



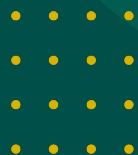
MODULE 3: INCREASED SHELF LIFE AND PACKAGING BIOLOGICAL CIRCULARITY



Extending shelf life of Fresh salads and ground raw vegetables through naturally controlled BIOPAP® LC gas permeability without MAP gas flushing

Sara Limbo,
Associate Professor, PhD
University of Milan,

Department of Food, Environmental and
Nutritional Sciences



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Sede: BIOPAP®'s ACADEMY- Settimo Milanese

sara.limbo@unimi.it





Market

READY-TO-EAT SALADS: INCREASING DEMAND

- Fresh-cut produce: over €1 billion in turnover
- Italy leader in Europe
- 84% of Italian customers buy fresh-cut products every year
- Increase in purchase frequency in stores (+20%)
- No more chosen as an alternative option, but as 'healthy comfort food'

Source: Unione Italiana Food
– Gruppo Prodotti
Ortofrutticoli IV e V Gamma;
AstraRicerche (2024); dati
aziendali Zerbinati.



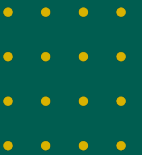


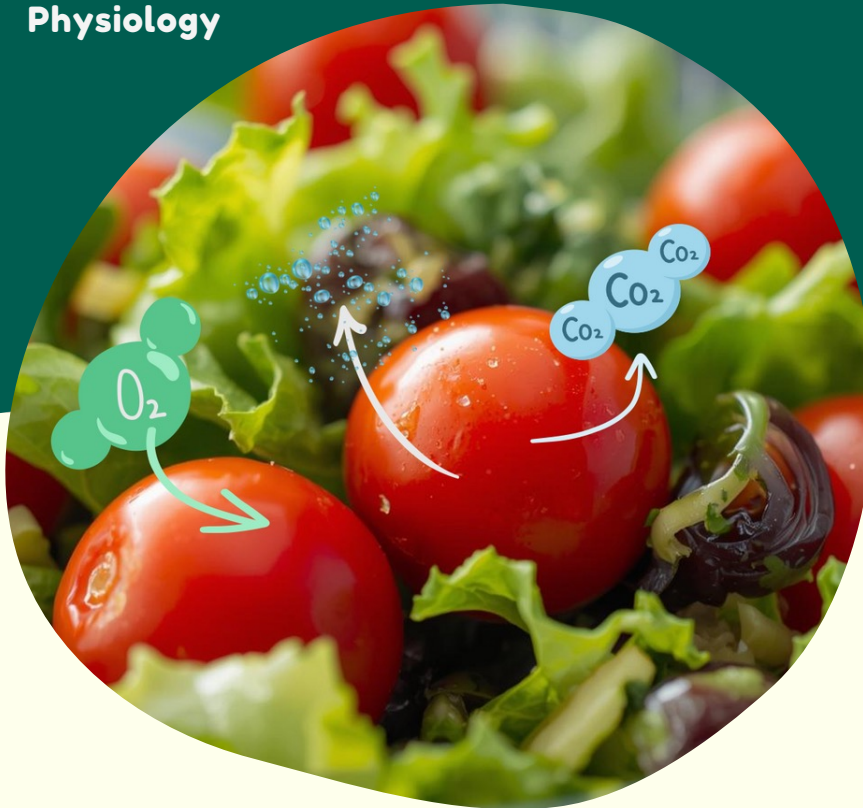
Technological challenges

READY-TO-EAT SALADS: SUSTAINABILITY AND SHELF LIFE – THE CHALLENGES AHEAD

TECHNOLOGICAL LIMITS

- **PACKAGING & PRIMARY SHELF LIFE:**
Extend the shelf life of 'mixed' salads in RECYCLABLE containers, also PAPER-BASED ones.
- **SECONDARY SHELF LIFE:**
The average shelf life of the product is approximately 1 day after opening. For this reason, MULTIPLE PURCHASES are NOT ENCOURAGED





BREATHING

Even after harvesting, vegetables continue to breathe → they absorb O_2 , release CO_2 and water vapour.



The rate of respiration is influenced by cutting, washing, temperature, humidity and gas composition.

BREATHING QUOTIENT $Q=CO_2/O_2$

LEAFY VEGETABLES
AND BABY LEAVES



0.9-1.2

ROOT VEGETABLES



0.8-1.1

TOMATOES



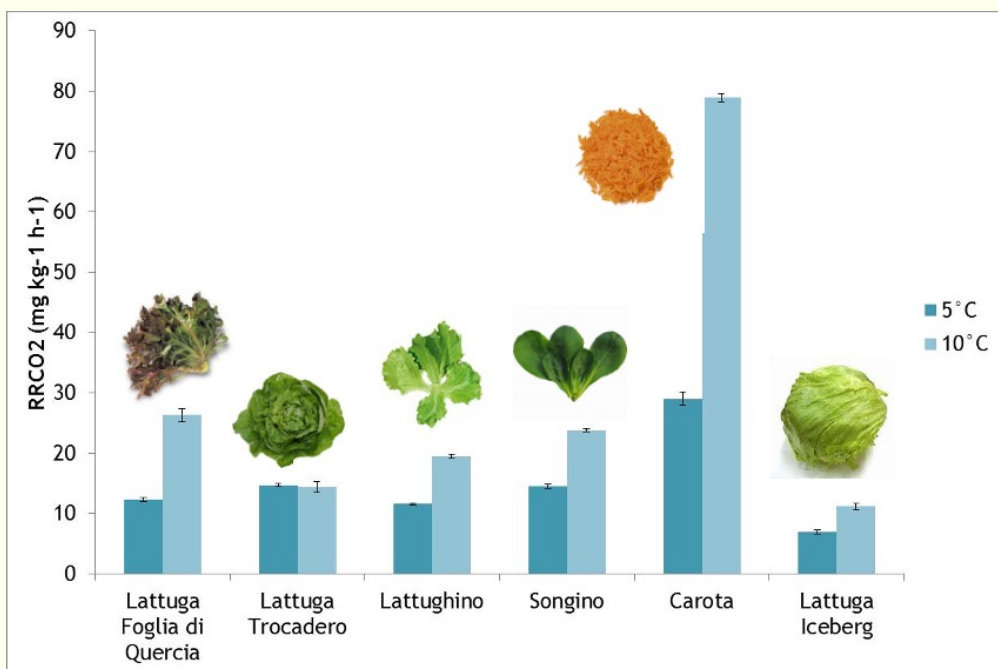
0.6-1.1

[Learn More](#)





RESPIRATION RATE



MOLTO BASSA	BASSA	MODERATA	ALTA	MOLTO ALTA	ALTISSIMA
					
					
					
<10	10-20	20-40	40-70	70-100	>100

*intervalli riferiti alla RR CO₂ (mg kg⁻¹ h⁻¹) 10° C





EXTENDING SHELF LIFE

MAP/ATM TECHNOLOGY

One way to slow down breathing is to use MAP/ATM.

MAP/ATM technologies require technical gases, specific mixtures (depending on the species) and specialised equipment.

INSUFFICIENT O₂ CONCENTRATIONS: fermentation metabolism and undesirable compounds

HIGH CO₂ CONCENTRATIONS: softening, undesirable odours, etc.



MAP/ATM

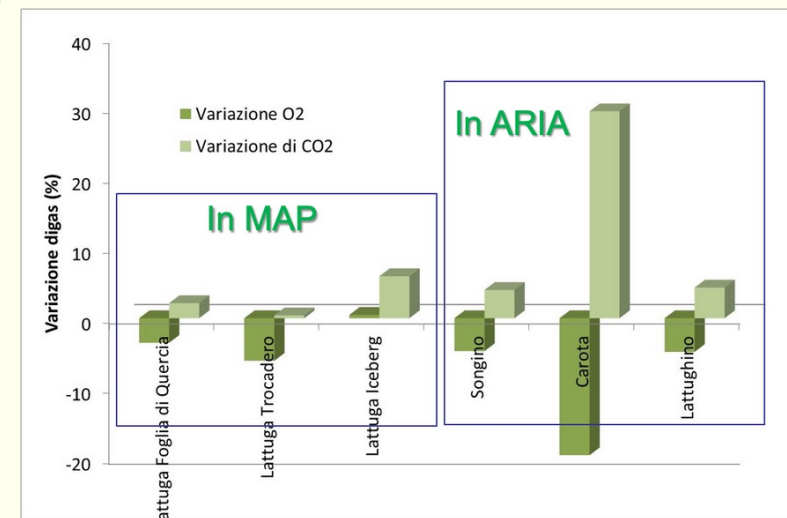
16%O₂-12 CO₂%

18%O₂-6 CO₂%

5%O₂-95 N₂%



ATM VARIATIONS AFTER 6 DAYS OF STORAGE AT 5°C





EXTENDING SHELF LIFE

PASSIVE ATMOSPHERE

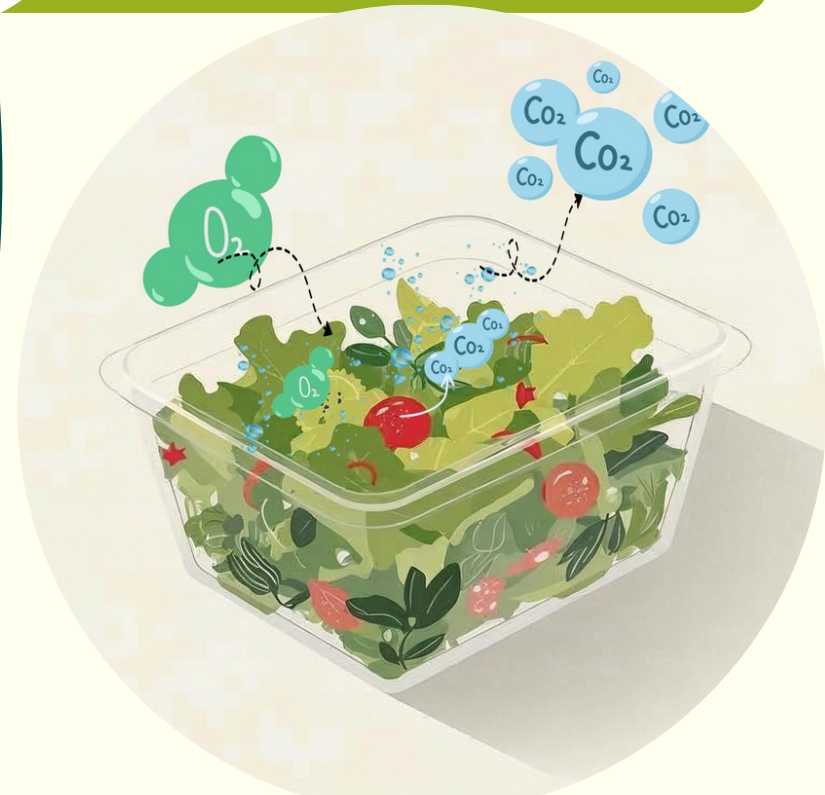
It is the modification of the atmosphere resulting from the product's own metabolism (RESPIRATION) and the transmission of gases through the packaging materials (PERMEABILITY) and the SELECTIVITY of the materials, and therefore not only from a deliberate and controlled replacement of the atmosphere.



MAP/ATM

**ECONOMIC AND ENVIRONMENTAL IMPACT
OF MAP/ATM NOT NEGLIGIBLE (UNLESS
NECESSARY FOR QUALITY MAINTENANCE)**

**NEED FOR PASSIVE AND SELF-
REGULATING ALTERNATIVES.**



MATERIALS

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PERMEABILITY & SELECTIVITY

THE ROLE OF PACKAGING MATERIALS

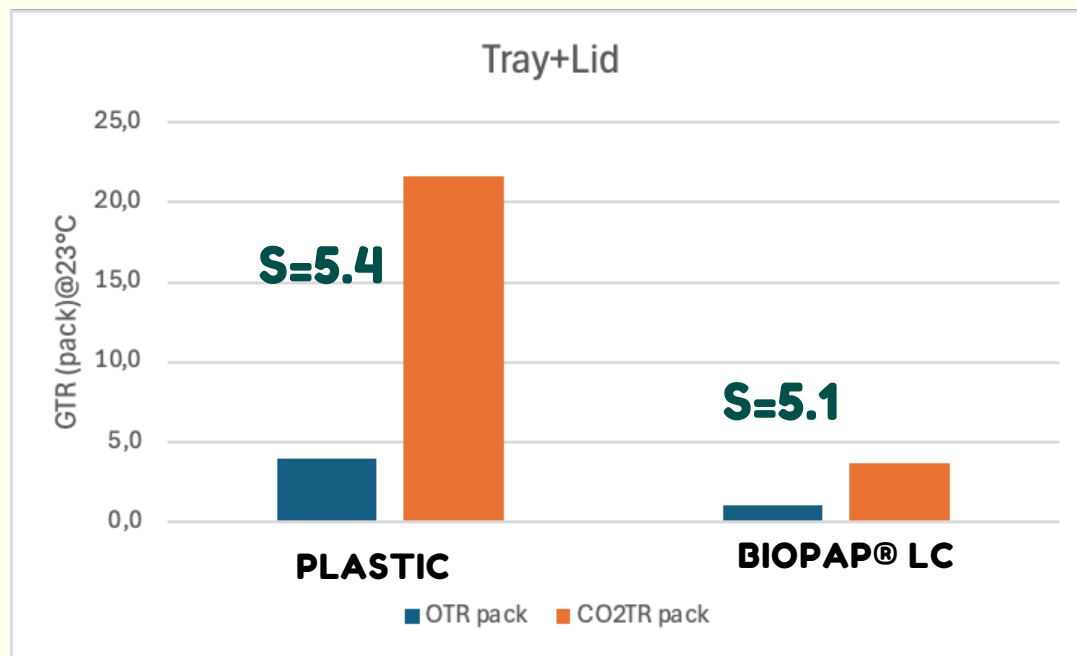
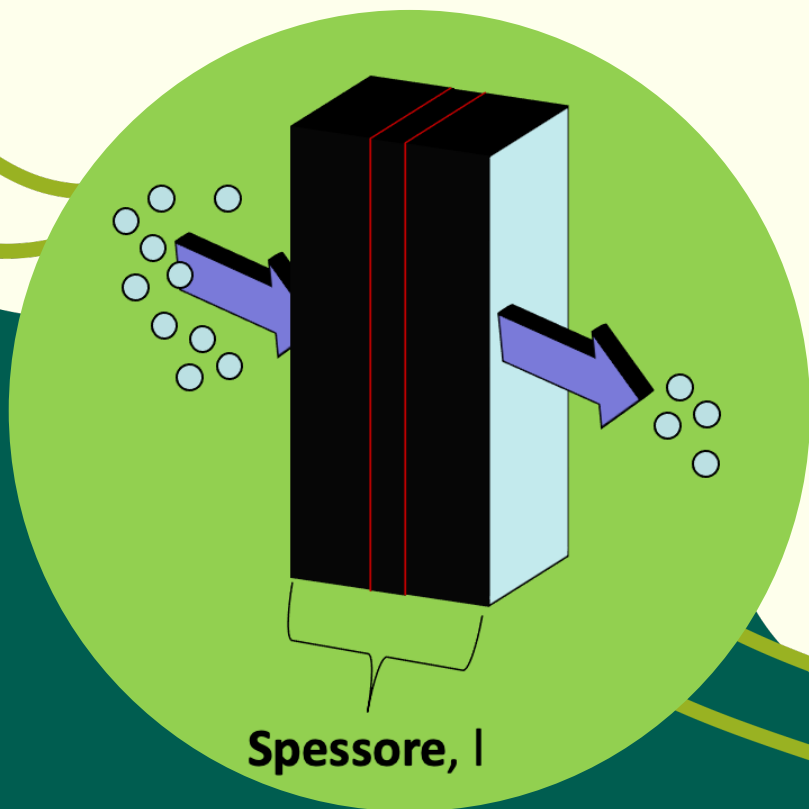
The ideal packaging will be one whose surface area, thickness, and permeability and selectivity characteristics with regard to O₂, CO₂, and water vapour will create an internal atmosphere that slows down the normal process of vegetable decay without inducing anaerobic metabolism or damage from excessive CO₂ concentration.





MATERIALS

GAS TRANSMISSION RATE OF BOWLS (WITH RELEVANT LID) AND SELECTIVITY OF MATERIALS





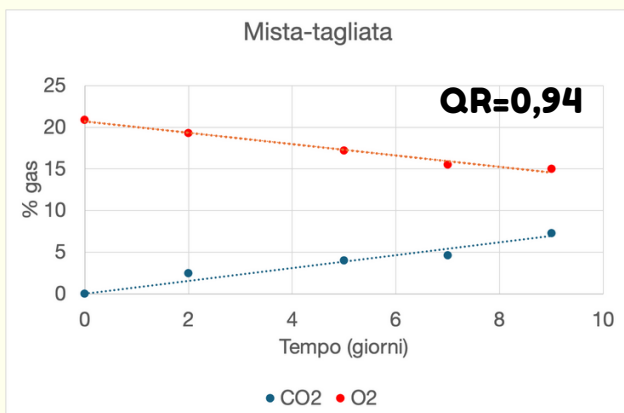
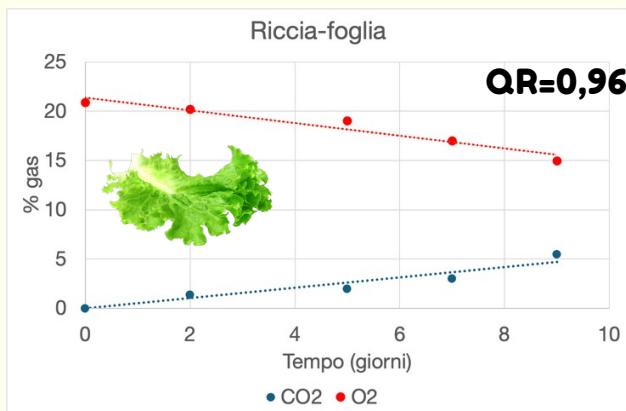
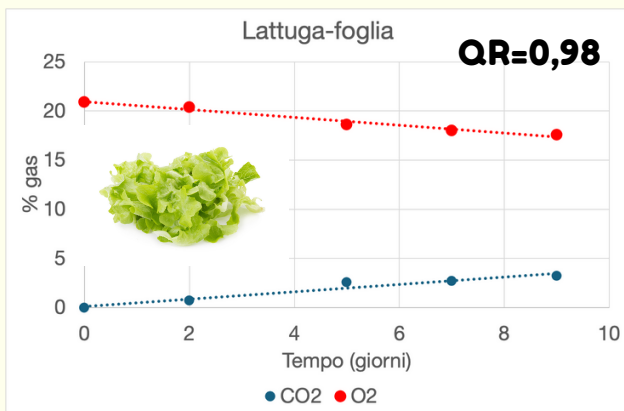
GAS EVOLUTION

(limits 5% O₂ - 15% CO₂)

STORAGE 5-6°C

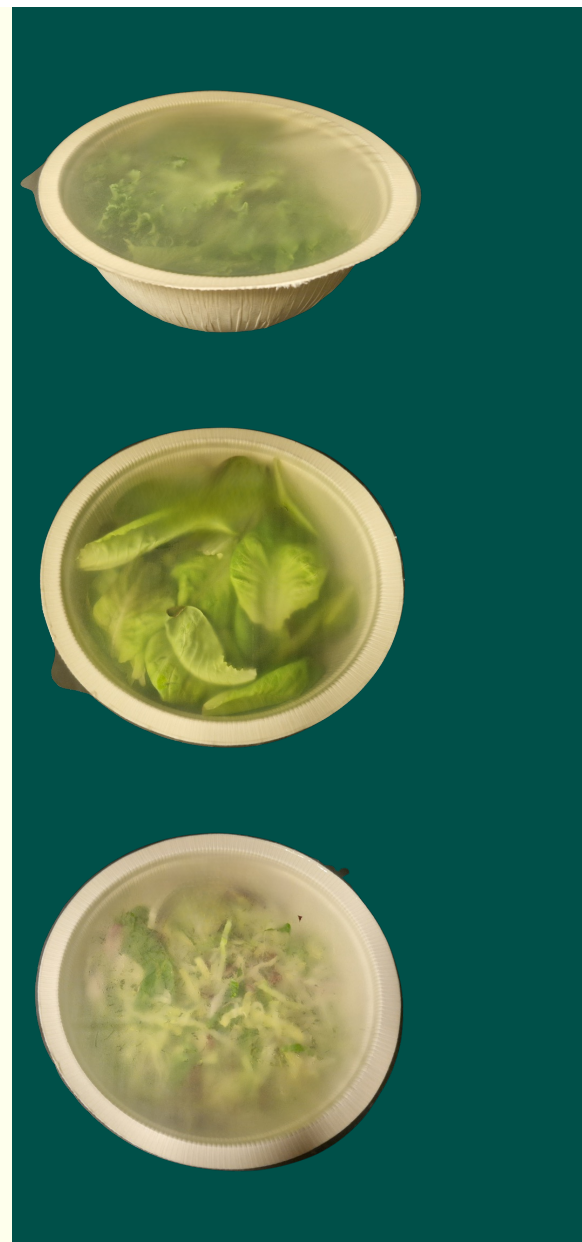


QR index of correct metabolism and O₂-CO₂ limits not exceeded



BIOPAP® LC

**LID BIODCOMPOSTABILE 55 micron
without ANTIFOG**





IV GAMMA

CONCLUSIONI

Thanks to the calibrated permeability of BIOPAP® LC trays, the internal atmosphere is self-regulated, in balance with the breathing of the plants.

In this way, you get an passively extension of the shelf life without resorting to MAP/ATM, offering advantages in terms of sustainability, process simplicity and product quality.



SHELF LIFE



**ENVIRONMENTAL
SUITABILITY**

