Indicator improvement between 25 and 49%:</p> 
<p>As to soil, the indicator refers to soil saved form further cultivation, and the unit of measurement to hectare saved form new cultivation.</p>	
Air	<p>Unmeasured impact:</p> 
<p><i>No direct relationship between the practice and the indicator in question</i></p>	
Biodiversity	<p>Unmeasured impact:</p> 
<p><i>No direct relationship between the practice and the indicator in question</i></p>	



Oltre.bio – Innovative Management of Organic Cherry Growing and Organic Table Viticulture

Short description of the OG

Oltre.bio links agriculture with government and research in the Apulia region. It focused on two main crops, organic table grapes and cherries, using an ecosystem approach to improve crop quality through soil and water management. Agronomic and post-harvest techniques were keys to success. By prioritising sustainability and organic practices, Oltre.bio aimed to produce top-quality fruit while promoting environmental conservation and biodiversity.

Benefits

Increasing soil fertility and managing adversity by using advanced sensors to analyse adversity early. Rationalizing and better managing the irrigation supply, post-harvest and packaging.

Stage of implementation

The project ended in February 2023.

Applicability box

Theme

Climate change adaptation
Organic fertilization
Pest management
Soil health
Value chain
Water-use efficiency
Digital technologies

Context

Apulia region, South of Italy.
On-farm composting to produce compost tea, application of DSS to improve water-use efficiency, sustainable adversity management and innovative packaging to increase shelf-life represent best practices at the experimental level in the region.

Duration

4 years (2019-2023)

Partners involved.

Producer organisations, research bodies, universities, regional institutions, innovation brokers.

Budget

495.000,00€

Particularity

In the context of the Apulia region, which is particularly suited to agriculture, the project aimed to create an ecosystem between private companies, research bodies, and regional institutions to foster soil health and water-use efficiency. This objective was pursued through innovative solutions experimented on-farm.



Main achieved or expected results

- **Improved soil fertility**

Public opinion is shifting towards sustainably produced agri-food products with a low environmental impact. The recovery of waste and organic residues through on-farm composting is key to achieving sustainability in agroecosystems (Fig. 1).



Figure 1. On-farm composting at the CREA-AA experimental farm

Compost tea is a liquid extract of organic and inorganic molecules and microorganisms (Fig. 2). The process usually lasts about 5–8 days. The Oltre.bio project aimed to enhance the understanding of compost tea production and its application in organic cherry orchards and vineyards in Apulia (Fig. 2).



Figure 2. Production of compost tea at the CREA-AA experimental company

- **Water use efficiency by using the Decision Support System (DSS) in organic table grape vineyards**

At farm level, the sensors measure soil moisture, temperature, electrical conductivity and atmospheric pressure. Data is gathered in Blueleaf software to aid farmers in making informed decisions, enhancing their awareness and efficiency in the field (Fig. 3).



Figure 3: Communication method between hardware and software



- **Innovative packaging to increase the shelf life of organic cherries and organic table grapes**

BlowDevice® technology, patented by UNIBAS and Ninetek Ltd, gives the packaging breathable characteristics to extend the shelf life of perishable organic fruit (Fig. 4). The device was recognized as a 'key technology' in Europe. A packaging machine for industrial use has been developed.



Figure 4. Organic table grapes stored under MAP in packaging equipped with BlowDevice®

- **Adversity management**

Different natural extracts were tested on the farms at blooming and before harvest to control the incidence of pre- and post-harvest rot in the main crops. Chitosan was the most effective product, reducing the development of rot by over 68% in post-harvest cherries (Fig. 5).



Figure 5. Application of treatment and the effect of natural extracts to control post-harvest rot

- **Phytosanitary and agronomic bulletins**

Oltre.bio partners carried out weekly field inspections on the farms involved in the project. The data collected on phytosanitary management and technical guidance were disseminated through 39 bulletins.

- **Phytosanitary management notebooks**

The main project outcome was the development of two notebooks dedicated to pest management for farm companies and technicians.

Existing materials

Videos


- **Oltre.bio. The new organic challenge:**
<https://www.youtube.com/watch?v=4uijvoO302k&t=3s>
- **Discover the results of the project:**
<https://www.youtube.com/watch?v=HiyblypTeno&t=188s>
- **How to get compost and compost tea. Oltre.bio project demonstration day on 29/04/2022:** <https://www.youtube.com/watch?v=TeVOBrJDkPw>


Web links

- <https://feder.bio/progetti/oltre-bio/>
- **Compost and extracts for the sustainability of agricultural systems:**
<https://feder.bio/wp-content/uploads/2017/07/Compost-ed-estratti-per-la-sostenibilita-dei-sistemi-agricoli.pdf>
- **On-farm compost:** <https://feder.bio/wp-content/uploads/2017/07/Poster-Oltrebio-23012023-1.pdf>
- **Compost tea:** <https://feder.bio/wp-content/uploads/2017/07/Poster-Oltrebio-23012023-2.pdf>
- **Organic cherry growing: a demonstration day in the field:**
<https://www.fruitjournal.com/cerasicoltura-bio-una-giornata-dimostrativa-in-campo-2/>
- **Innovative strategies for the control of pests and fungal agents: monitoring activities at the service of operators:** <https://feder.bio/wp-content/uploads/2017/07/monitoraggio-e-strategia-di-controllo-dei-parassiti-nel-ciliegeto-bio-1.pdf>
- **Organic cherry growing: a demonstration day in the field:**
<https://www.fruitjournal.com/cerasicoltura-bio-una-giornata-dimostrativa-in-campo-2/>
-  **BlowDevice®**
- **BlowDevice®: the eco-sustainable solution for the shelf-life of table grapes:**
https://feder.bio/wp-content/uploads/2017/07/Blow-device_Uvadatavola_II_Apr-Mag-2022.pdf
- **Oltre.bio, innovative results for the organic table grape market:**
<https://www.rinnovabili.it/agrifood/oltre-bio-risultati-innovativi-per-il-mercato-delluva-da-tavola-biologica/>
- **39 phytosanitary and agronomic bulletins:**
 - **21 bulletins in 2021:** https://feder.bio/wp-content/uploads/2017/07/Bollettino-fitosanitario-e-agronomico-N-1-OLTREBIO_rev-01.pdf
 - **18 bulletins in 2022:** <https://feder.bio/wp-content/uploads/2017/07/Bollettino-Fitosanitario-ed-agronomico-N-6.pdf>
- **2 phytosanitary management notebooks:**
 - **Phytosanitary protection of the cherry tree in organic farming:**
https://feder.bio/wp-content/uploads/2017/07/rev-29-NOV-22-Schede-impaginate_ciliegio.pdf
 - **Phytosanitary protection of table grapes in organic farming:** https://feder.bio/wp-content/uploads/2017/07/REv-18-MAGGIO-2023-Schede-impaginate_vite.pdf



Further reading

 Effect of Materials and Assembly Methods on Gas Selectivity of Blow® Device:
https://link.springer.com/chapter/10.1007/978-3-030-39299-4_80

 Effect of Packaging Technology on the Quality of Pre-cooled Clementine Fruit:
https://link.springer.com/chapter/10.1007/978-3-030-39299-4_78

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